



**DBT- BET**

**2008-2019**

**Old PAPERS**



**The  
Biomics**



[/thebiomics](https://www.instagram.com/thebiomics)



[/thebiomics](https://www.facebook.com/thebiomics)



**Biotechnology Eligibility Test (BET)  
for DBT-JRF Award (2008-09)**

Government of India, Ministry of Science & Technology,  
Department of Biotechnology, New Delhi  
(Coordinated by University of Pune)

**April 20, 2008      Total Marks – 300      Duration 10.00 a.m. - 12.30 p.m.**

- N.B.**
- 1) All questions in Section A are **compulsory**.
  - 2) Answer any 50 questions from Section B.
  - 3) In case more than 50 are attempted, first 50 will be considered.
  - 4) Each question carries 3 marks; for every wrong answer, one mark will be deducted.
  - 5) Write your seat no. strictly inside the space provided on the Answer sheet.
  - 6) Answers marked inside the question paper will not be evaluated.
  - 7) Please return the question paper along with the Answer sheet.

**Instructions for filling the Answer sheet:**

- 1) There is only one correct answer for each question and once a mark has been made the same cannot be altered.
- 2) All entries in the circle must be made by **BLACK ink Ball Point Pen** only. Do not try to alter the entry.
- 3) Oval should be darkened completely so that the numeral inside the oval is not visible.
- 4) Do not make any stray marks for rough work on the sheet.
- 5) Do not use marker, white fluid or any other device to hide the shading already done.
- 6) More than one entry of an answer will be considered wrong, and negative marking will be done as above.
- 7) Mark your answer as shown in the example.

<b>Examples For Entering Answers</b>			
<b>Wrong Method</b>			
<del>A</del>	B	C	D
A	<del>B</del>	C	D
A	●	C	D
A	B	●	●
<b>Correct Method</b>			
●	B	C	D

## Section A

- Virus-mediated transfer of cellular genetic material from one bacterial cell to another by means of virus particles is called:
  - transduction
  - transposition
  - transformation
  - transfection
- The plasmid cloning vector pBR322 contains  $\text{amp}^R$  and  $\text{tet}^R$  genes that confer resistance to ampicillin and tetracycline, respectively. The  $\text{tet}^R$  gene contains a site for the restriction endonuclease BamHI. pBR322 is first cleaved with BamHI, added to a BamHI restriction fragment from a different DNA molecule and the resulting mixture is treated with DNA ligase and used to transform *E. coli* cells. Under these conditions, which one of the following statements is true?
  - Tetracycline can then be used to select for transformed *E. coli* carrying recombinant plasmids
  - Tetracycline can then be used to select for transformed *E. coli* carrying non-recombinant plasmids
  - Tetracycline can then be used to select for non-transformed *E. coli*
  - E. coli* cells with recombinant plasmids will grow on both tetracycline and ampicillin
- Which subunit of *E. coli* RNA polymerase is responsible for gene selection?
  - alpha
  - beta
  - omega
  - sigma
- Which one of the following radioisotopes does not emit  $\beta$  rays?
  - $^{14}\text{C}$
  - $^3\text{H}$
  - $^{32}\text{P}$
  - $^{125}\text{I}$
- Which of the statements about tRNAs is FALSE?
  - All organisms have more than 20 tRNA genes
  - The three-dimensional structure of tRNAs looks like a cloverleaf
  - tRNAs contain modified bases
  - The sequence of the last 3 nt at the 3' end of all tRNAs is the same
- Collagen consists of 3 helical chains containing Glycine and proline amino acids in each chain. The overall structure of each polypeptide in the collagen molecule is a:
  - polyproline I
  - polyproline II
  - $\alpha$ -helix
  - Polyglycine I
- In nuclear magnetic resonance (NMR) spectroscopy, the absorption spectra result by the absorption of one of the following electromagnetic radiation by the spinning nucleus:
  - ultraviolet waves
  - infrared waves
  - radiowaves
  - microwaves
- A ribonuclease solution gave an absorbance of 1.0 at 278 nm in a UV spectrometer using a 1 cm quartz cuvette. Given that the molar extinction coefficient of the enzyme at 278 nm is  $10^2 \text{ M}^{-1}\text{cm}^{-1}$ , the concentration of the enzyme would be:
  - 1 mM
  - 20 mM
  - 10 mM
  - 100 mM
- Two proteins have the same molecular mass as well as the same isoelectric point. The best way to separate them would be to use:
  - Reverse phase chromatography
  - Gel filtration chromatography
  - Ion-exchange chromatography
  - Chromatofocusing.
- One strand of double-stranded DNA is mutated, changing all cytosines to uracils. After one round of replication of the mutated DNA strand, the melting temperature of the resulting DNA will:
  - be higher
  - be lower
  - remain the same
  - be double
- Which type of restriction enzymes does not require ATP?
  - Type I
  - Type II
  - Type III

- (D) Type IV
12. The Southern blotting technique is used for:
- the detection of RNA fragments on membranes by specific radioactive antibodies
  - the detection of DNA fragments on membranes by a radioactive DNA probe
  - the detection of proteins on membranes using a radioactive DNA probe
  - the detection of DNA fragments on membranes by specific radioactive antibodies
13. Which of the following is not found in an *E. coli* replication fork?
- DnaA
  - Primase
  - PCNA
  - Single-stranded DNA binding protein.
14. Which of the following is changing the fastest over evolutionary time?
- The amount of intergenic DNA
  - The order of genes on chromosomes
  - Microsatellites
  - Exon DNA sequences
15. Superoxide dismutase is an important enzyme for maintenance of red blood cells and is defective in some neurodegenerative diseases. What does this enzyme do?
- catalyzes the conversion of  $O_2^-$  to  $H_2O_2$  and  $O_2$
  - creates superoxides by oxidizing heme
  - converts  $H_2O_2$  to water and  $O_2$
  - removes  $H_2O_2$  by oxidizing glutathione and producing water
16. Which of the following conditions would NOT promote denaturation of double-stranded DNA?
- heating to 100 degrees Celsius
  - adding high concentrations of sodium citrate
  - decreasing the ionic strength of the solution
  - adding a protein that binds to single-stranded, but not to double-stranded DNA
17. Carboxymethyl cellulose is:
- a cation -exchange matrix
  - a gel filtration matrix
  - an anion-exchange matrix
  - a plant cell wall constituent
18. Biological washing powders remove stains by enzyme action. Which of the following combinations would be most effective in removing an egg stain?
- Amylase and protease
  - Catalase and lipase
  - Lipase and maltase
  - Lipase and protease
19. A tetanus booster shot results in the increased production of:
- tetanus-specific NK cells
  - T cells that recognize tetanus toxoid but not tetanus toxin
  - antibodies which neutralize tetanus toxin
  - T-cells which kill *Clostridium tetani*
20. Allotypes are:
- antigenic determinants which segregate within a species
  - critical to the function of the antibody combining site
  - involved in specificity
  - involved in memory
21. ELISA:
- results in cell lysis
  - uses a radiolabeled second antibody.
  - involves addition of substrate which is converted to a colored end-product
  - requires sensitized red blood cells
22. Which of the following is not a member of the Immunoglobulin supergene family?
- Antibodies
  - lymphokines
  - TCR
  - $F_c$  receptor on leukocytes
23. Exchange of two non-homologous chromosomes is known as:
- Crossing over
  - Reciprocal translocation
  - Inversion
  - Duplication
24. ESTs are obtained through:
- Genomic DNA library
  - cDNA library
  - RT-PCR
  - Chromosome walking



25. Targetted suppression of gene expression is achieved by:  
 (A) T-DNA insertion  
 (B) EMS  
 (C) RNAi  
 (D) Gamma ray
26. A set of two or more overlapping DNA fragments that form a contiguous stretch of DNA is called:  
 (A) contigs  
 (B) BAC clones  
 (C) YAC clones  
 (D) map
27. A vector can accept an insert of 20 kb size and the recombinant vector can be replicated in *E. coli*. In order to make complete gene library of *E. coli* by using this vector, minimum number of bacterial colonies which must be present should not be less than:  
 (A)  $1.1 \times 10^3$   
 (B)  $4.1 \times 10^3$   
 (C)  $2.1 \times 10^4$   
 (D)  $1.5 \times 10^4$
28. Scientist involved with "Golden Rice" technology is:  
 (A) Norman Borlaug  
 (B) I. Potrykus  
 (C) M.S. Swaminathan  
 (D) G.S. Khush
29. Haploid production by anther culture was first demonstrated by:  
 (A) Bhojwani  
 (B) Guha and Maheshwari  
 (C) Murashige and Skoog  
 (D) Cocking
30. The DNA of temperate phage P4 is linear, double stranded, 11.5 kb long and has cohesive ends. Digestion with BamH1 yields fragments 6.4, 4.1 and 1.0 kb in length. The partial digestion with the same enzyme yields fragments 10.5, 7.4, 6.4, 4.1, and 1.0 kb in length. Circular P4 DNA made with DNA ligase can be digested with BamH1 to yield fragments in the DNA. What is the order of fragments in DNA ?  
 (A) 6.4- 1.0- 4.1  
 (B) 4.1- 6.4- 1.0  
 (C) 1.0- 6.4- 4.1  
 (D) 4.1- 1.0- 6.4
31. The peptide bond is rigid because it is a:  
 (A) single bond  
 (B) partial double bond  
 (C) double bond  
 (D) triple bond
32. If we increase the confidence limits then:  
 (A) No change in significant result  
 (B) Statistically significant result may change to non-significant  
 (C) Non-significant result may change to significant result  
 (D) No change in level of significance
33. A woman has a color blind father but husband with normal vision. What are the chances for their sons and daughters to be color blind?  
 (A) 1/2 for sons; 1/2 for daughters  
 (B) 1/4 for sons; 3/4 for daughters  
 (C) 1/2 for sons; zero for daughters  
 (D) Zero for sons; 3/4 for daughters
34. An isolated human population, with approximately equal number of blue eyed and brown eyed individuals, was killed due to earthquake. Only a few brown eyed people remained to form the next generation. This kind of change in the gene pool is called  
 (A) Hardy- Weinberg equilibrium  
 (B) blocked gene flow  
 (C) bottleneck effect  
 (D) founder effect
35. Cystic fibrosis is due to:  
 (A) defective chloride channel  
 (B) defective LDL receptor  
 (C) High levels of HDL  
 (D) increased dopamine
36. HAT selection is based on:  
 (A) TK and HPRT genes  
 (B) APRT and ATK genes  
 (C) HK and AP genes  
 (D) HAT gene.
37. The main difference between active transport and facilitated diffusion is that:  
 (A) in active transport, the molecules move from areas of high concentration to areas of low concentration  
 (B) carrier protein is involved only in case of active transport  
 (C) in active transport, energy is consumed to move molecules against a concentration gradient

- (D) in active transport, only water molecules are transported
38. What is the correct order of molecular weights?  
 (A) Human antibody>albumin>insulin>glutathione  
 (B) albumin>insulin>antibody>glutathione  
 (C) glutathione>insulin>albumin>antibody  
 (D) insulin>antibody>glutathione>albumin
39. Beaker A has 100 ml of a fluid at 80°C and beaker B has 200 ml of the same fluid at 20°C. If both the fluids are mixed, what would be the resultant temperature of the mixture?  
 (A) 20°C  
 (B) 80°C  
 (C) 40°C  
 (D) 50°C
40. During batch fermentation lowest specific growth rate is achieved during:  
 (A) Exponential phase  
 (B) Lag and stationary phase  
 (C) When cells are growing at their fastest pace  
 (D) Throughout the fermentation
41. In competitive inhibition  
 (A)  $K_m$  increases,  $V_{max}$  constant  
 (B)  $K_m$  decreases,  $V_{max}$  constant  
 (C)  $K_m$  constant,  $V_{max}$  increases  
 (D)  $K_m$  decreases,  $V_{max}$  increases
42. For a reaction to be spontaneous,  
 (A)  $\Delta G$  is negative  
 (B)  $\Delta G$  is positive  
 (C)  $\Delta G = 0$   
 (D)  $\Delta H$  increases
43. The dependence of molecular weight of protein molecule to the distance traveled in denaturing gel electrophoresis is: (E)  
 (A) linear  
 (B) cubic  
 (C) logarithmic  
 (D) inversely related to the amount of denaturant
44. Addition of salt to a culture medium only allows the salt-tolerant bacteria to grow. This is an example of a:  
 (A) Complex media  
 (B) Chemically defined media  
 (C) Selective media  
 (D) Differential media
45. Long terminal repeats are found in:  
 (A) proviral DNA  
 (B) retroviral RNA  
 (C) reoviral genome  
 (D) influenza virus
46. A signal sequence KDEL is removed from a ER resident protein. Assuming that there is no change in tertiary structure of protein and on other signal sequences present in protein, the changed protein will now have following fate:  
 (A) It will remain in ER and be degraded  
 (B) It will be targeted to Golgi apparatus  
 (C) It will be secreted outside the cell  
 (D) It will be targeted to lysosome for degradation
47. "All living cells arise from preexisting cells" was proposed in cell theory by:  
 (A) Schleiden and Schwann  
 (B) Rudolf Virchow  
 (C) Dutrocht  
 (D) Pasteur
48. Using deliberate attenuation approach Louis Pasteur Produced vaccine against which diseases?  
 (A) Rabies  
 (B) Tuberculosis  
 (C) Anthrax  
 (D) FMD
49. What is PROSITE?  
 (A) a database of protein structures  
 (B) a database of interacting proteins  
 (C) a database of protein motifs  
 (D) a search tool
50. Which is the best annotated database?  
 (A) Genbank  
 (B) PDB  
 (C) Prodom  
 (D) Swissprot

## Section B

51. Protein sequence comparison is more sensitive than nucleic acid sequence comparison because:
- (A) proteins are functional
  - (B) proteins have definite three dimensional structures
  - (C) the protein alphabet has more letters than the nucleic acid
  - (D) codon bias
52. Sickle-cell anemia is an example of Single Nucleotide Polymorphism (SNP) of
- (A) A to T mutation
  - (B) T to A mutation
  - (C) G to C mutation
  - (D) C to G mutation
- 
53. Which of the statements about translation is FALSE?
- (A) During translocation in the "hybrid sites" model, the tRNA attached to the nascent polypeptide chain is in the P site of the small subunit and the A site of the large subunit
  - (B) Fusidic acid prevents the release of EF-G-GDP from the ribosome
  - (C) Puromycin leads to premature release of the polypeptide chain
  - (D) IF-3 preferentially binds to 30S ribosomes
54. For the folding of a linear polypeptide into a compact tertiary structure, globular in nature, the change in entropy is known to be negative. In order for the folding process to be thermodynamically feasible, the overall change in enthalpy based in intermolecular interaction should be:
- (A) +Ve
  - (B) -Ve
  - (C) Zero
  - (D) Endothermic
55. If the equilibrium constant for a chemical reaction at 20° C is 20, the standard free energy change associated with the reaction will be:
- (A) -1.74 kcals
  - (B) 1.74 kcals
  - (C) 0.76 kcals
  - (D) 0.12 kcals
56. Cyclic adenosine monophosphate (cAMP) regulates the lactose (*lac*) operon by:
- (A) binding to the operator to turn on transcription
  - (B) binding to the *lac* repressor to prevent transcription
  - (C) combining with the catabolite activator protein (CAP) to form a complex that enhances transcription upon binding to the promoter
  - (D) combining with the CAP to remove CAP's inhibition of transcription
57. Co-transport of nutrients across the intestinal cell membranes is an active process that can move glucose against a concentration gradient. The energy requiring step for co-transport involves:
- (A) The Na<sup>+</sup>K<sup>+</sup>ATPase that pumps Na<sup>+</sup> from the cell into the lumen of the intestine
  - (B) The permease that allows glucose and Na<sup>+</sup> into the cell requires ATP
  - (C) The permease that pumps glucose from the cell into the blood requires ATP
  - (D) The Na<sup>+</sup>K<sup>+</sup>ATPase that pumps Na<sup>+</sup> from the cell into the blood, maintaining low Na<sup>+</sup> levels in the cell
58. The endogenous GTPase activity of G-proteins serves to:
- (A) stimulate the activity of enzymes by producing energy
  - (B) synthesize cGMP as a second messenger
  - (C) synthesize GTP as an energy source
  - (D) hydrolyze GTP returning the G protein to a pre-stimulated level of activity
59. Cytochalasins are drugs that interfere with actin polymerization into microfilaments. If you add cytochalasin to cultured mammalian cells that have just begun mitosis what is most likely to happen?
- (A) The cells will arrest at mitotic metaphase
  - (B) The cells will cease metabolism and die
  - (C) The cells will complete mitosis and arrest at cytokinesis
  - (D) The cells will arrest at mitotic anaphase
60. Which of the following is NOT a part of the methods used in single locus probe analysis of VNTR regions of human DNA?
- (A) DNA extraction
  - (B) Restriction endonuclease digestion of DNA
  - (C) Gel electrophoresis

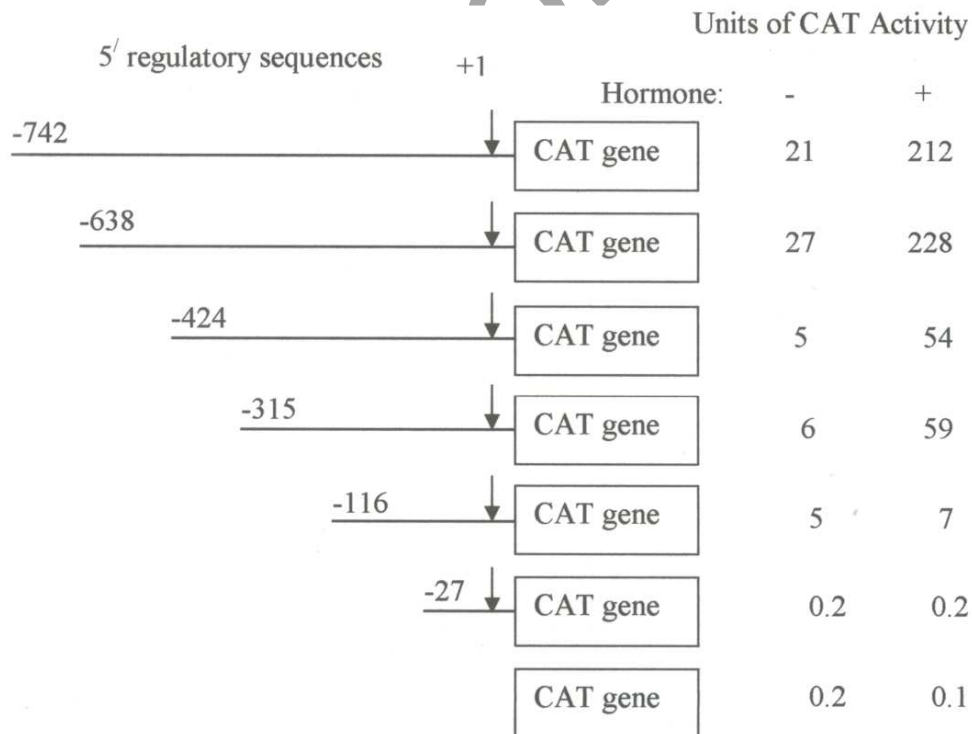
- (D) Recombinant DNA
61. Which of the following elements is NOT a characteristic of factor-independent terminators in *E. coli*?
- a C-rich sequence
  - an RNA sequence that can form a stem-loop
  - a run of single-stranded U residues
  - a GC rich sequence
62. A covalently closed circular DNA containing a single promoter is mixed with RNA polymerases that open complexes form where 1 turn of DNA is unwound. Which of the following statements will be TRUE? Please note that L = linking number, T = twist, and W = writhe.
- L will decrease because T will decrease by 1
  - L will increase because W will increase by 1
  - L will stay the same because T and W will not change
  - L will stay the same because an increase in W will cancel out the decrease in T
63. The RNA from the ribosomes of *E. coli* has a GC content of 51%. After infection with a phage that has a GC content of 40%, you purify the RNA, and run it on a density gradient, which gives you peaks at 23S, 16S, and 4S, plus a high baseline between the 23S and 16S peaks. Which of the following would you expect to see from the analysis of the GC content of each fraction?
- All the RNA will be 40% GC
  - The RNA in the 4S peak will be 40% GC, but everything else will be 51% GC
  - The RNA in the 23S, 16S and 4S peaks will be 51% GC, but the material between 16S and 23S will be 40% GC
  - The RNA in the 23S, 16S and 4S peaks will be 40% GC, but the material between 16S and 23S will be 51% GC
64. Which of the following statements about tumor suppressors is TRUE?
- Tumor suppressors are mutant tRNAs that recognize stop codons
  - Tumor suppressors are mutated viral versions of cellular proteins involved in signal transduction
  - Recessive mutations that inactivate the Rb tumor suppressor are found in families with high incidence of retinoblastomas
  - Viral oncogenes can act by increasing the activity of cellular tumor suppressor p53
65. The insulin receptor functions as a:
- receptor with 7 transmembrane spanning regions
  - nuclear protein that acts as a transcription factor
  - receptor guanylate cyclase
  - tyrosine kinase
66. Frameshift mutations are observed because the DNA code is:
- Comma-less
  - redundant
  - anti-parallel
  - degenerate
67. When synthetic mRNA consisting of alternating A and C residues (ACACAC...) was translated in a bacterial extract, only one kind of polypeptide consisting of alternating threonine and histidine residues was made. When the base sequence was . . . AACACAAC . . . three different polypeptides were formed: polyasparagine, polythreonine and polyglutamine. Hence we may conclude that one codon for histidine is:
- ACA
  - CAC
  - AAC
  - CAA
68. Hybrid dysgenesis is asymmetrical. It is induced by:
- X male x P female crosses
  - P male x M female crosses
  - M male x P female crosses
  - it is a random event, can occur in all the three.
69. During RNA polymerase II transcriptional initiation, phosphorylation of the following factor is essential to commence transcription:
- Polymerase II CTD
  - TFIID
  - TFIIH
  - TFIIE
70. Typical nucleosomal organization of a gene is not found in:
- human liver nuclei
  - malarial parasite
  - human sperm
  - Neuron

71. A mutational event inserts bases in the beginning of the coding sequence of a gene. The highest chance of the altered protein being functional when the number of base(s) inserted is:
- (A) 1
  - (B) 2
  - (C) 3
  - (D) 4

72. In a temperature sensitive mutant bacteria, at non-permissive temperature, there are huge accumulation of Okazaki fragments. The bacteria are mutant for:
- (A) DNA polymerase I
  - (B) DNA topoisomerase I
  - (C) DNA ligase
  - (D) DNA gyrase

Answer questions 73-75 based on the information provided below:

Researchers studying the regulation of a hormone-responsive gene isolated 750 base pairs of DNA immediately preceding the start site of transcription (+ 1). They demonstrated that if these sequences are cloned upstream of the bacterial chloramphenicol acetyltransferase (CAT) gene and the DNA then introduced into mammalian cells, CAT enzyme activity increases in response to hormone treatment. To define the sequences involved in the regulation of this gene, they made a series of deletions containing various lengths of the 5' regulatory sequences. They cloned these truncated DNA fragments upstream of the CAT gene as shown in the figure below, introduced the constructs into the mammalian cells, and assayed for the CAT enzyme activity in the absence (-) and presence (+) of hormone. The figure below gives the results of a representative experiment.



73. The maximal stimulation of CAT activity due to the addition of hormone is approximately:

- (A) 1-fold
- (B) 10-folds
- (C) 50-folds
- (D) 100-folds

74. Assuming that there is a single hormone-responsive regulatory element in the gene, that element is located between:

- (A) -742 and 638
- (B) -638 and -424
- (C) -424 and -315
- (D) -315 and -116

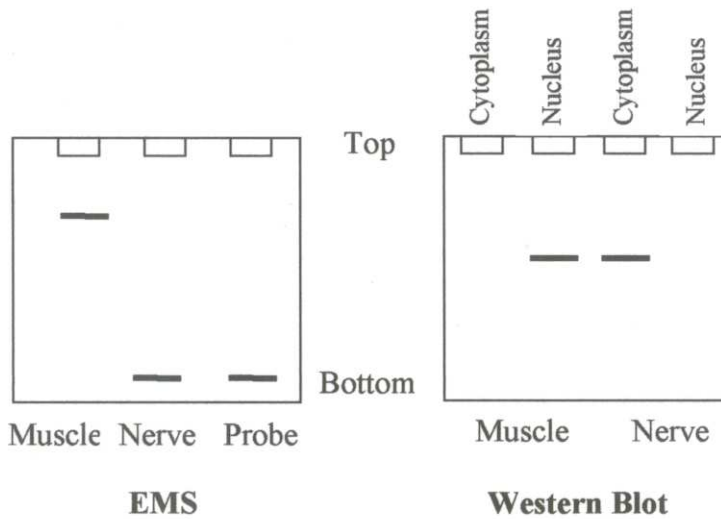
75. A new construct was made that began at -742 and was identical to that shown in the figures except that the sequences between -424 and -315 were inverted. In this new construct, which of the following are closest to the expected CAT activities in the absence and presence, respectively, of hormones?

- (A) 5 units/50 units
- (B) 5 units/25 units
- (C) 25 units/10 units
- (D) 25 units/5 units

Answer questions 76-78 based on the information provided below:

A transcription factor Y (TFY) is examined for its DNA binding ability and its expression in different cell lines. The specific DNA binding sequence has been determined and is used as a probe in an electromobility shift (EMS) assay.

Specific antibody against TFY is used in Western blot analysis to check the subcellular localization of the protein. The EMS and Western blot results of TFY activity in muscle cells and nerve cells are shown below.



76. The EMS results suggest that:
- (A) TFY is expressed only in the muscle cells
  - (B) TFY binds DNA in the muscle cells, but not in nerve cells
  - (C) TFY binds DNA in the nerve cells, but not in muscle cells
  - (D) TFY is expressed only in the nerve cells
77. According to the results of the Western blot,
- (A) TFY binds with DNA in nerve cells
  - (B) TFY is expressed only in muscle cells
  - (C) TFY is expressed both in nerve and muscle cells
  - (D) TFY binds with DNA in muscle cells
78. It was observed that TFY activity is significantly blocked in the nerve cells in comparison to muscle cells. Based on these data, what could be most likely mechanism of regulation of TFY in nerve cells?
- (A) Inhibition of transcription of TFY in the nucleus
  - (B) Inhibition of translation of TFY in cytoplasm
  - (C) Inhibition of translocation of TFY to the nucleus
  - (D) Inhibition of translocation of TFY to the cytoplasm
79. Which of the following is not correct pair of a metabolic pathway and its subcellular location?
- (A) oxidative phosphorylation occurs in mitochondria
  - (B) fatty acid synthesis occurs in mitochondria
  - (C) ganglioside degeneration occurs in lysosomes
  - (D) glycolysis occurs in mitochondria
80. A solution of a protein whose sequence includes three tryptophan residues, no tyrosine residues, and no phenylalanine residues has an absorbance of 0.3 at 280 nm in a cell with a path length of 1 cm. Estimate the concentration of the protein in units of molarity. If the protein has a molecular mass of 100 kDa, estimate the concentration in units of milligrams of protein per milliliter of solution. ( $\epsilon = 10000 \text{ M}^{-1} \text{ cm}^{-1}$ ):
- (A) 10  $\mu\text{M}$ , 1 mg/mL
  - (B) 30  $\mu\text{M}$ , 1 mg/mL
  - (C) 30  $\mu\text{M}$ , 3 mg/mL
  - (D) 10  $\mu\text{M}$ , 3 mg/mL
81. Repolarization after an action potential occurs:
- (A) through the opening of  $\text{Na}^+$  channels
  - (B) through the opening of  $\text{Na}^+$  and closure of  $\text{K}^+$  channels
  - (C) through the closure of  $\text{Na}^+$  and opening of  $\text{K}^+$  channels
  - (D) through the opening of  $\text{Na}^+$  and  $\text{K}^+$  channels
82. Chitosan, a derivative of chitin isolated from Shrimps and marine crustaceans is being used as a tool for drug and vaccine delivery. It is a polymer of:
- (A) acetylated  $\beta$ -(1-4)-linked D-glucosamine
  - (B) acetylated N-acetyl-D-glucosamine
  - (C) deacetylated  $\beta$ -(1-4)-linked D-glucosamine
  - (D) acetylated  $\beta$ -(1-4)-linked D-glucosamine and acetylated N-acetyl-D-glucosamine

83. The gene that increases susceptibility to breast cancer is:  
 (A) p53  
 (B) BRCA-1  
 (C) Rb-1  
 (D) H-Ras
84. In the urine of Burkitt's lymphoma patient abnormal quantities of the following is detected  
 (A) Bence-Jones Proteins  
 (B) Human Chorionic Gonadotrophin (hCG)  
 (C) Carcinoembryonic antigen (CEA)  
 (D) Alpha-fetoprotein (AFP)
85. What would be the functional consequence for the immune system in a knock out mice lacking  $\beta_2$  microglobulin?  
 (A) Loss of TCR expression  
 (B) Loss of phagocytic ability  
 (C) Loss of structural integrity of MHC II  
 (D) Loss of structural integrity of MHC I
86. Frequent development of primary tumours of reticulo-endothelial system is due to:  
 (A) Acquired haemolytic anemia  
 (B) Hypergammaglobulinemia  
 (C) Corticosteroid abuse  
 (D) Impairment of CMI
87. Negative selection of T-cells depends on:  
 (A) High affinity to self antigen  
 (B) High affinity to thymosin  
 (C) Intermediate affinity to self antigen  
 (D) Low affinity to self MHC
88. Hemophilia A, a common X-linked bleeding disorder is caused due to lack of function of a gene for:  
 (A) Factor VIII  
 (B) Factor VII  
 (C) Platelets  
 (D) Fibrinogen
89. Which one of the following statements is true for mitochondrial disease?  
 (A) Heteroplasmy  
 (B) Mitochondrial gene mutates less often than nuclear gene  
 (C) Mitochondrial conditions only affect muscle and nerve tissue  
 (D) The risk of passing on a mitochondrial condition to the next generation may be as high as 100%
90. Immuno-suppression is mediated by T-cells having:  
 (A) CD4+CD25-  
 (B) CD8+CD25-  
 (C) CD8+CD25+  
 (D) CD4+CD25+
91. The target cells for ADA gene therapy are:  
 (A) bone marrow cells  
 (B) B-lymphocytes  
 (C) Liver cells  
 (D) Spleen cells
92. All of the following are angiogenic factors EXCEPT:  
 (A) VEGF  
 (B) Ang-1  
 (C) Endostatin  
 (D) Cox-2
93. Acute graft versus host disease is mediated by:  
 (A) Helper T cells  
 (B) Cytotoxic T cells  
 (C) NK Cells  
 (D) B cells
94. All of the following disorders can be diagnosed prenatally by chorionic villus sampling, EXCEPT:  
 (A) Down's syndrome  
 (B) Alpha thalassemia  
 (C) Tay Sach's disease  
 (D) Spina bifida
95. The germ layer that produces nervous system is:  
 (A) endoderm  
 (B) mesoderm  
 (C) ectoderm  
 (D) endoderm and mesoderm
96. The rate of impulse conduction in a nerve depends on:  
 (A) axon diameter and axon length  
 (B) axon length and number of dendrites  
 (C) axon diameter and thickness of myelination



- (D) myelination and nuclear size
97. Pain sensation is a subjective and conscious feeling. However, although the autonomic organs do not get represented in the cerebral cortex, one feels pain in those parts as well. The reason is:
- (A) those parts receive less blood supply  
 (B) increased pH in those parts  
 (C) the pain is referred to other parts of the body  
 (D) those organs are not superficially located
98. Which one of the following is NOT a function of glia?
- (A) providing support to the neural tissue  
 (B) conduction of electrical signal  
 (C) myelination of neurons  
 (D) help in neuronal growth
99. At chemical synapse, communication between two neurons is:
- (A) physical process  
 (B) chemical process  
 (C) physico-chemico-physical process  
 (D) physico-chemico-mechanical process
100. Retrograde transport may be used for :
- (A) nerve path tracing  
 (B) determining nerve fiber diameter  
 (C) determining soma size  
 (D) estimating number of dendrites
101. Which of these electrodes will be preferred for intracellular potential recording?
- (A) glass capillary electrode  
 (B) steel micro-electrode  
 (C) copper micro-electrode  
 (D) solid glass electrode
102. Which of the following types of neurons may be identified using Tyrosine hydroxylase immunostaining ?
- (A) Cholinergic  
 (B) GABA-ergic  
 (C) Glutamatergic  
 (D) Aminergic
103. Nerve is a bundle of fibres. In vertebrates it contains:
- (A) many myelinated axons of different diameters as well as large number of unmyelinated fibres  
 (B) many unmyelinated fibres as well as large number of myelinated axons of same diameter  
 (C) only myelinated axons of same diameter  
 (D) only unmyelinated axons of different diameter
104. In a neuronal culture experiment the response gradually reduced when the neurons were exposed to increasing concentration of a chemical. However, if the cells were thoroughly washed and left for sometime in normal medium and then the experiment was repeated, the cells started responding similarly as before. Which of the following could be the most probable explanation?
- (A) increased apoptosis of the cells  
 (B) the cells were gradually necrosed in an exponential manner  
 (C) the pH of the medium was changed  
 (D) the receptors were desensitized/down-regulated
105. Under a condition (A) a neuron showed transmembrane potential  $-50\text{mV}$  while after some treatment (B) it was  $-70\text{mV}$ . Given such a condition, which of the following statements would be correct ?
- (A) condition (A) is hyperpolarized state than condition (B)  
 (B) condition (A) needs higher intensity stimulation than condition (B) for inducing a response  
 (C) the treatment caused depolarization of the neuron  
 (D) the treatment induced hyperpolarization
106. Which of the statements is true for matured human RBC? It
- (A) divides once a day  
 (B) does not divide  
 (C) divides every 120 days  
 (D) divides under stressful condition
107. The intervention by which a gadget e.g. an electrode may be accurately guided to a

- predefined region deep inside the brain is known as:
- stereoscopy
  - stereotaxic surgery
  - craniotomy
  - laparoscopy
108. Hybridization between species followed by polyploidy or chromosome doubling is known as:
- Autopolyploid
  - Aneuploid
  - Haploid
  - Allopolyploid
109. Identify the hormone combination that induces shoot development in vitro
- no auxin + average cytokinin
  - High auxin + no cytokinin
  - high auxin + low cytokinin
  - low auxin + high cytokinin
110. C<sub>4</sub> rice has been developed by transforming rice with
- PCPC
  - PPDK
  - GS
  - Both PEPC and PPDK
111. Stress signalling is mediated by:
- ABA
  - GA
  - Both the above
  - None of the above
112. The first commercially released GM crop in India is:
- Cotton expressing *cryIAb* gene
  - Brinjal expressing *cryIAb* gene
  - Corn expressing *cryIAb* gene
  - Cotton expressing *cryIIAc* gene
113. Biodiesel is produced by:
- Transesterification
  - Fermentation
  - High pressure oxidation
  - Esterification
114. A pair of genes in two organisms of different species which are similar and they are strongly predicated to have the same function is known as:
- homologous genes
  - Orthologous genes
  - Paralogous genes
  - Isoforms
115. Vitrification of cultured explants caused by:
- low light irradiance, high temperature and intensive sterilization
  - high auxin, low temperature and high light irradiance
  - higher agar, high nutrients and low pH
  - high pH, low temperature and high micronutrient concentration
116. Which of the following objectives can not be achieved through use of cybrids ?
- Transfer of cytoplasmic male sterility
  - Recombination of cytoplasmic genes with nuclear gene of another species.
  - Introgression of Chromosome segment
  - Development of true hybrid line
117. The most preferred choice for development of hybrid plants from a male sterile line would be:
- Pollen culture
  - Anther culture
  - Ovary culture
  - Meristem culture
118. The transplastomic lines bear no risk of gene escape through pollens because:
- Pollens degenerate before fertilization
  - Transformed mitochondrial DNA is lost during pollen maturation
  - Transformed chloroplast DNA is lost during pollen maturation
  - Transformed genomic DNA is maternally inherited
119. A cross between two true breeding lines one with dark blue flowers and one with bright white flowers produces F<sub>1</sub> offspring that are light blue. When the F<sub>1</sub> progeny are selfed a 1:2:1 ratio of dark blue to light blue to white flowers is observed) What genetic phenomenon is associated with these results?
- epistasis
  - incomplete dominance
  - co-dominance
  - inbreeding depression

120. Mutations which occur in vegetative parts during growth which do not go on to form gametes can be classified as:
- auxotrophic mutations
  - somatic mutations
  - morphological mutations
  - oncogenes
121. *Arabidopsis* is advantageous for plant genetic research because:
- it is commercially important as a food crop
  - it is having longer life cycle
  - it is a small plant with a small genome size which can be raised inexpensively
  - it is a close relative of corn and results with this species can be applied to problems in corn
122. DNA polymerase processivity:
- is a measure of the number of nucleotides joined before the polymerase dissociates
  - is determined by the ability of the enzyme to also have nuclease activity
  - is a measure of thermal stability of the enzyme.
  - is a measure of rate of elongation of newly synthesized strands
123. Dye injected into a plant cell might be able to enter an adjacent cell through a:
- tight junction.
  - microtubule.
  - desmosome.
  - plasmodesma
124. The most dominant trait incorporated in transgenic plants worldwide is:
- Insect resistance
  - yield
  - nutritional quality
  - herbicide tolerance
125. Clean gene technology in developing transgenic plants means:
- transgenic plants without marker genes
  - transgenic plants with provision of removing marker gene after transformation
  - plant obtained with conventional breeding approach
  - transgenic plants obtained through plastid transformation
126. Transformation method which avoids use of plant tissue culture technique is:
- electroporation
  - biolistic
  - In planta
  - Microinjection
127. Which of the following is an example of GURT?
- Hybridoma technology
  - PCR technology
  - Terminator technology
  - Transgenic technology
128. Tobacco leaf discs are transferred with *Agrobacterium tumefaciens* strain containing binary vector (GUS as reporter gene) with selectable marker neo (kanamycin resistant gene) and then regenerated to the plants. The plants are kanamycin resistant but leaf tissues are negative to GUS assay. The explanation is:
- the plants are transformed for both the genes but GUS gene is turned off.
  - the plants are transformed to only neo genes not the GUS genes
  - the plants are not transformed at all, but the development of kanamycin resistance is due to somaclonal variation
  - all of the above
129. Some of the genes from viruses introduced into plants in fully functional form often exhibit Mendelian inheritance, because:
- the genes are stably integrated in chromosomes
  - the genes are stably maintained in vectors
  - the genes are co- expressed with chromosomal genes
  - the genes are not interrupted by introns
130. Which of the following techniques can be utilized to measure the rate of diffusion of membrane proteins?
- Patching and capping
  - Immunodiffusion
  - Patch-clamp
  - FRAP

131. A researcher made an interesting observation about a protein made by the rough ER and eventually used to build a cell's plasma membrane. The protein in the membrane was slightly different from the protein made in the ER. The protein was probably changed in the:
- Golgi apparatus.
  - Smooth ER.
  - Mitochondrion.
  - Nucleus
132. A particular enzyme loses its activity if just stored in normal saline. However, if normal saline contains 10 mM 2-mercaptoethanol, a reducing agent the enzyme retains its activity. What can you conclude about the enzyme from above?
- It has methionine residues that are necessary for activity
  - It has sulphhydryl groups that are necessary for activity
  - It has disulphide bonds that are necessary for activity
  - It has histidine residues that are necessary for activity
133. The major contribution to the stability of Watson-Crick structure of DNA in aqueous solution comes from:
- hydrogen bonds between Watson-Crick base pairs
  - stacking interaction of bases
  - counter-ion condensation on phosphates
  - entropic contribution
134. Optimum bead loading for cell disruption in a bead mill is:
- 40-50%
  - 75-85%
  - 60-70%
  - 55-65%
135. Driving force for a membrane process is only the concentration difference in the case of:
- Reverse osmosis
  - Ultrafiltration
  - Microfiltration
  - Dialysis
136. The basic equation characterizing filtration is governed by:
- Darcy's law
  - Fourier law
  - Ficks law
  - Stokes law
137. Sedimentation constant (S) is the ratio of:
- Rate of sedimentation to acceleration due to gravity
  - Rate of sedimentation to angular acceleration
  - Rate of sedimentation to relative acceleration
  - Velocity of sedimentation to acceleration due to gravity
138. The oxygen solubility in a bioreactor depends upon:
- Agitation
  - Aeration
  - Both Agitation and Aeration
  - Viscosity and surface tension
139. In which type of elution technique, there is no change in gradient with respect to time?
- Isocratic elution technique
  - Stepwise elution technique
  - Linear elution technique
  - Exponential elution technique
140. For 100% purity of peak recovery in chromatography, the desired resolution factor ( $R_s$ ) is:
- $R_s=0.99$
  - $R_s= 1$
  - $R_s=1.5$
  - $R_s= \text{infinity}$
141. One of the these purification steps requires initial high ionic strength in sample
- Ion exchange chromatography
  - Hydrophobic interaction chromatography
  - Chromatofocusing
  - Preparative chromatography
142. The bioprocess model that differentiates cells on the basis of morphology and /or size distribution is:
- Structured model
  - Unstructured model
  - Segregated model
  - Non-segregated model
143. Unit of second order rate constant is:
- $\text{mol L}^{-1} \text{S}^{-1}$
  - $\text{sec}^{-1}$
  - $\text{mol}^{-1} \text{L S}^{-1}$

- (D)  $\text{mol}^2 \text{L}^2 \text{S}^{-1}$
144. The *E.coli* concentration in a growth medium is 0.6 g/l . The respiration rate of *E.coli* at this condition is 0.6 g/l. h. What will be the oxygen uptake rate?  
 (A) 36 g/g.h  
 (B) 36 g/l.h  
 (C) 0.1 g/g.h  
 (D) 0.01 g/l h
145. In equilibrium condition of the Freundlich adsorption isotherm:  
 (A) The solid loading increases with the increase of equilibrium concentration  
 (B) The solid loading decreases with the increase of equilibrium concentration  
 (C) The solid loading takes place independent of the increase of equilibrium concentration  
 (D) The solid loading initially decreases and then increases
146. In an enzyme catalyzed reaction,  $K_m = 4 \times 10^{-5} \mu\text{mol/l}$ , and the rate of reaction (V) at substrate concentration  $[S] = 1.2 \times 10^{-2} \text{M}$  is 80  $\mu\text{mol/l-min}$ . Assume no inhibitor is present.  $V_{\text{max}}$  is practically equal to:  
 (A) 40  $\mu\text{mol/l-min}$   
 (B) 80  $\mu\text{mol/l-min}$   
 (C) 120  $\mu\text{mol/l-min}$   
 (D)  $4.8 \times 10^2 \mu\text{mol/l-min}$
147. Immobilization of microbial cells:  
 (A) Increases apparent  $K_s$   
 (B) Decreases apparent  $K_s$   
 (C) Has no effect on  $K_s$   
 (D) Increases cell's affinity for the substrate
148. In the Dynamic gassinol method, the volumetric oxygen transfer coefficient ( $K_L a$ ) is given by:  
 (A) X- intercept  
 (B) Y- intercept  
 (C) Slope  
 (D) Inverse of Y- intercept
149. The ratio of BOD/COD is approximately 0.5. When this ratio falls below 0.3, it signifies that it:  
 (A) Contains large amount of microorganism  
 (B) Contains large amount of organic compounds  
 (C) Contains large amount of organic compounds that are not easily biodegradable  
 (D) Contains no organic compounds
150. For running a Continuous Stirred Tank Reactor, critical dilution rate is:  
 (A) Equal to the washout rate  
 (B) Less than the washout rate  
 (C) Higher than the washout rate  
 (D) Unpredictable
151. In continuous sterilization process, fluid flows through the holding section where there is:  
 (A) A positive axial dispersion value  
 (B) A negative axial dispersion value  
 (C) Axial dispersion is zero  
 (D) No relationship between axial dispersion and fluid flow
152. The physical significance of specific growth rate constant is:  
 (A) Rate at which the organism is growing  
 (B) Fraction per unit growth of microorganism per unit time  
 (C) Grams of cell formed per grams cell mass per unit time  
 (D) Gram of cells formed per unit time
153. Supercritical fluid (SCF) extraction is much better than normal solvent extraction. This is because:  
 (A) SCF is non –toxic  
 (B) Diffusivity is much higher than normal solvent  
 (C) Handling of SCF is much easier  
 (D) SCF viscosity is higher than normal solvent and hence extraction is better
154. Growth yield coefficient is defined as:  
 (A) Cell mass formed: substrate utilized  
 (B) Substrate utilized: cell mass formed  
 (C) Product formed: cell mass formed  
 (D) Carbon dioxide produced to substrate utilized
155. Anticancer vitamin is:  
 (A) Retinol  
 (B) Phylloquinone  
 (C) Thiamine  
 (D) Pyridoxine

156. If the rate of product formation is approximately proportional to the rate of cell growth, then this pattern of product formation is referred to as:
- Non-growth associated
  - Growth associated
  - Uncoupled
  - Metabolically uncoupled
157. The viscosity of a fluid decreases with increasing stirrer speed. This fluid would be best described as being:
- Newtonian
  - Pseudoplastic
  - Dilatant
  - Thixotropic
158. The addition of acid to maintain the pH at 2 – 2.6 in the filtered fermentation broth before penicillin extraction is carried out to extract maximum amount of penicillin in solvent phase. The pH is adjusted to 2 – 2.6 because this helps:
- In precipitation of proteins
  - In maintaining penicillin in aqueous phase
  - In maintaining penicillin in organic phase
  - In reducing the bacterial contamination
159. The advantage of counter current flow in the heat exchanger is always desirable as in counter current system:
- Temperature control is easier
  - Area required for heat transfer is less
  - Fluid flow is easy
  - Terminal temperature difference is less
160. Which of the following is the name of the satellite developed recently to scan the oceans around the country?
- INSAT-2D
  - INSAT-1B
  - INSAT-2E
  - Aryabhata
161. Which one of the following algae is a wonder crop with about 70% protein even surpassing famous Soya bean in food value?
- Chlorella
  - Dunaliella
  - Scenedesmus
  - Spirulina
162. The origin of tetrodotoxin in mollusks is:
- endogeneous
  - exogeneous
  - symbiotic microorganisms
  - all the above
163. Which of the following commercially available cancer drug is obtained from marine source?
- Bleomycin
  - AraC
  - Cisplatin
  - Vinblastin
164. Spores of *Gracilaria* settle on hard substrate, begin to germinate by cell division within:
- 12hrs
  - 20hrs
  - 48hrs
  - 24hrs
165. The waves which generally occur during hurricanes are called:
- seismic sea waves
  - storm waves
  - tsunami
  - both (A) and (B)
166. Heparin is a:
- lipopolysaccharide
  - glycated lipopolysaccharide
  - sulphated polysaccharide
  - sulphated lipopolysaccharide
167. Eutrophication in coastal water results in the following phenomenon:
- red tide
  - diurnal tide
  - mixed tide
  - neap tide
168. Barophiles are capable of growth up to:
- 100 to 200 atm
  - 700 to 800 atm
  - 500 to 600 atm
  - 1 to 100 atm
169. The most abundant group of organisms inhabiting hydrothermal vents are:
- Sulphate reducing bacteria
  - Chemoautotrophic sulphur bacteria

- (C) Sulphur oxidizing chemolithotrophs  
(D) Nitrifiers
170. Deep sea hydrothermal vents are habitats where the primary producers are:  
(A) Organotrophic bacteria  
(B) Chemolithotrophic bacteria  
(C) Chemoorganotrophs  
(D) Methylootrophs
171. Giant tube worms receive their nutrition  
(A) through unusual haemoglobins which bind  $H_2S$  as well as  $O_2$ , transport to the trophosome and release to bacterial symbionts  
(B) from methanotrophic symbionts living in symbiotic association  
(C) from thermophilic prokaryotes which reside in smoker chimneys  
(D) through normal haemoglobin
172. The lux gene from *Vibrio fischeri* has been used to make glowing tobacco plants. This gene is involved in:  
(A) Bioluminescence  
(B) Photosynthesis  
(C) Phosphorescence  
(D) Fluorescence
173. Hydrocolloids extracted from seaweeds have attained commercial significance specially as:  
(A) Detergents  
(B) Biofuels  
(C) Food additives  
(D) Laboratory chemicals
174. \_\_\_\_\_ is used in the production of explosives.  
(A) Carrageenan  
(B) Alginate  
(C) agar  
(D) xanthine
175. Nutraceuticals available in the market from marine sources are largely from  
(A) bacteria  
(B) fungi  
(C) diatoms  
(D) macro algae
176. \_\_\_\_\_ are being cultured and harvested as a source of biofuels:  
(A) anaerobic bacteria
- (B) luminescent bacteria  
(C) non-methanogenic bacteria  
(D) sea weeds
177. The repeating galactose units of all carrageenans is joined by:  
(A)  $\alpha$  1-3 glycosidic linkages  
(B)  $\beta$  1-4 glycosidic linkages  
(C) both (A) and (B)  
(D) none
178. Fish can survive inside a frozen lake because:  
(A) Fish hibernate in ice  
(B) Fish are warm blooded animals  
(C) Ice is a good conductor of heat  
(D) Water near the bottom does not freeze.
179. The virus-host surface interaction is a:  
(A) Specific event  
(B) Non-specific event  
(C) Random attachment  
(D) Natural event
180. Which one of the following tests is not suitable for immunocytochemical studies of pathogens?  
(A) Immunofluorescence  
(B) Immunoperoxidase  
(C) Immunoelectrophoresis  
(D) Immunoelectronmicroscopy
181. The insertion of foreign DNA into non-essential region of vaccinia virus can be achieved by:  
(A) Homologous recombination  
(B) Heterologous recombination  
(C) Conjugation  
(D) Hybridization
182. Antiviral cellular immunity is predominantly mediated by:  
(A)  $CD^{8+}$  cytotoxic T lymphocytes  
(B) Natural killer cells  
(C)  $CD^{4+}$  T lymphocytes  
(D) Dendritic cells
183. Activation of classical pathway of complement requires:  
(A) Antigen-antibody reaction  
(B) Properdine  
(C) Interleukin  
(D) Interferon

184. Bovine group A rotavirus contains:
- (A) ss RNA  
(B) ds RNA  
(C) ss DNA  
(D) ds DNA
185. Use of 2-deoxy adenosine in semen sample may:
- (A) Decrease sperm motility  
(B) Increase sperm motility  
(C) Inactivate sperms  
(D) Separate head of sperm from the tail
186. In cows, before embryo transfer, they are grown upto:
- (A) Mid morula stage  
(B) Late morula stage  
(C) Very early morula stage  
(D) Blastocyst stage
187. Capacitation of sperm takes place in the reproductive tract of cows due to presence of :
- (A) Amino acids  
(B) Proteins  
(C) Galactosamine  
(D) Glycosaminoglycan
188. Sperm DNA is covered by:
- (A) Lipid  
(B) Protamines  
(C) Carbohydrate  
(D) Histones
189. One of the following is not a viral disease of sheep:
- (A) FMD  
(B) PPR  
(C) Bluetongue  
(D) Haemonchosis
190. Nili Ravi is a breed of:
- (A) Cattle  
(B) Sheep  
(C) Goat  
(D) Buffalo
191. Average gestation period of cow is
- (A) 280 days  
(B) 245 days  
(C) 310 days  
(D) 325 days
192. Cow comes in heat every:
- (A) 19 to 20 days  
(B) 30 to 45 days  
(C) 40 to 50 days  
(D) 10 to 15 days
193. One of the following diseases has been eradicated from India:
- (A) Sheep pox  
(B) PPR  
(C) Rinderpest  
(D) BQ
194. BSE is caused by:
- (A) Prion  
(B) Viroid  
(C) RNA virus  
(D) Mycoplasma
195. Fertilized single cell cattle egg is what type of stem cell?
- (A) Totipotent stem cell  
(B) Pluripotent stem cell  
(C) Multipotent stem cell  
(D) None of the above
196.  $\beta$ -lactoglobulin promoter is used for expression of gene in:
- (A) Liver  
(B) Spleen  
(C) Mammary gland  
(D) D. Lymphnode
197. Which one of the following virus vectors has been used for development of bluetongue virus particle like recombinant vaccine?
- (A) AcNPV  
(B) BmNPV  
(C) HSV  
(D) VSV
198. Which one of the following is connected with 'Ranikhet disease'?
- (A) Poultry  
(B) Cows  
(C) Fishes  
(D) Sheep
199. For searching a query sequence with a database, which of the following statement is correct?
- (A) Nucleotide query against a nucleotide sequence database is done by blastp  
(B) Protein query against a translated nucleotide sequence database is done by blastp



- (C) Translated nucleotide query against a protein database is done by blastx  
(D) Protein query against a protein database is done by tblastn
200. Which is the default scoring matrix used in BLAST?  
(A) PAM62  
(B) BLOSUM 62  
(C) BLOSUM 60  
(D) BLOSUM 80
201. PAM matrices are derived by noting evolutionary changes in protein sequences that are more than:  
(A) 80% similar  
(B) 60% similar  
(C) 40% similar  
(D) 25% similar
202. Which alignment is used to predict whether two sequences are homologous or not?  
(A) Local  
(B) Global  
(C) Pair-wise  
(D) Multiple
203. In Molecular Dynamics simulation, the dependence is on:  
(A) only position  
(B) only momentum  
(C) both position and momentum  
(D) either position or momentum
204. In phylogenetic analysis, maximum likelihood method is chosen when the sequences have:  
(A) strong similarity  
(B) local similarity  
(C) medium level similarity  
(D) no clear identifiable similarity
205. The method of maximum parsimony is also known as:  
(A) maximum evolution method  
(B) minimum evolution method  
(C) zero evolution method  
(D) moderate evolution method
206. In Needleman Wunsch algorithm of pairwise alignment of sequences with lengths  $n$  and  $m$ , the computational time is proportional to:  
(A)  $n \times m$   
(B)  $(n+1) \times (m+1)$   
(C)  $n + m$   
(D)  $n \times (m+1)$
207. In a PHYLIP output, the first line is two numbers, what do they indicate?  
(A) Number of sequences, length of alignment  
(B) Length of alignment, number of sequences  
(C) Number of gaps, number of sequences  
(D) Number of sequences, number of gaps
208. BLAT is used to find:  
(A) regions of higher identity within genomic assemblies  
(B) regions of higher differences within genomic assemblies  
(C) folds in a RNA sequence  
(D) secondary structures in a given protein
209. Homology modeling may be distinguished from *ab initio* prediction because:  
(A) Homology modeling requires a model to be built  
(B) Homology modeling requires alignment of a target to a template  
(C) Homology modeling is usefully applied to any protein sequence  
(D) The accuracy of homology modeling is independent of the percent identity between the target and the template
210. Molecular Dynamics simulation is carried out for:  
(A) Obtaining ensemble of structures at physiological condition  
(B) Obtaining the structure at global energy minimum  
(C) Fitting prospective drug candidate molecules to a receptor  
(D) Modeling a protein structure from sequence alone
211. A left handed alpha helix falls in the Ramachandran plot under:  
(A) allowed region  
(B) partially allowed region  
(C) disallowed region  
(D) line joining allowed and partially allowed region

212. The Greek key motif is composed of:
- Four alpha helices
  - Three alpha helices and one beta strand
  - Two alpha helices and two beta strands
  - Four beta strands
213. Which of the following statements is true regarding a secondary amide?
- It can only participate in hydrogen bonding as a hydrogen bond donor
  - It can only participate in hydrogen bonding as a hydrogen bond acceptor
  - It can participate in hydrogen bonding both as a hydrogen bond donor and a hydrogen bond acceptor
  - It cannot participate in hydrogen bonding at all
214. If systematic conformational search is performed for a molecule with six rotatable bonds and step size is 30 degree then number of conformers will be:
- 1, 895, 672
  - 2, 985, 984
  - 2, 008, 672
  - 1, 895, 760
215. Which of the following amino acids are more likely to occur in alpha helices?
- A, E, L, M
  - P, G, Y, S
  - A, G, Y, W
  - A, C, G, S
216. The alpha helix can be called a  $3.6_{13}$  helix . The numbers refer to:
- the number of residues and the pitch of the helix
  - the number of residues and number of atoms in the helix
  - the number of residues in a turn of the helix and the number of atoms in the hydrogen bond ring
  - the number of turns and diameter of the helix
217. Arrange the following in hierarchical top to bottom order as is done in SCOP:
- Classes, domains, superfamilies, folds, families
  - domains, superfamilies, folds, families, classes
  - superfamilies, folds, families, domains, classes
  - Classes, folds, superfamilies, families, domains
218. Which of the following cases are commonly used?
- gap opening penalty = -2, gap extension penalty = -0.5
  - gap opening penalty = -0.5, gap extension penalty = -2.0
  - gap opening penalty = -100, gap extension penalty = 0
  - gap opening penalty = -100, gap extension penalty = -100
219. The description of a new organism identified must be submitted to a Journal and the name validated before it is formally accepted as a new taxon of prokaryotes. The Journal is:
- Bergey's Manual
  - International Journal of Systematic and Evolutionary Microbiology
  - The Prokaryotes
  - Applied and Environment Microbiology
220. The Omph protein is a type of porin, synthesized in bacterial cells grown under a pressure of
- One atmosphere
  - 100 to 200 atm
  - 500 to 600 atm
  - 600 to 700 atm
221. Gasohol in USA is produced by adding 10% ethanol to lead-free gasoline. The combustion of gasohol produces:
- lower amounts of CO and nitrogen oxides than pure gasoline
  - lower amounts of CO<sub>2</sub> and higher amounts of SO<sub>2</sub> than pure gasoline
  - lower amounts of CO<sub>2</sub> and CO than pure gasoline
  - higher amounts of CO<sub>2</sub> and CO than pure gasoline
222. Some extremophiles produce extremozymes which have major industrial application as
- many industrial processes operate best at high temperatures
  - they have high specificity and their ability to distinguish between chiral

- isomers enable them to function in extremes environment
- (C) they are always produced by hyperthermophiles
- (D) many bioprocesses operate at low pH
223. The main pacemaker for endogenous rhythms (Circadian rhythms) is the:
- (A) Zeitgeber
- (B) Suprachiasmatic nucleus
- (C) Optic chiasm
- (D) Core body temperature
224. *Eupulviscium fishelsoni* whose length ranges from 200-500  $\mu\text{m}$  belongs to the microbial group:
- (A) Microalgae
- (B) Fungi
- (C) Protozoa
- (D) Bacteria
225. Agar-agar is a polymer of:
- (A) Glucose
- (B) Sulphated sugar
- (C) Pectin
- (D) Protein
226. The most uncommon characteristic of marine microorganisms is:
- (A) They require low nutrients
- (B) They are slow growing
- (C) 95% are gram negative
- (D) They do not exhibit pleomorphism
227. Which of the following statements is false when describing SWISS-PROT ?
- (A) It is a curated protein sequence database
- (B) Data is redundant
- (C) Provides a high level of annotations
- (D) It is maintained by Swiss Institute of Bioinformatics and EBI
228. Threading approaches can be used to:
- (A) Predict secondary structures of proteins
- (B) Build phylogenetic trees
- (C) Identify distantly related structural homologs of proteins
- (D) To check the fitness of a modeled protein structure
229. Linkage analysis is performed in a large family with an autosomal hemolytic anemia, using a polymorphic marker within the  $\beta$ -globin locus. The LOD score at  $b=0$  is negative infinity. The LOD score at  $b=0.01$  is -4.5. You conclude that the disorder in this family:
- (A) Is due to a point mutation in the  $\beta$ -globin gene
- (B) Is due to a mutation in a gene on chromosome 11, 10cM centromeric  $\beta$ -globin
- (C) Is not due to a  $\beta$ -globin gene mutation
- (D) Is an acquired disorder due to a somatic gene mutation
230. A catalyst is one which speeds up the reaction by:
- (A) The enthalpy of the reaction
- (B) Decreasing the free energy of the reaction
- (C) Increasing the kinetic energy of the reaction
- (D) Decreasing the activation energy of the reaction
231. Transfer of T-DNA from Ti-plasmid into plant cells is mediated by:
- (A) MOB-gene
- (B) Nif gene
- (C) Vir gene
- (D) Octopine gene
232. During RNA polymerase II transcription initiation, phosphorylation of the following factor is essential to commence transcription:
- (A) Polymerase II CTD
- (B) TFIID
- (C) TFIIH
- (D) TFIIIE
233. In human genome, approximately-----of the DNA codes for proteins:
- (A) 10%
- (B) 2%
- (C) 50%
- (D) 20%
234. A linear fragment of DNA will be unstable if it carries:
- (A) Two origins of replication
- (B) Two centromeres
- (C) Two telomeres
- (D) Two selection markers
235. A restriction endonuclease recognizes a 8 bp unbiased conserved sequence as its

- cleavage site. How many probable site(s) can be present in a 70 kb DNA fragment ?
- (A) 2  
(B) 1  
(C) 4  
(D) 6
236. Typical nucleosomal organization of gene is not found in the nuclei of:
- (A) Human liver cells  
(B) Muscle cell  
(C) Human sperm  
(D) Neural cells
237. Which of the following organelles is surrounded by a single membrane?
- (A) Chloroplast  
(B) Mitochondria  
(C) Peroxisomes  
(D) Nucleus
238. If a DNA sequence predominantly contains alternating pyrimidines and purines, which of the following DNA structures is highly favored ?
- (A) A-DNA  
(B) B-DNA  
(C) Z-DNA  
(D) A-B-DNA
239. In a temperature-sensitive mutant bacteria, at non-permissive temperature, there are huge accumulation of Okazaki fragments. The bacteria are mutant for:
- (A) DNA polymerase  
(B) DNA topoisomerase I  
(C) DNA ligase  
(D) DNA gyrase
240. Which among the following enzymes is not a component of nitrogen assimilation complex ?
- (A) Nitrate reductase  
(B) Glutamate synthase  
(C) Lactate dehydrogenase  
(D) Glutamine synthetase
241. A cDNA encoding an eukaryotic gene was ligated to an expression vector which was then introduced into *E.coli* for expression of protein. However, the experiment resulted in poor expression of inactive form of the protein, which could be due to:
- (A) Absence of capping at the 5' end of the transcript  
(B) Absence of polyadenylation at the 3' end of the transcript  
(C) Codon bias  
(D) Lack of splicing machinery in *E. coli*.
242. The genomic DNA fraction which has highest value of  $\text{cot } \frac{1}{2}$  on Cot curve represents:
- (A) Highly repetitive DNA  
(B) Moderately repetitive DNA  
(C) Minisatellite DNA  
(D) Unique DNA
243. The best method to permeabilize yeast cells chemically is to use:
- (A) EDTA and Lysozyme  
(B)  $\beta$ -(1,3) glucanase and protease  
(C)  $\beta$ -(1,6) glucanase  
(D) Alkaline hydroxylase
244. Asparaginase is used as an:
- (A) Anti-tumor agent  
(B) Anti-tuberculosis agent  
(C) Anti-malarial agent  
(D) Anti-diabetic agent
245. Which of the following will have the largest interfacial area per unit volume ?
- (A) A bubble with a diameter of 1 mm  
(B) A bubble with a diameter of 2 mm  
(C) A bubble with a diameter of 3 mm  
(D) A bubble with a diameter of 4 mm
246. Mr. B and Mrs. B have a 2 month-old baby with Down's syndrome. Her Karyotype is showing translocation variety of Down's syndrome. Which of the following investigations will you advise to the parents before next pregnancy ?
- (A) Triple test  
(B)  $\alpha$ -foetoprotein analysis  
(C) Karyotyping  
(D)  $\beta$ -hCG analysis
247. Occurrence of TB in HIV patients suggests the potent protective role played by:
- (A) NK cells in healthy individuals  
(B) NKT cells in healthy individuals  
(C) CD3+ T cells in healthy individuals  
(D) CD4+ T cells in healthy individuals

248. Which of the following types of neurons is primarily lost in Parkinson's disease?
- (A) Dopaminergic neurons in the substantia nigra
  - (B) Cholinergic neurons in the brain stem
  - (C) Noradrenergic neurons in the cerebellum
  - (D) GABA-ergic neurons in cortex
249. The term  $k$  in the following energy expression  $E = \frac{1}{2} k (\theta - \theta_0)^2$  represents:
- (A) Van der Waals interaction
  - (B) Stretching constant for bond angle variation
  - (C) Torsional potential
  - (D) Kinetic energy of an atom
250. "Heyflick's limit refers to which one of the following phenomena?"
- (A) DNA repair
  - (B) Cell senescence *in vitro*
  - (C) Protein synthesis
  - (D) RNA transport
- 

The Biomimics

## Key to the MCQs for BET 08

### Section A

- |         |         |         |
|---------|---------|---------|
| 1. (A)  | 22. (B) | 43. (C) |
| 2. (B)  | 23. (B) | 44. (C) |
| 3. (D)  | 24. (B) | 45. (A) |
| 4. (D)  | 25. (C) | 46. (C) |
| 5. (B)  | 26. (A) | 47. (D) |
| 6. (B)  | 27. (A) | 48. (A) |
| 7. (C)  | 28. (B) | 49. (C) |
| 8. (C)  | 29. (B) | 50. (D) |
| 9. (A)  | 30. (C) |         |
| 10. (B) | 31. (B) |         |
| 11. (B) | 32. (C) |         |
| 12. (B) | 33. (C) |         |
| 13. (A) | 34. (C) |         |
| 14. (C) | 35. (A) |         |
| 15. (A) | 36. (A) |         |
| 16. (B) | 37. (C) |         |
| 17. (A) | 38. (A) |         |
| 18. (D) | 39. (C) |         |
| 19. (C) | 40. (B) |         |
| 20. (A) | 41. (A) |         |
| 21. (C) | 42. (A) |         |

**Section B**

- |         |         |          |          |
|---------|---------|----------|----------|
| 51. (D) | 73. (B) | 95. (C)  | 117. (C) |
| 52. (A) | 74. (D) | 96. (C)  | 118. (C) |
| 53. (A) | 75. (A) | 97. (C)  | 119. (B) |
| 54. (B) | 76. (B) | 98. (B)  | 120. (B) |
| 55. (A) | 77. (C) | 99. (C)  | 121. (C) |
| 56. (C) | 78. (C) | 100. (A) | 122. (A) |
| 57. (D) | 79. (B) | 101. (A) | 123. (D) |
| 58. (D) | 80. (A) | 102. (D) | 124. (D) |
| 59. (C) | 81. (C) | 103. (A) | 125. (B) |
| 60. (D) | 82. (C) | 104. (D) | 126. (C) |
| 61. (A) | 83. (B) | 105. (D) | 127. (C) |
| 62. (D) | 84. (A) | 106. (B) | 128. (D) |
| 63. (C) | 85. (D) | 107. (B) | 129. (A) |
| 64. (C) | 86. (D) | 108. (D) | 130. (D) |
| 65. (D) | 87. (A) | 109. (D) | 131. (A) |
| 66. (A) | 88. (A) | 110. (D) | 132. (B) |
| 67. (B) | 89. (D) | 111. (A) | 133. (B) |
| 68. (B) | 90. (D) | 112. (A) | 134. (B) |
| 69. (A) | 91. (A) | 113. (A) | 135. (D) |
| 70. (C) | 92. (C) | 114. (B) | 136. (A) |
| 71. (C) | 93. (B) | 115. (A) | 137. (B) |
| 72. (C) | 94. (D) | 116. (D) | 138. (C) |

139. (A)            162. (D)            185. (B)            208. (A)  
140. (C)            163. (B)            186. (D)            209. (B)  
141. (B)            164. (D)            187. (D)            210. (A)  
142. (C)            165. (D)            188. (B)            211. (B)  
143. (C)            166. (D)            189. (D)            212. (D)  
144. (D)            167. (A)            190. (D)            213. (C)  
145. (A)            168. (C)            191. (A)            214. (B)  
146. (B)            169. (C)            192. (A)            215. (A)  
147. (A)            170. (B)            193. (C)            216. (C)  
148. (C)            171. (A)            194. (A)            217. (D)  
149. (C)            172. (A)            195. (A)            218. (A)  
150. (B)            173. (C)            196. (C)            219. (D)  
151. (C)            174. (B)            197. (A)            220. (C)  
152. (C)            175. (D)            198. (A)            221. (A)  
153. (B)            176. (D)            199. (C)            222. (B)  
154. (A)            177. (C)            200. (B)            223. (B)  
155. (A)            178. (D)            201. (A)            224. (D)  
156. (B)            179. (A)            202. (B)            225. (B)  
157. (B)            180. (C)            203. (C)            226. (D)  
158. (C)            181. (A)            204. (D)            227. (B)  
159. (B)            182. (A)            205. (B)            228. (C)  
160. (C)            183. (A)            206. (B)            229. (C)  
161. (D)            184. (B)            207. (A)            230. (D)



231. (C)                      249. (B)
232. (A)                      250. (B)
233. (B)
234. (B)
235. (B)
236. (C)
237. (C)
238. (C)
239. (C)
240. (B)
241. (C)
242. (D)
243. (B)
244. (A)
245. (A)
246. (C)
247. (D)
248. (A)

The Biomimics



**Biotechnology Eligibility Test (BET)  
for DBT-JRF Award (2009-10)**

Government of India, Ministry of Science & Technology,  
Department of Biotechnology, New Delhi  
(Coordinated by University of Pune)

**April 19, 2009**

**Total Marks – 300**

**Duration 10.00 a.m. - 12.30 p.m.**

- N.B.**
- 1) All questions in Section A are **compulsory**.
  - 2) Answer any 50 questions from Section B.
  - 3) In case more than 50 are attempted, first 50 will be considered.
  - 4) Each question carries 3 marks; for every wrong answer, one mark will be deducted.
  - 5) Write your seat no. strictly inside the space provided on the Answer sheet.
  - 6) Answers marked inside the question paper will not be evaluated.
  - 7) Please return the question paper along with the Answer sheet.

**Instructions for filling the Answer sheet:**

- 1) There is only one correct answer for each question and once a mark has been made the same cannot be altered.
- 2) All entries in the circle must be made by **BLACK ink Ball Point Pen** only. Do not try to alter the entry.
- 3) Oval should be darkened completely so that the numeral inside the oval is not visible.
- 4) Do not make any stray marks for rough work on the sheet.
- 5) Do not use marker, white fluid or any other device to hide the shading already done.
- 6) More than one entry of an answer will be considered wrong, and negative marking will be done as above.
- 7) Mark your answer as shown in the example.

<b>Examples For Entering Answers</b>			
<b>Wrong Method</b>			
<del>A</del>	B	C	D
A	<del>B</del>	C	D
A	●	C	D
A	B	●	●
<b>Correct Method</b>			
●	B	C	D

## Section A

- Which of the following does not apply to triplex DNA?
  - It is triple stranded in nature
  - It requires only Hoogsteen hydrogen bonding
  - It requires Watson-Crick hydrogen bonding
  - It forms at neutral or acidic pH
- A C-terminal KDEL motif will most often ensure
  - the protein to be folded by hsc70
  - the protein to be degraded by the ubiquitin-proteasome pathway
  - secretion of the protein
  - ER-retention of the protein
- 5-Methylcytosines are common sites for mutations because they
  - are not recognized by the proofreading activity of DNA polymerase
  - can mispair with adenine
  - can deaminate to thymidine
  - prevent discrimination between the daughter and parental strand
- Nickel Nitriloacetic acid columns are used in \_\_\_\_\_ chromatography
  - Ion exchange
  - Affinity
  - Size exclusion
  - Reverse phase
- The antibiotic that resembles the 3' end of the charged tRNA molecule is
  - Tetracycline
  - Puromycin
  - Kanamycin
  - Streptomycin.
- Mitochondria are involved in the following except
  - ATP production
  - Glycosylation
  - Fatty acid biosynthesis
  - TCA cycle
- Mycoplasmas are bacterial cells that
  - fail to reproduce in artificial media
  - have a rigid cell wall
  - are resistant to penicillin
  - stain well with Gram's stain
- The technique for identifying the nucleic acid sequences bound by a DNA/RNA binding protein is
  - Finger printing
  - Foot printing
  - Array printing
  - AFLP
- To know the structural similarity between two proteins, the server to use is
  - PRODOM
  - PROSITE
  - TREMBLE
  - DALI
- Which of the following is a molecular chaperone ?
  - Dna G
  - Dna A
  - Lysozyme
  - Dna K
- Activation of phospholipase C initiates a sequence of events including all of the following, except
  - release of inositol 4,5-bisphosphate from a phospholipid
  - increase in intracellular  $Ca^{2+}$  concentration
  - release of diacylglycerol from phospholipid
  - activation of protein kinase C
- 5' RACE is often necessary to
  - delete sequences from 5' end of the DNA strand
  - label 5' end of DNA with a dye
  - clone 5' region of genes from mRNA
  - add sequences at 5' end to facilitate annealing of a specific primer
- Activation of genes in euchromatic regions is an outcome of-----of histone N-terminal tails
  - deacylation
  - methylation
  - hyperacetylation
  - phosphorylation
- Integration of phage lambda genome into *E. coli* chromosome is by
  - COS sites
  - random integration by the function of  $\lambda$  element in the chromosome
  - site specific recombination
  - red gene mediated recombination
- 3' Overhangs of 2-bp length are found in
  - genome-length RNA of CaMV
  - subgenomic RNAs of RNA viruses
  - Taq polymerase-amplified DNA fragments
  - short RNA fragments involved in RNA silencing
- Matrix Attachment Regions are involved in
  - specific attachment of pathogens to the cell surface

- (B) formation of clathrin-coated vesicles  
 (C) genomic compartmentalization creating chromatin domains favourable for transcription  
 (D) transport of spliced mRNA from the nucleus to the cytoplasm
17. The biosafety problem due to spread of transgenes from transgenic plants to its wild relatives can be avoided by  
 (A) developing transgenic plants with herbicide markers  
 (B) Posi-Tech selection using non-antibiotic markers like *pmi*  
 (C) developing transplastomic lines  
 (D) elimination of markers using *Cre/lox* system
18. Full expression of the lac operon requires  
 (A) lactose and cAMP  
 (B) allolactose and cAMP  
 (C) cAMP  
 (D) lactose
19. An enzyme that induces double strand breaks in DNA and rejoins them is called  
 (A) Restriction endonuclease  
 (B) DNA gyrase  
 (C) DNA ligase  
 (D) DNA polymerase
20. Which of the following best describes interferon's suspected mode of action in producing resistance to viral infection?  
 (A) It stimulates cell-mediated immunity  
 (B) It stimulates humoral immunity  
 (C) Its direct antiviral action is related to the suppression of messenger RNA formation  
 (D) Its action is related to the synthesis of a protein that inhibits translation or transcription
21. The most sensitive method of detecting infection by cytomegalovirus (CMV) in the new born is  
 (A) isolation of the virus  
 (B) identification of characteristic cells in gastric secretions  
 (C) detection of IgM antibody by immunofluorescence  
 (D) direct detection of antigen by ELISA
22. In Staphylococci, antibiotic resistance genes can exist either on plasmids or chromosomes. The genes are carried by  
 (A) Prophage  
 (B) Free DNA  
 (C) Transposons  
 (D) Protein A
23. The main host defense against bacterial exotoxins is  
 (A) activation of macrophages secreting proteases  
 (B) Production of IgG and IgM antibodies  
 (C) activation of helper T cells  
 (D) modulation of the host cell receptors in response to the toxin
24. The effects of endotoxin include each of the following except  
 (A) Opsonization  
 (B) Fever  
 (C) Activation of the coagulation cascade  
 (D) Hypotension
25. Which of the following statements is true concerning Natural Killer (NK) cells?  
 (A) They belong to T-cell lineage  
 (B) They belong to B-cell lineage  
 (C) They kill bacterially infected cells  
 (D) They display cytotoxic effect on tumor cells
26. The E-value in a BLAST search measures  
 (A) the probability that the search result is non-random  
 (B) the significance of the search result  
 (C) the probability that the search result is obtained randomly  
 (D) the reliability of the search
27. During protein evolution the region of protein most prone to mutation is  
 (A) functional domain  
 (B) structurally conserved domain  
 (C) connective loops  
 (D) hydrophobic domain
28. Operon having positive and negative regulation by single regulatory protein is  
 (A) lac operon  
 (B) trp operon  
 (C) ara operon  
 (D) his operon
29. Uvr ABC endonuclease is present in which repair system ?  
 (A) Mismatch repair  
 (B) Nucleotide excision repair  
 (C) Base excision repair  
 (D) SOS repair
30. The first commercially produced plant secondary metabolite using bioreactor technology is  
 (A) shikonin  
 (B) colchicine  
 (C) cercosporin  
 (D) cytokinin
31. You can patent a product/process only if it is  
 (A) a major discovery reported in high impact journals

- (B) novel, non-obvious and usable  
 (C) new and extension of earlier principles  
 (D) new applications of a patented product
32. The hydrogen-bonding pattern in alpha helices is  
 (A)  $n$  to  $n+4$   
 (B)  $n$  to  $n+3$   
 (C)  $n$  to  $n+5$   
 (D)  $n-1$  to  $n$
33. Calf thymus terminal deoxynucleotidyl transferase  
 (A) adds nucleotide to the 3'OH terminus of a DNA molecule  
 (B) adds nucleotide to the 5' P terminus of a DNA molecule  
 (C) removes nucleotide from the 3'OH terminus of a DNA molecule  
 (D) removes nucleotide from 5' P terminus of a DNA molecule
34. The rate of renaturation of DNA is governed by the equation  
 (A)  $dc/dt = -kC^2$   
 (B)  $dt/dc = -kC^2$   
 (C)  $dt/dc = kC^2$   
 (D)  $dc/dt = 2kC$
35. The enzyme of choice for converting DNA with 3'end overhang into a blunt ended one is  
 (A) Klenow fragment of DNA Polymerase I  
 (B) DNA Polymerase I holoenzyme  
 (C) T4 DNA polymerase  
 (D) S1 nuclease
36. If you want literature information, which is the best website to visit?  
 (A) OMIM  
 (B) Entrez  
 (C) PubMed  
 (D) PROSITE
37. What would be the likely explanation for the existence of pseudogenes?  
 (A) gene duplication  
 (B) gene duplication and mutation events  
 (C) mutation events  
 (D) unequal crossing over
38. The  $\alpha$ -helical motifs of gene regulatory proteins generally bind to  
 (A) major groove of A-DNA  
 (B) minor groove of B-DNA  
 (C) major groove of B-DNA  
 (D) sugar-phosphate backbone of A-DNA
39. Which of the following ionizes at physiological pH?  
 (A) glycine  
 (B) alanine  
 (C) histidine  
 (D) purine
40. A peptide bond  
 (A) has a partial double bond character  
 (B) is stable in strong acids  
 (C) occurs most commonly in *cis* configuration  
 (D) is cleaved by agents that denature proteins, such as organic solvents and high concentrations of urea.
41. The complete denaturation of a protein leads to a loss of the following structure(s):  
 (A) primary  
 (B) primary and tertiary  
 (C) primary and secondary  
 (D) secondary and tertiary
42. HeLa cell line is derived from which type of carcinoma?  
 (A) lung  
 (B) colon  
 (C) cervical  
 (D) brain
43. Vinblastine, a chemotherapeutic agent, inhibits  
 (A) microtubule polymerization  
 (B) microtubule depolymerization  
 (C) spindle formation  
 (D) actin polarisation
44. Turner's syndrome is due to  
 (A) XXY  
 (B) XXO  
 (C) XO  
 (D) XXX
45. Which one of the following is not an antigen presenting cell?  
 (A) dendritic Cell  
 (B) B Cell  
 (C) macrophage  
 (D) Natural Killer cell
46. Bird flu in last decade was caused by  
 (A) H5N1  
 (B) H3N2  
 (C) H1N1  
 (D) H2N1
47. Ultraviolet radiation causes DNA damage by formation of  
 (A) cytidine dimer  
 (B) thymidine dimer  
 (C) adenine dimer

- (D) guanine dimer
48. Autoreactive cells are present in our immune system due to  
 (A) increased tolerance  
 (B) defective thymic selection  
 (C) peripheral deletion  
 (D) breakdown of host immunity
49. Which one of the following microbes removes oil spills by digesting hydrocarbons?  
 (A) *Helicobacter* sp.  
 (B) *Pseudomonas* sp.  
 (C) *Trichoderma* sp.  
 (D) *Staphylococcus* sp.
50. Apart from gas transport Hemoglobin plays an important role in  
 (A) red cell morphology  
 (B) blood buffering  
 (C) globin synthesis  
 (D) bone marrow regeneration
- 

## Section B

51. The smallest genome among the plants listed below is that of  
 (A) *Gossypium* sp  
 (B) *Oryza sativa*  
 (C) *Arabidopsis thaliana*  
 (D) *Arachis hypogaea*
52. Porins  
 (A) are cytoskeletal proteins  
 (B) form channels which allow passage of hydrophilic molecules  
 (C) are fatty acids  
 (D) are pores in the stem of a plant
53. nif genes which encode the nitrogenase complex and other enzymes involve  
 (A) ammonification  
 (B) nitrogen fixation  
 (C) nitrification  
 (D) denitrification
54. ABA is a  
 (A) growth promoter  
 (B) stress hormone  
 (C) protein  
 (D) polyamine
55. EMS is a mutagen capable of causing  
 (A) large deletions  
 (B) single base substitutions  
 (C) translocations  
 (D) chromosomal rearrangements
56. Enucleated protoplast is called  
 (A) cybrid  
 (B) tonoplast  
 (C) cytoplasm  
 (D) duplast
57. The gene which is suppressed by another nonallelic gene through interaction is known as  
 (A) Epistatic  
 (B) Incomplete  
 (C) Hypostatic  
 (D) Homologs
58. Cleistogamy occurs in  
 (A) Rice  
 (B) Barley  
 (C) Maize  
 (D) Pearl millet
59. Doubled haploid lines can be generated by  
 (A) Protoplast fusion  
 (B) Transformation  
 (C) Anther culture  
 (D) RNAi technology
60. A mapping method for identifying markers linked to a trait of interest in a natural population is called  
 (A) Linkage mapping  
 (B) Association mapping  
 (C) Transcriptome mapping  
 (D) Chromosome walking
61. Break down of Gibberellic acid is mediated by  
 (A) GA 20 Oxidase  
 (B) GA 2 Oxidase  
 (C) GA 3 Oxidase  
 (D) Kaurene Oxidase
62. SSR markers are  
 (A) Dominant  
 (B) Co-dominant  
 (C) Epistatic  
 (D) Recessive

63. Isopentenyl transferase is an enzyme involved in  
 (A) cytokinin synthesis  
 (B) auxin synthesis  
 (C) proline synthesis  
 (D) purine synthesis
64. Luciferase gene (*luc*) is isolated from  
 (A) *E. coli*  
 (B) *Aequorea victoria*  
 (C) *Photinus pyralis*  
 (D) *Bacillus* sp.
65. Slender (*slr*) mutant in rice is due to mutation in  
 (A) GA signalling  
 (B) ABA signalling  
 (C) Auxin signalling  
 (D) Cytokinin signaling
66. Biological nitrogen fixation occurs when atmospheric nitrogen is converted into  
 (A) ammonia  
 (B) nitrate  
 (C) nitrite  
 (D) nitrogen dioxide
67. It was possible to engineer genes of interest between right and left border of T-DNA of *Agrobacterium* for plant transformation because  
 (A) T-DNA is nontoxic  
 (B) T-DNA is not required by *Agrobacterium*  
 (C) The *agrobacterium* genes essential for mobilization of the T-DNA lie outside the T-DNA  
 (D) T-DNA cannot function in plants
68. Integration of more than one copy of transgene is not desirable because  
 (A) It can make more transcript than needed  
 (B) It can cause toxicity  
 (C) It can cause mutation in the gene of interest  
 (D) It can induce gene silencing
69. Systemic acquired resistance  
 (A) is an enhanced resistance exhibited by uninfected plant tissue through a memory of previous infection  
 (B) is a resistance exhibited by plants towards any pathogen  
 (C) is a resistance acquired by a sensitive plant through breeding  
 (D) is a resistance exhibited by bacterial pathogens towards a large number of antibiotics
70. rasiRNAs are involved in  
 (A) heterochromatinization of DNA through histone tail modification  
 (B) post transcriptional RNA degradation  
 (C) degradation of proteins  
 (D) heterochromatinization of DNA through methylation at cytosine residues
71. The first product of photosynthesis in C3 plants is  
 (A) glycerate 3 phosphate  
 (B) malate  
 (C) glycerate 1,3 bisphosphate  
 (D) phosphoenol pyruvate
72. Which of the following reactor systems is generally used to generate microbial mutants?  
 (A) CSTR system  
 (B) BSTR system  
 (C) PBR system  
 (D) FBR system
73. In microbial fermentation, generally inhibitors  
 (A) are consumed by the microbes  
 (B) are incorporated in the synthesized molecule  
 (C) help in combating contamination  
 (D) help in the production of desired products
74. Product yield coefficient is defined as  
 (A) Cell mass formed: substrate utilized  
 (B) Substrate utilized: cell mass formed  
 (C) Product formed: substrate utilized  
 (D) Substrate utilized : product formed
75. Which of the following reactors would have mixing profiles that are closest to plug flow?  
 (A) A continuous air lift bioreactor  
 (B) A continuous fluidized bed bioreactor  
 (C) A continuous packed bed reactor  
 (D) Continuous stirred tank reactors with biomass recycle
76. Which of the following antibiotics/toxicants acts by interfering with the phosphodiester bond formation?  
 (A) Rifamycin  
 (B) Actinomycin  
 (C)  $\alpha$  - amanitin  
 (D) Penicillin
77. Diphtheria toxin blocks protein synthesis by  
 (A) ADP ribosylation of EF-2  
 (B) Phosphorylating EF-1  
 (C) Inhibiting peptidyl transferase activity  
 (D) ADP ribosylation of EF-G

78. By a single experiment how would you know that the stationary phase in a batch culture is due to substrate depletion or toxin accumulation?
- By adding highly concentrated substrate in the stationary phase
  - By adding more substrate in the stationary phase
  - By diluting the broth by sterilized water in the stationary phase
  - By extracting toxin from the broth in the stationary phase
79. The average value of dissolved oxygen concentration in water is
- 10 mg/l
  - 100 mg/l
  - 160 mg/l
  - 1 mg/l
80. Seitz filter is made of
- Diatomaceous earth
  - Porcelain
  - Asbestos pad
  - Sintered glass disks
81. A fungal disease Moniliasis is caused by
- Filobasidiella neoformans*
  - Candida albicans*
  - Blastomyces dermatitidis*
  - Histoplasma capsulatum*
82. Which of the following tests is done for the diagnosis of scarlet fever?
- Frei test
  - Tuberculin test
  - Ducrey test
  - Schultz-Charlton test
83. In a plant scale reactor temperature is controlled by passing cold water
- through jacket only
  - through internal coil only
  - through both jacket and internal coil
  - by sprinkling cold water on the wall of the reactor
84. The Robertsonian translocation that is most widely distributed in cattle populations worldwide is referred to as
- Roberson's anomaly
  - Anderson's anomaly
  - Gustavsson's anomaly
  - Smith's anomaly
85. An example of a motile microorganism is
- Brucella
  - Lactobacillus
  - Shigella
  - Pseudomonas
86. Which one of the following is an unprotected fermentation?
- Ethanol production
  - Citric acid production
  - Antibiotic production
  - Enzyme production
87. A method commonly used to determine the level of damage of animal cells in a culture medium is to monitor
- the concentration of lactate in the medium
  - the level of lactate oxidase activity in the medium
  - the level of lactate dehydrogenase activity
  - the level of laccase activity in the medium
88. Vortexing in stirred tank reactor can be reduced by using
- An axial flow impeller
  - A turbine impeller
  - Baffles in the reactor
  - Multiple impellers
89. In which type of chromatography are ion-pairing agents used for elution?
- Hydrophobic Interaction Chromatography
  - Reverse Phase Chromatography
  - Ion Exchange Chromatography
  - Immobilized Metal Anion Chromatography
90. Blocking of 'A' site on the ribosome and thereby inhibiting protein synthesis is the mechanism of action of
- Streptomycin
  - Tetracycline
  - Chloramphenicol
  - Erythromycin
91. *Clostridium tetanomorphum* is known to produce
- Vitamin A



- (B) Vitamin B  
(C) Vitamin C  
(D) Vitamin K
92. Multiple antigen peptides (MAPs) are peptide vaccines which are chemically 'stitched' together usually onto a  
 (A) Poly-lysine backbone  
 (B) Poly-arginine backbone  
 (C) Poly-methionine backbone  
 (D) Poly-histidine backbone
93. Which of the following antibiotics is produced by chemical synthesis?  
 (A) Penicillin  
 (B) Streptomycin  
 (C) Tetracycline  
 (D) Chloramphenicol
94. Which of the following obtains energy from the oxidation of inorganic or organic chemicals?  
 (A) Chemotroph  
 (B) Lithotroph  
 (C) Autotroph  
 (D) Heterotroph
95. A common clinical pathological finding during a viral infection is  
 (A) Neutrophilia  
 (B) Eosinophilia  
 (C) Leukopenia  
 (D) Basophilia
96. Regimes of the world with an unusually large concentration of various species are called  
 (A) Natural preserves  
 (B) Cloud forests  
 (C) Landscape  
 (D) Biodiversity hotspots
97. Deficiency of lipase enzyme can cause  
 (A) Muscle cramps  
 (B) Joint inflammation  
 (C) Hepatotoxicity  
 (D) Coma and death
98. Which of the following can be grown anaerobically?  
 (A) *E. coli*  
 (B) *S. aureus*  
 (C) *Pseudomonas*  
 (D) *Clostridia*
99. For which of the following, the units of rate constant and rate of reaction are same?  
 (A) 1<sup>st</sup> order reaction  
 (B) 2<sup>nd</sup> order reaction  
 (C) 3<sup>rd</sup> order reaction  
 (D) Zero order reaction
100. High density yeast culture represents  
 (A) Pseudoplastic rheology  
 (B) Dilatant rheology  
 (C) Bingham rheology  
 (D) Casson body rheology
101. In order to permeabilize yeast cell, it is best to treat with  
 (A) EDTA and Lysozyme  
 (B)  $\beta$ -(1, 3) glucanase and protease  
 (C)  $\beta$ -(1, 6) glucanase  
 (D) Alkaline hydroxylase
102. In Aqueous two phase extraction, proteins are highly influenced by \_\_\_\_\_ polymer phase  
 (A) Low molecular weight  
 (B) High molecular weight  
 (C) Similar molecular weight  
 (D) Medium molecular weight
103. In order to fractionate particles based on size which of the following is most suitable?  
 (A) Tubular centrifuge  
 (B) Multichamber centrifuge  
 (C) Disk stack centrifuge  
 (D) Decanter centrifuge
104. Which among the following purification steps initially requires high ionic strength in the sample?  
 (A) Ion exchange chromatography  
 (B) Hydrophobic interaction chromatography  
 (C) Chromatofocusing  
 (D) Preparative chromatography
105. Dynamic kinetic resolution of chiral molecules yields a maximum of  
 (A) 50% conversion  
 (B) 100% conversion  
 (C) 75% conversion  
 (D) 25% conversion

106. Unit of  $n^{\text{th}}$  order rate constant is  
 (A)  $(\text{mol L}^{-1})^{1-n} \text{sec}^{-1}$   
 (B)  $(\text{mol L}^{-1})^{n-1} \text{sec}^{-1}$   
 (C)  $(\text{mol}^{-1} \text{L})^{1-n} \text{sec}^{-1}$   
 (D)  $(\text{mol L}^{-1})^{n-1} \text{sec}$
107. The half life of the 1<sup>st</sup> order reaction is independent of  
 (A) Square of final substrate  
 (B) Initial substrate concentration  
 (C) Final substrate concentration  
 (D) Cube root of final substrate concentration
108. In a first order reaction  $A \rightarrow B$ . The plot \_\_\_\_\_ is a straight line  
 (A)  $[A]$  versus time (t)  
 (B)  $1/[A]$  versus time (t)  
 (C)  $\ln [A]$  versus time (t)  
 (D)  $1/\ln [A]$  versus time (t)
109. Bang's disease is caused by  
 (A) *Corynebacterium pyogenes*  
 (B) *Staphylococcus aureus*  
 (C) *Brucella abortus*  
 (D) *Salmonella dublin*
110. Catalytic efficiency allows a comparison of different enzymes. It is the ratio of  
 (A)  $K_{\text{cat}}/K_m$   
 (B)  $K_m/K_{\text{cat}}$   
 (C)  $V_{\text{max}}/K_{\text{cat}}$   
 (D)  $K_{\text{cat}}/V_{\text{max}}$
111. Gas gangrene is caused by the bacteria of the genus  
 (A) Staphylococcus  
 (B) Streptococcus  
 (C) Clostridium  
 (D) Corynebacterium
112. Random single displacement enzyme reactions resemble  
 (A) Competitive inhibition  
 (B) Uncompetitive inhibition  
 (C) Irreversible inhibition  
 (D) Noncompetitive inhibition
113. In an enzyme catalyzed reaction,  $K_m = 4 \times 10^{-5}$   $\mu\text{mol/l}$ , and the rate of reaction (V) at substrate concentration  $[S] = 1.2 \times 10^{-2}$  M is 80  $\mu\text{mol/l-min}$ .  
 Assuming no inhibitor is present,  $V_{\text{max}}$  is practically equal to  
 (A) 40  $\mu\text{mol/l-min}$   
 (B) 80  $\mu\text{mol/l-min}$   
 (C) 120  $\mu\text{mol/l-min}$   
 (D)  $4.8 \times 10^2$   $\mu\text{mol/l-min}$
114. The rate of reaction increases by increase in temperature because  
 (A) Collision frequency increases  
 (B) Energy of products decreases  
 (C) Fraction of molecules possessing energy  $\geq E_T$  (Threshold energy) increases  
 (D) Mechanism of reaction is changed
115. If the concentration of the reactants is increased by "X", then the rate constant K becomes  
 (A)  $e^{K/X}$   
 (B) K  
 (C)  $K/X$   
 (D)  $X/K$
116. Plug flow of both gas phase and liquid phase is a characteristic of  
 (A) STR  
 (B) Air-Lift reactor  
 (C) Bubble column reactor  
 (D) Fluidized bed reactor
117. The unit of volumetric oxygen transfer coefficient ( $K_L a$ ) is  
 (A)  $\text{m}^2\text{h}^{-1}$   
 (B)  $\text{m}^3\text{h}^{-1}$   
 (C)  $\text{h}^{-1}$   
 (D)  $\text{mh}^{-1}$
118. Which of the following statements is not true in case of Chemostat?  
 (A) An increase in flow rate leads to decrease in dissolved oxygen tension  
 (B) Cell recycle leads to increased productivity  
 (C) If operated with fixed flow rate, steady state is achieved by metabolic control  
 (D) Maximum cell mass yield is obtained when operating at dilution rate greater than maximum specific growth rate
119. Bacteria utilize glucose preferentially over other sugars through a mechanism called  
 (A) Operon repression

- (B) Enzyme repression  
(C) Catabolite repression  
(D) Catabolite induction
120. Syntrophism is a type of  
(A) Commensalism  
(B) Mutualism  
(C) Parasitism  
(D) Synergism
121. When organisms make toxic substances more toxic, the process is called  
(A) Bioremediation  
(B) Biomagnification  
(C) Biotoxification  
(D) Bioamplification
122. Non-superimposable mirror images having similar molecular formula are called  
(A) *Cis-trans* isomers  
(B) Geometric isomers  
(C) Anomers  
(D) Enantiomers
123. One of the following is not a zoonotic disease  
(A) Rabies  
(B) Anthrax  
(C) Brucellosis  
(D) Canine distemper
124. A protein antigen requires to be processed in order to make it  
(A) induce tolerance  
(B) facilitatory for clearance by spleen  
(C) to produce strong NK cell response  
(D) to form peptide-MHC complex
125. Diabetes insipidus is caused due to insufficient level of  
(A) insulin  
(B) ADH  
(C) thyroxine  
(D) TSH
126. Which of the following leukocytes is present in highest number in the human blood?  
(A) neutrophil  
(B) eosinophil  
(C) basophil  
(D) macrophage
127. In Parkinson's disease there is a predominant loss of  
(A) dopaminergic neurons in the substantia nigra  
(B) cholinergic neurons in the brain stem  
(C) noradrenergic neurons in the locus coeruleus  
(D) GABA-ergic neurons in the cortex
128. In Dengue fever the blood cell count that tends to decrease to a dangerous level is of  
(A) basophil  
(B) eosinophil  
(C) platelet  
(D) monocyte
129. The co-receptor responsible for the entry of HIV into the host cell is  
(A) CCR1  
(B) CCR5  
(C) CXCR3  
(D) CXCR7
130. Calcium present in which of the following spaces take part in the release of neurotransmitter?  
(A) Vesicles at the presynaptic terminal  
(B) Extracellular space  
(C) Intracellular space  
(D) Presynaptic terminal in free form
131. Maximum concentration of dopaminergic neurons is present in  
(A) locus coeruleus  
(B) red nucleus  
(C) substantia nigra  
(D) mammillary body
132. In Alzheimer's disease there is predominant loss of which type of neurons?  
(A) Cholinergic  
(B) Cholinoceptive  
(C) Noradrenergic  
(D) Noradrenoceptive
133. Under stress condition which of the following pairs of organs plays as haemopoietic organ other than bone marrow?  
(A) Both liver and lymph node  
(B) Both spleen and liver  
(C) Both lymphnode and thymus  
(D) Both spleen and thymus
134. Gene therapy through stem cells may be done using  
(A) lentiviral vector  
(B) plasmid vector  
(C) episomal vector  
(D) baculovirus vector
135. Defect in the SCID mice may be cured by inserting  
(A) ADA gene  
(B) SCID gene

- (C) SCDA gene  
(D) DAA gene
136. Insufficiency of the adrenal cortex causes which of the following diseases?  
(A) Cancer  
(B) Gout  
(C) Addison's disease  
(D) Psoriasis
137. Primary colours of vision are  
(A) red, black and yellow  
(B) black, white and green  
(C) orange, yellow and blue  
(D) red, blue and green
138. Thermoregulatory centre is located in the  
(A) cerebellum  
(B) cerebral cortex  
(C) preoptic area  
(D) mammillary body
139. Which category of hypersensitivity best describes hemolytic disease of the newborn caused by Rh incompatibility?  
(A) atopic or anaphylactic  
(B) cytotoxic  
(C) immune complex  
(D) delayed type
140. FMD virus belongs to the family  
(A) Parvoviridae  
(B) Adenoviridae  
(C) Flaviviridae  
(D) Picornaviridae
141. Myasthenic syndromes are caused due to impairment of which of the following receptor types?  
(A) Acetylcholinergic  
(B) Dopaminergic  
(C) GABA-ergic  
(D) Histaminergic
142. DNA vaccination induces  
(A) Cytotoxic T-cell response  
(B) NK-cell response  
(C) Antibody response  
(D) Immediate hypersensitivity response
143. Graft rejection is induced by  
(A) Antibody response  
(B) T-helper cell response  
(C) NK-T cell response  
(D) Cytotoxic T-cell response
144. Antiviral cellular immunity is predominantly mediated by  
(A) CD<sup>8+</sup> cytotoxic T lymphocytes  
(B) Natural Killer cells  
(C) CD<sup>4+</sup> T lymphocytes  
(D) Dendritic cells
145. Type 2 diabetes is due to  
(A) lack of utilization of insulin  
(B) lack of insulin production  
(C) lack of glucose synthesis  
(D) high intake of glucose
146. Which of the following is the best way to detoxify the methanol toxicity if a person drinks methanol?  
(A) Make the patient drink glucose water  
(B) Intravenous injection with steroid  
(C) Make the patient drink ethanol  
(D) Make the patient drink lemon juice
147. Which of the following protozoan parasites replicates inside the lysosomes?  
(A) *Toxoplasma*  
(B) *Leishmania*  
(C) *Trypanosoma*  
(D) *Plasmodium*
148. Which of the following hormones initiates biological actions by crossing the plasma membrane and then binding to a receptor?  
(A) Insulin  
(B) Glucagon  
(C) Estradiol  
(D) Norepinephrine
149. Which of the following is not an RNA virus?  
(A) Paramyxovirus  
(B) HIV  
(C) HPV  
(D) Picornavirus
150. During vigorous exercise lactic acid gets accumulated in skeletal muscle due to  
(A) lack of NADH  
(B) lack of NAD<sup>+</sup>  
(C) excess supply of CO<sub>2</sub>  
(D) excess supply of O<sub>2</sub>
151. Structure of amyloid fibril is  
(A) random coil  
(B)  $\beta$ -sheet  
(C)  $\alpha$ -helix  
(D)  $\beta$ -barrel

152. In meiosis  
 (A) Chromosomes separate in meiosis I and chromatids separate in meiosis II  
 (B) Chromosomes separate in meiosis II and chromatids separate in meiosis I  
 (C) Chromosomes separate in both meiosis I and II  
 (D) Chromatids separate in both meiosis I and II
153. Which one of the following viruses has been extensively used as expression vector for a number of foreign genes?  
 (A) Vaccinia virus  
 (B) Rotavirus  
 (C) Rabies virus  
 (D) Papilloma virus
154. Bovine group A rotavirus contains  
 (A) ss RNA  
 (B) ds RNA  
 (C) ss DNA  
 (D) ds DNA
155. Somatic mutation of immunoglobulin gene accounts for  
 (A) allelic exclusion  
 (B) class switching from IgM to IgG  
 (C) affinity maturation  
 (D) V(D)J recombination
156. The earliest thymocytes are  
 (A) CD4<sup>-</sup>CD8<sup>-</sup>  
 (B) CD4<sup>+</sup>CD8<sup>+</sup>  
 (C) CD4<sup>+</sup>CD8<sup>-</sup>  
 (D) CD4<sup>-</sup>CD8<sup>+</sup>
157. Which one of the following is an enveloped virus?  
 (A) Adenovirus  
 (B) SV40  
 (C) Parvovirus  
 (D) Influenza virus
158. Which one of the following mouse immunoglobulins has three domains in the constant region of the heavy chain?  
 (A) IgG2b  
 (B) IgG2a  
 (C) IgE  
 (D) IgA
159. Metabolic engineering of *E.coli* as a commercial source of the fuel ethanol involves alteration of its  
 (A) Carbohydrate catabolic pathways  
 (B) Fermentative pathways  
 (C) TCA cycle  
 (D) Ability to grow autotrophically
160. Locus coeruleus in the brain possesses maximum concentration of  
 (A) cholinergic neurons  
 (B) noradrenergic neurons  
 (C) astrocytes  
 (D) microglia
161. A tissue slice (non-dividing cells) was exposed for prolonged time to a chemical. The response of the slice to such chemical gradually reduced. However, if washed and left for sometime, the tissue started responding to the same chemical at the same concentration. The reduced response was likely to be due to  
 (A) increased apoptosis of the cells  
 (B) the cells were necrosed  
 (C) the pH of the medium was changed  
 (D) the receptors were desensitized/down-regulated
162. In albino Wistar rats the red colour of the blood is due to  
 (A) lack of pigmentation  
 (B) absence of porphyrin ring in the heme of haemoglobin  
 (C) oxidized state of the iron in the heme  
 (D) reduced state of the iron in the heme
163. Large calf syndrome primarily occurs in  
 (A) Naturally born calves  
 (B) Transgenic calves  
 (C) Calves produced by IVF  
 (D) Calves produced by Artificial insemination
164. Patients suffering from tetanus are given antiserum for therapy. This process of immunization is defined as  
 (A) active immunization  
 (B) prophylaxis  
 (C) booster immunization  
 (D) passive immunization
165. Which of the following is not a site in humans where invading microorganisms are filtered from body fluids passing through the site?  
 (A) Liver  
 (B) Heart  
 (C) Lung  
 (D) Spleen
166. Which of the following serologic tests involves competing antigen-antibody reactions?  
 (A) Complement fixation  
 (B) ELISA  
 (C) Agglutination  
 (D) Fluorescent-tagged immunoglobulins

167. Respiratory Quotient is given by  
 (A) moles of CO<sub>2</sub> produced / moles of O<sub>2</sub> consumed  
 (B) moles of O<sub>2</sub> consumed / moles of CO<sub>2</sub> produced  
 (C) moles of biomass produced / moles of O<sub>2</sub> consumed  
 (D) moles of biomass produced / moles of CO<sub>2</sub> produced
168. By using reference sequencing developed through human genome project, individual differences can now be analysed by using  
 (A) SSLPs  
 (B) SNPs  
 (C) SNRPs  
 (D) AFLPs
169. A person suffering from a killer disease SCID may be cured by inserting  
 (A) ADA gene  
 (B) SCID gene  
 (C) SCDA gene  
 (D) DAA gene
170. Vitamin E is  
 (A) menaquinone  
 (B) α-tocopherol  
 (C) Phylloquinone  
 (D) Retinol
171. A channel forming protein produced by cytotoxic T-cells is  
 (A) Streptolysin  
 (B) Channelin  
 (C) Porin  
 (D) Perforin
172. Cervical cancer is caused by  
 (A) Papilloma virus  
 (B) Herpes simplex virus  
 (C) Hepatitis B virus  
 (D) Vesicular stomatitis virus
173. The rate of impulse conduction in a nerve depends on  
 (A) axon diameter and axon length  
 (B) axon length and number of dendrites  
 (C) axon diameter and thickness of myelination  
 (D) myelination and nuclear size
174. Melatonin is secreted in the  
 (A) day time before noon  
 (B) day time after noon period  
 (C) just before sun set  
 (D) dark period
175. Heart rate would increase by the application of  
 (A) acetylcholine  
 (B) adrenaline  
 (C) cold saline  
 (D) cold glucose solution
176. Posture maintenance is mainly controlled by the  
 (A) cerebrum  
 (B) cerebellum  
 (C) hypothalamus  
 (D) mammary bodies
177. Galactosemia is a recessive human disease that is treatable by restricting lactose and glucose in the diet. A couple is heterozygous for the galactosemia gene. If the couple has 4 children, what is the probability that none of the four will have galactosemia?  
 (A) 1/16  
 (B) 9/16  
 (C) 1/256  
 (D) 81/256
178. The genetic event that causes transition from membrane-bound to secretory form of IgM is  
 (A) Somatic Hypermutation  
 (B) V-D-J Recombination  
 (C) Alternative Splicing  
 (D) Gene Jumping
179. If the association constant for the binding of a given hapten to an antibody is 10<sup>9</sup> M<sup>-1</sup> and second order rate constant for its binding is 10<sup>8</sup> M<sup>-1</sup> s<sup>-1</sup> what would be the rate constant for the dissociation of the hapten from the antibody?  
 (A) 10<sup>-1</sup> s<sup>-1</sup>  
 (B) 10 s<sup>-1</sup>  
 (C) 10<sup>17</sup> s<sup>-1</sup>  
 (D) 10<sup>-17</sup> s<sup>-1</sup>
180. Idiotypic determinants of a given immunoglobulin molecule are located within  
 (A) hypervariable regions of heavy and light chains  
 (B) constant regions of light chains  
 (C) constant regions of heavy chains  
 (D) the hinge region
181. The best method to demonstrate IgG on the glomerular basement membrane in a kidney tissue section is  
 (A) precipitin test  
 (B) complement fixation test  
 (C) agglutination test  
 (D) indirect fluorescent-antibody test
182. Which one of the following substances is not released by activated helper T-cells?  
 (A) interleukin-1

- (B) gamma interferon  
(C) interleukin-2  
(D) interleukin-4
183. Which of the following produce(s) analgesia and autonomic inhibition?  
(A) Glycine  
(B) Glutamate  
(C) Acetylcholine  
(D) Opiates
184. Which of the following blood cell count decreases rapidly in dengue ?  
(A) Basophil  
(B) Eosinophil  
(C) Platelet  
(D) Monocytes
185. Anti-malarial function of quinine is mediated by  
(A) blocking the formation of hemoglobin in the host  
(B) blocking the formation of hemozoin in the parasite  
(C) triggering synthesis of hemoglobin in the host  
(D) triggering synthesis of hemozoin in the parasite
186. SARS is caused by which of the following viruses?  
(A) double stranded RNA  
(B) positive sense RNA  
(C) negative sense RNA  
(D) double stranded DNA
187. An inhibitor of sodium dependent glucose transport across the plasma membrane is  
(A) ouabain  
(B) sodium azide  
(C) dicumarol  
(D) phlorhizin
188. Tyrosine hydroxylase immunopositive neurons are  
(A) only noradrenergic  
(B) only dopaminergic  
(C) either dopaminergic or noradrenergic  
(D) only serotonergic
189. In adult neurogenesis, which of the brain areas has been suggested to play a role in periodic clearance of outdated hippocampal memory traces?  
(A) cortex  
(B) brainstem  
(C) dentate gyrus  
(D) hypothalamus
190. Antibody to a hapten could be raised without hapten-carrier conjugate by injecting  
(A) antiallotypic antibody  
(B) antiisotypic antibody  
(C) self antigen  
(D) antiidotypic antibody
191. phi, psi angles of a peptide segment adopting alpha helical conformation would be around  
(A)  $-78, +59$   
(B)  $+49, +26$   
(C)  $-57, -78$   
(D)  $-60, -40$
192. Structurally independent unit of protein structure is a  
(A) fold  
(B) domain  
(C) motif  
(D) super-fold
193. The allowed region in the Ramachandran Plot for three residues (alanine, glycine and proline) decreases in the order:  
(A) Pro > Gly > Ala  
(B) Gly > Ala > Pro  
(C) Ala > Pro > Gly  
(D) Gly > Pro = Ala
194. Which residue, among alanine, arginine, proline and methionine has the lowest propensity to occur in an alpha-helix?  
(A) alanine  
(B) arginine  
(C) proline  
(D) methionine
195. Which of the following databases is derived from mRNA information?  
(A) dbEST  
(B) PDB  
(C) OMIM  
(D) HTGS
196. Which of the following amino acids is least mutable according to PAM scoring matrix?  
(A) Alanine  
(B) Glutamine  
(C) Methionine  
(D) Cysteine
197. You have two distantly related proteins. Which of the following sets is the best for comparing them?  
(A) BLOSUM45 or PAM250  
(B) BLOSUM45 or PAM1  
(C) BLOSUM80 or PAM250  
(D) BLOSUM80 or PAM1

198. In a sequence database of a given size, which of the following expressions is likely to retrieve more matches (X means any amino acid; any of the residues in square brackets can occupy that position)?  
 (A) D-A-V-I-D  
 (B) [DE]-A-V-I-[DE]  
 (C) [DE]-[AVILM]-X-E  
 (D) D-A-V-E
199. Which alignment is used to predict whether two sequences are homologous or not?  
 (A) Local  
 (B) Global  
 (C) Pair-wise  
 (D) Multiple
200. In sequence analysis, Twilight zone refers to  
 (A) a zone of domain in a protein sequence  
 (B) a zone of sequence similarity (0-20% identity) but statistically not significant  
 (C) substitutions in sequence  
 (D) a zone of sequence similarity that is statistically significant
201. BLOCKS refers to  
 (A) gapped, aligned motif in a multiple sequence alignment  
 (B) ungapped, aligned motif in a multiple sequence alignment  
 (C) coding sequences  
 (D) non-coding sequences
202. CpG islands and codon bias are tools used in eukaryotic genomics to  
 (A) identify open reading frames  
 (B) differentiate between eukaryotic and prokaryotic DNA sequences  
 (C) Look for DNA-binding domains  
 (D) determine STS
203. The type of algorithm that GENSCAN tool employs is  
 (A) Neural network  
 (B) Rule-based system  
 (C) Hidden Markovs model  
 (D) Statistics based
204. BLASTx is used to  
 (A) search a nucleotide database using a nucleotide query  
 (B) search protein database using a protein query  
 (C) search protein database using a translated nucleotide query  
 (D) search translated nucleotide database using a protein query
205. Which of the following is a retrieval system?  
 (A) Entrez  
 (B) Bioedit  
 (C) Vecscreen  
 (D) Rasmol
206. The Smith-Waterman algorithm was developed for  
 (A) Local pairwise sequence alignment  
 (B) Global pairwise sequence alignment  
 (C) Multiple sequence alignment  
 (D) Structural alignment
207. In Molecular Dynamics simulation the dependence is on  
 (A) position only  
 (B) momentum only  
 (C) both position and momentum  
 (D) either position or momentum
208. Homology modeling involves  
 (A) alignment of the target sequence to the sequence of a template structure  
 (B) alignment of the target sequence with multiple sequences with no structural information  
 (C) *ab initio* structure prediction  
 (D) no input of sequence information
209. Which of the following cases are commonly used in sequence alignment?  
 (A) gap opening penalty = -2, gap extension penalty = -0.5  
 (B) gap opening penalty = -0.5, gap extension penalty = -2  
 (C) gap opening penalty = -100, gap extension penalty = 0  
 (D) gap opening penalty = -100, gap extension penalty = -100
210. CATH database classifies protein domains. CATH stands for  
 (A) Classified, Advanced, Technology and Homology  
 (B) Automatic Classification of Turns and Helices  
 (C) Class, Architecture, Topology and Homologous superfamily  
 (D) Classification of Alpha Trans-membrane Helices
211. *Ab initio* approaches for prediction of protein structure utilize  
 (A) sequence similarity  
 (B) structural similarity  
 (C) both sequence and structural similarity  
 (D) basic physicochemical principles



212. To know the structural similarity between two proteins, the server to use is  
 (A) PRODOM  
 (B) PROSITE  
 (C) TREMBLE  
 (D) DALI
213. Quantitative Structure Activity Relationship (QSAR) is used for  
 (A) Drug design  
 (B) Protein modeling  
 (C) Aligning two sequences  
 (D) Molecular Dynamics simulation
214. In protein modeling, molecular mechanics force field is used, because  
 (A) it takes less time as compared to others  
 (B) it is more accurate  
 (C) it guarantees global minimum  
 (D) it explicitly represents the electrons in a calculation
215. The potential energy for the interaction of two atoms is given by  $U = A/r^{12} - B/r^6$ . The bottom of the potential well corresponds to  
 (A) the sum of van der Waals radii of the atoms  
 (B) the existence of the maximum electrostatic interaction  
 (C) the situation when the first term vanishes  
 (D) the situation when the atoms get bonded covalently
216. A protein with mostly hydrophobic residues in the surface is likely to be a  
 (A) fibrous protein  
 (B) globular protein  
 (C) membrane protein  
 (D) glycosylated protein
217. The overall cost of production of recombinant DNA products for human use, in general increases due to complications in  
 (A) Upstream processing  
 (B) Fermentation process  
 (C) Downstream processing  
 (D) Formulation process
218. Which of the following does not represent a valid amino acid sequence?  
 (A) EINSTEIN  
 (B) CRICK  
 (C) FARADAY  
 (D) WATSON
219. Quaternary structure of a protein consists of  
 (A) arrangement of one protein chain in a protein with a single subunit  
 (B) arrangement of separate protein chains in a protein molecule with more than one subunit  
 (C) arrangement of only parallel and antiparallel  $\beta$ -sheets in a protein chain  
 (D) occurrence of an alpha-helix bundle in a protein chain
220. Among the following, which one is another anti-angiogenic factor than Squalamine extracted from Shark?  
 (A) Neovastat  
 (B) Chlorampenciol  
 (C) Streptomycin  
 (D) Histamine
221. Which of the following marine sources acts as a  $\text{Na}^+$  channel blocker?  
 (A) Tetrodotoxin  
 (B) Conotoxin  
 (C) Carageneen  
 (D) Acetyl choline
222. Which of the following proteins was used to create the first transgenic fish?  
 (A) Green Fluorescent protein  
 (B) Anti freezing protein  
 (C) Horseshoe peroxidase  
 (D) Myosin protein
223. Which of the following provides the best source of prostaglandins?  
 (A) Ctenophores  
 (B) Echinoderms  
 (C) Coral reefs  
 (D) Molluscs
224. The DNA replication inhibitor yielded by sponge is  
 (A) Clathesine  
 (B) Spongosides  
 (C) Spongin  
 (D) Sclerorin
225. Calyculins are natural products originally isolated from the marine  
 (A) Mollusk  
 (B) Sea weeds  
 (C) Sponges  
 (D) Mangrove
226. Curacin A is a potent anti-tumor agent obtained from a marine  
 (A) Actinomyces  
 (B) Cyanobacterium  
 (C) Aspergillus

- (D) Coral reef
227. In sea urchins \_\_\_\_\_ nerve fibers are involved in spawning.  
 (A) Cholinergic  
 (B) Peptidergic  
 (C) Dopaminergic  
 (D) Serotonergic
228. Which of the following is a pollution tolerant species?  
 (A) Shrimp  
 (B) Cuttle fish  
 (C) Isopods  
 (D) Polychaetes
229. Sponge cells are capable of constitutively expressing ----- and thus resemble tumor cells  
 (A) DNase  
 (B) Polymerase  
 (C) Helicase  
 (D) Telomerase
230. Which of the following trend is not the treatment used for the induction of triploidy in gastropods ?  
 (A) Pressure shock  
 (B) Thermal shock  
 (C) 6-dimethylamino purine  
 (D) Osmotic shock
231. UV-A absorbing compound present in marine cyanobacteria is  
 (A)  $\alpha$ -glucoside  
 (B)  $\alpha$ -galactoside  
 (C) Biopterin glucoside  
 (D) Biopterin galactoside
232. Members of luminous *Vibrio* sp. communicate with each other by  
 (A) Conjugation  
 (B) Recombination  
 (C) Quorum sensing  
 (D) Secreting Pheromones
233. The only naturally transformable marine cyanobacteria is  
 (A) *Agmenellum* sp.  
 (B) *Spirulina* sp.  
 (C) *Oscillatoria* sp.  
 (D) *Nostoc* sp.
234. Most of the cyanobacterial plasmids are  
 (A) Relaxed  
 (B) R plasmids  
 (C) Stringent  
 (D) Cryptic
235. Which of the following is not an epibiont?  
 (A) Barnacles  
 (B) Bryozoans  
 (C) Sea anemone  
 (D) Mussels
236. Which of the following peptides showing anti-tumor activity is isolated from marine organism?  
 (A) Saxitoxin  
 (B) Tetradoxin  
 (C) Ecteinascidin  
 (D) Dolostatin
237. The clown fish shows mutualism with  
 (A) Sea urchin  
 (B) Sea cucumber  
 (C) Sea anemone  
 (D) Hermit crab
238. Which of the following cell cycle regulatory proteins was first identified in marine invertebrates?  
 (A) p53  
 (B) Cyclins  
 (C) P27  
 (D) Cyclin dependent kinase
239. Gene coding for luminescence in marine luminescent bacteria is  
 (A) luxR  
 (B) toxR  
 (C) recA  
 (D) Luciferase
240. Red fluorescent protein used in the development of transgenic ornamental fish was isolated from  
 (A) Star fish  
 (B) Sponges  
 (C) Red algae  
 (D) Corals
241. Leydig's organ in cartilaginous fishes is for  
 (A) Sensation  
 (B) Respiration  
 (C) Immunity  
 (D) Reproduction
242. Melanosis in shrimps occurs due to the activity of  
 (A) Phenol oxidase  
 (B) alpha-glucosidase  
 (C) Prophenol oxidase  
 (D) All the above
243. The best source for salt tolerant gene is  
 (A) Fishes  
 (B) Mangroves

- (C) Seaweeds  
(D) Bacteria
244. Water resistant bioadhesives are produced by  
(A) Seaweeds  
(B) Mangroves  
(C) Mussels  
(D) Sea anemones
245. What kind of proteins are synthesized in marine algae in response to metal stress?  
(A) Metalloprotease  
(B) Phytochelatins  
(C) Metallothioneins  
(D) Phycobilins
246. The commercially available marine-derived anticancer drug is  
(A) Vincristine  
(B) Carboplastin  
(C) Vinblastin  
(D) Ara C
247. Which of the following is a marine pollution monitoring programme?  
(A) Bird watch programme  
(B) Mussel watch programme  
(C) Fish watch programme  
(D) Bay of Bengal programme
248. The viral infection in shrimp is caused by  
(A) HSV  
(B) WSSV  
(C) HIV  
(D) HPV
249. Alginate is obtained from  
(A) Brown algae  
(B) Green algae  
(C) Red algae  
(D) Blue green algae
250. General Economic Zone distance is  
(A) 500 nautical miles  
(B) 200 nautical miles  
(C) 300 nautical miles  
(D) 100 nautical miles

## Key to the MCQs for BET 09

### Section A

- |         |         |         |
|---------|---------|---------|
| 1. (B)  | 22. (C) | 43. (A) |
| 2. (D)  | 23. (B) | 44. (C) |
| 3. (C)  | 24. (A) | 45. (D) |
| 4. (B)  | 25. (D) | 46. (A) |
| 5. (B)  | 26. (D) | 47. (B) |
| 6. (B)  | 27. (C) | 48. (B) |
| 7. (C)  | 28. (C) | 49. (B) |
| 8. (B)  | 29. (B) | 50. (B) |
| 9. (D)  | 30. (A) |         |
| 10. (D) | 31. (B) |         |
| 11. (A) | 32. (A) |         |
| 12. (C) | 33. (A) |         |
| 13. (C) | 34. (A) |         |
| 14. (C) | 35. (C) |         |
| 15. (D) | 36. (C) |         |
| 16. (C) | 37. (B) |         |
| 17. (C) | 38. (C) |         |
| 18. (B) | 39. (C) |         |
| 19. (B) | 40. (A) |         |
| 20. (D) | 41. (D) |         |
| 21. (A) | 42. (C) |         |

**Section B**

- |         |         |          |          |
|---------|---------|----------|----------|
| 51. (C) | 73. (D) | 95. (C)  | 117. (C) |
| 52. (B) | 74. (C) | 96. (D)  | 118. (D) |
| 53. (B) | 75. (C) | 97. (A)  | 119. (C) |
| 54. (B) | 76. (A) | 98. (D)  | 120. (B) |
| 55. (B) | 77. (A) | 99. (D)  | 121. (B) |
| 56. (C) | 78. (A) | 100. (B) | 122. (D) |
| 57. (C) | 79. (A) | 101. (B) | 123. (D) |
| 58. (B) | 80. (C) | 102. (B) | 124. (D) |
| 59. (C) | 81. (B) | 103. (B) | 125. (B) |
| 60. (B) | 82. (D) | 104. (B) | 126. (A) |
| 61. (B) | 83. (C) | 105. (B) | 127. (A) |
| 62. (B) | 84. (C) | 106. (A) | 128. (C) |
| 63. (A) | 85. (D) | 107. (B) | 129. (B) |
| 64. (C) | 86. (D) | 108. (C) | 130. (B) |
| 65. (A) | 87. (C) | 109. (C) | 131. (C) |
| 66. (A) | 88. (C) | 110. (A) | 132. (A) |
| 67. (C) | 89. (B) | 111. (C) | 133. (B) |
| 68. (D) | 90. (B) | 112. (D) | 134. (A) |
| 69. (A) | 91. (B) | 113. (B) | 135. (A) |
| 70. (D) | 92. (A) | 114. (C) | 136. (C) |
| 71. (A) | 93. (D) | 115. (B) | 137. (D) |
| 72. (A) | 94. (A) | 116. (B) | 138. (C) |

139. (D)            162. (C)            185. (B)            208. (A)  
140. (D)            163. (D)            186. (B)            209. (A)  
141. (A)            164. (D)            187. (A)            210. (C)  
142. (A)            165. (B)            188. (C)            211. (D)  
143. (D)            166. (A)            189. (C)            212. (D)  
144. (D)            167. (A)            190. (D)            213. (A)  
145. (A)            168. (B)            191. (D)            214. (A)  
146. (C)            169. (A)            192. (B)            215. (A)  
147. (B)            170. (B)            193. (B)            216. (C)  
148. (C)            171. (C)            194. (C)            217. (C)  
149. (C)            172. (A)            195. (A)            218. (D)  
150. (B)            173. (C)            196. (D)            219. (B)  
151. (B)            174. (D)            197. (A)            220. (A)  
152. (A)            175. (B)            198. (C)            221. (A)  
153. (D)            176. (B)            199. (B)            222. (B)  
154. (D)            177. (D)            200. (B)            223. (C)  
155. (C)            178. (C)            201. (B)            224. (B)  
156. (B)            179. (A)            202. (A)            225. (C)  
157. (D)            180. (A)            203. (C)            226. (B)  
158. (C)            181. (D)            204. (C)            227. (A)  
159. (B)            182. (A)            205. (A)            228. (D)  
160. (B)            183. (D)            206. (A)            229. (D)  
161. (D)            184. (C)            207. (C)            230. (D)

231. (C)            249. (A)  
232. (C)            250. (B)  
233. (A)  
234. (D)  
235. (C)  
236. (D)  
237. (C)  
238. (B)  
239. (A)  
240. (D)  
241. (C)  
242. (A)  
243. (B)  
244. (C)  
245. (B)  
246. (D)  
247. (B)  
248. (B)

The Biomimics



**Biotechnology Eligibility Test (BET)**  
**for DBT-JRF Award (2010-11)**  
**Government of India, Ministry of Science & Technology,**  
**Department of Biotechnology, New Delhi**  
**(Coordinated by University of Pune)**

**April 18, 2010**

**Total Marks – 300    Duration 10.00 a.m. - 12.30 p.m.**

- N.B.**
- 1) All questions in Section A are **compulsory**.
  - 2) Answer any 50 questions from Section B.
  - 3) In case more than 50 are attempted, first 50 will be considered.
  - 4) Each question carries 3 marks; for every wrong answer, one mark will be deducted.
  - 5) Write your seat no. strictly inside the space provided on the Answer sheet.
  - 6) Answers marked inside the question paper will not be evaluated.
  - 7) Please return the question paper along with the Answer sheet.

**Instructions for filling the Answer sheet:**

- 1) There is only one correct answer for each question and once a mark has been made the same cannot be altered.
- 2) All entries in the circle must be made by **BLACK ink Ball Point Pen** only. Do not try to alter the entry.
- 3) Oval should be darkened completely so that the numeral inside the oval is not visible.
- 4) Do not make any stray marks for rough work on the sheet.
- 5) Do not use marker, white fluid or any other device to hide the shading already done.
- 6) More than one entry of an answer will be considered wrong, and negative marking will be done as above.
- 7) Mark your answer as shown in the example.

<b>Examples For Entering Answers</b>			
<b>Wrong Method</b>			
<del>A</del>	B	C	D
A	<del>B</del>	C	D
A	●	C	D
A	B	●	●
<b>Correct Method</b>			
●	B	C	D



## Section A

- Which one of the following microscopic techniques is best suited to visualize the topology and distribution of transmembrane protein of a cell membrane?
  - Scanning electron microscopy
  - Transmission electron microscopy
  - Freeze-fracture electron microscopy
  - Thin-section electron microscopy
- Which of the following compounds mimics aminoacyl t-RNA and blocks protein synthesis ?
  - puromycin
  - kirromycin
  - streptomycin
  - neomycin
- A novel type II restriction enzyme has been isolated from a thermophilic bacteria. This restriction endonuclease recognizes 5'ATAANNNTTAT3' (N= any nucleotide) and cuts after third 'A' in the above sequence. What is the fate of DNA after restriction digestion ?
  - a 3 nucleotide long 5' overhang
  - a 7 nucleotide long 5' overhang
  - a 4 nucleotide long 5' overhang
  - a 3 nucleotide long 3' overhang
- Pyrosequencing derives its name from the fact that
  - the bases are detected by pyrolysis
  - it uses enzyme apyrase to detect the bases
  - it detects pyrophosphate released during base incorporation
  - it generates pyrograms as output
- A mammalian cell has an outstretched double stranded DNA of 1.2 meter which duplicates in 4hrs. If it duplicates at the rate of 20μmeter/min, how many origins of replication are there in the DNA?
  - 2500
  - 250
  - 25
  - 1
- An extracellular ligand will
  - elicit the same response in various cells that have a receptor for the ligand
  - elicit the same response but to varying degrees in various cells that have a receptor for the ligand
  - may elicit different responses in various cells that have a receptor for the ligand
  - elicit the same response in all types of cells because receptors have to be identical to bind to the same ligand
- In presence of a significant quantity of IFN  $\gamma$ , what will be the response of a T cell to an antigen presenting cell?
  - T cell will become anergic
  - T cell will get activated and start secreting IFN  $\gamma$
  - T cell will get activated and start secreting IL4
  - T cell will become a T cytotoxic cell
- cis-trans isomerization of the peptide bond preceding an amino acid X is known to be critical in the folding of proteins by slowing down the folding reaction. The amino acid X is
  - isoleucine
  - tryptophan
  - proline
  - histidine
- When immature B cells mature in the bone marrow, they need to interact with
  - stem cells present in the bone marrow
  - stromal cells and cytokines such as IL7
  - mature B cells present in the bone marrow
  - antigen presenting cells with different B cell epitopes presented on MHC II molecules
- Antibodies which can cross placenta and are involved in allergic reactions, respectively are
  - IgG and IgA
  - IgM and IgE
  - IgG and IgE
  - IgD and IgM
- Somatic mutations of immunoglobulin genes account for
  - allelic exclusion
  - class switching from IgM to IgG
  - affinity maturation
  - class switching from IgG to IgA
- Yellow mosaic of legumes is caused by Mung bean yellow mosaic virus which belongs to
  - Potexvirus group
  - Potyvirus group
  - Carlavirus group

- (D) Geminiviruses group
13. Cell cycle progression from one phase to another is primarily controlled by  
 (A) phosphorylation of cyclin  
 (B) proteolysis of cyclin  
 (C) dephosphorylation of cyclin  
 (D) proteolysis of cyclin dependent kinase
14. Elevation of intracellular inositol triphosphate (IP<sub>3</sub>) results in the release of Ca<sup>2+</sup> from which of the following organelles?  
 (A) Mitochondria  
 (B) Smooth endoplasmic reticulum  
 (C) Peroxisome  
 (D) Golgi-complex
15. Resting membrane potential of a biological membrane is close to the theoretical Nernst potential for the ions that are  
 (A) least abundant  
 (B) most abundant  
 (C) impermeable  
 (D) permeable
16. Testosterone hormone necessary for spermatogenesis is secreted by  
 (A) sertoli cells  
 (B) leydig cells  
 (C) spermatozoa  
 (D) cowpers gland
17. When Hfr strain of *E. coli* is crossed with F<sup>-</sup> strain, recombinants obtained are  
 (A) always F<sup>+</sup>  
 (B) always HFr<sup>+</sup>  
 (C) rarely F<sup>+</sup>  
 (D) rarely HFr<sup>+</sup>
18. Archea is considered as a separate group from bacteria and eukaryotes, based on  
 (A) genome sequence  
 (B) 16S rRNA gene sequence  
 (C) 23S rRNA gene sequence  
 (D) EFTu sequence
19. Which one of the following viruses does not replicate in the cytoplasm of host cells?  
 (A) Picornaviruses, e.g., poliovirus  
 (B) Poxviruses, e.g., vaccinia virus  
 (C) Rhabdoviruses, e.g., rabies virus  
 (D) Hepadnaviruses, e.g., hepatitis B virus
20. Which one of the following statements is incorrect about Retroviruses?  
 (A) Retroviruses are the only family of viruses to encode Reverse Transcriptase  
 (B) They are the only RNA viruses whose genome is produced by cellular transcription machinery  
 (C) They are the only (+) sense RNA viruses whose genome does not serve directly as mRNA immediately after infection  
 (D) They have high mutation rates
21. Which one of the following organisms is used in Ames test?  
 (A) *E. coli*  
 (B) *Streptococcus aureus*  
 (C) *Pseudomonas aerogenosa*  
 (D) *Salmonella typhimurium*
22. Which of the following protozoan parasites replicates inside the lysosomes?  
 (A) *Toxoplasma*  
 (B) *Leishmania*  
 (C) *Trypanosoma*  
 (D) *Plasmodium*
23. Which one of the following repetitive motifs is responsible for the formation of triple helix in collagen?  
 (A) Ala-X-Y  
 (B) Gly-X-Y  
 (C) Cys-X-Y  
 (D) Pro-X-Y
24. Which of the following processes occurs in the formation of disulfide bridge between two cysteine residues?  
 (A) Reduction of sulphydryl group  
 (B) Electrostatic interaction  
 (C) Oxidation of sulphydryl group  
 (D) Hydrogen bond formation
25. Electrophoresis of a purified protein in SDS-PAGE in the presence of 2-mercaptoethanol yields two bands of 35 kDa and 45 kDa. However, in a gel filtration chromatography, the same protein elutes as 80 kDa. What conclusion can be drawn from the above observation?  
 (A) Protein is not purified to homogeneity  
 (B) Two bands generated in SDS-PAGE due to degradation  
 (C) Protein is a multimer  
 (D) Protein is a heterodimer

26. Cholesterol contributes to which of the following properties of biological membranes?
- Membrane rigidity
  - Membrane fluidity
  - Membrane permeability
  - Membrane osmolarity
27. Active site of all serine proteases consists of
- Ser- Glu -Asp
  - Ser- Glu - Met
  - Ser-His-Asp
  - Ala-Glu-Met
28. Conversion of glucose to glucose-6-phosphate requires energy. However, critically ill patients are treated with intravenous infusion of glucose rather than glucose -6-phosphate because
- glucose-6-phosphate is unable to enter into cells
  - glucose-6-phosphate is degraded very fast
  - exogenous glucose-6-phosphate is toxic to the cells
  - exogenous glucose-6-phosphate will competitively inhibit endogenous enzymes
29. Analysis of a nucleotide sequence reveals the proportion of A : T : C : G :: 0.40 : 0.85 : 1.56 : 1. Type of DNA concluded from this study is a
- purine rich DNA
  - cruciform DNA
  - double stranded DNA
  - single stranded DNA
30. Which of the following properties is common to all cytoskeletal motor proteins like kinesins, dyneins and myosins?
- GTPase activity
  - ATPase activity
  - Actin binding domain
  - DNA binding domain
31. A dNTP master mix is prepared by combining 50 $\mu$ l each of 10mM dNTP stock. Two micro liters from this dNTP mix are added to the PCR master mix of 25 $\mu$ l reaction volume. What is the total dNTP concentration in the PCR reaction?
- 200 $\mu$ M
  - 400  $\mu$ M
  - 800  $\mu$ M
  - 250  $\mu$ M
32. Which of the following statements is correct for a reaction  $A + B \rightleftharpoons AB$ ?
- Larger the value of the equilibrium constant, weaker is the binding between A and B
  - Lower the value of the equilibrium constant, stronger is the binding between A and B
  - Larger the value of the equilibrium constant, stronger is the binding between A and B
  - This is a third order reaction
33. The amino acids with Phi and Psi values (-60, -40); (-59,-47) and (-80, 120) will be adopting which of the following conformation?
- Helix-helix-extended
  - Helix-coil-extended
  - Extended-extended-loop
  - Loop-loop-coil
34. A BSA stock solution is diluted 10 folds with phosphate buffer. The absorbance of the solution in a quartz cuvette of pathlength 1 mm at 281.5 nm is 0.330. If the extinction coefficient of the protein is 0.66 ml/mg.cm, the concentration of the stock protein solution would be
- 5 mg/ml
  - 20 mg/ml
  - 33 mg/ml
  - 50 mg/ml
35. Sodium dodecyl sulphate, an anionic detergent commonly used in SDS-Polyacrylamide gel electrophoresis, works in facilitating electrophoretic separation of a mixture of proteins by its ability to bind to the
- negatively charged amino acid side chains in proteins
  - hydrophobic side chains in proteins
  - positively charged amino acid side chains in proteins
  - peptide group in proteins
36. Regulation of fatty acid biosynthesis occurs at the enzymatic step catalyzed by
- carnitine acyltransferase I
  - acetyl CoA carboxylase
  - pyruvate carboxylase
  - citrate synthase
37. Which of the following is a lipid with a signal-transducing activity?
- Phosphatidyl serine
  - Phosphatidyl ethanolamine

- (C) Phosphatidyl inositol 4,5-bisphosphate  
(D) Phospholipase A2
38. Which one of the following antibiotics attaches to 50S ribosome and inhibits peptidyl-transferase activity?  
(A) Penicillin  
(B) Chloramphenicol  
(C) Trimethoprim  
(D) Amphotericin
39. The amino acid sequence of a novel membrane protein contains four immunoglobulin like domains and six fibronectin like repeats. This protein is most likely a  
(A) hormone responsive ion channel  
(B) cell adhesion molecule  
(C) G-protein  
(D) transcription factor
40. In a population of 200 individuals which is at equilibrium, the frequency of one of the alleles under study is 0.11. What is the expected frequency of heterozygous individual?  
(A) 0.89  
(B) 0.0979  
(C) 0.1958  
(D) 0.842
41. Increased genetic diversity following extended time in a tissue culture is a problem called  
(A) gene alteration  
(B) temporal modification  
(C) somaclonal variation  
(D) culture shock
42. To produce plants that are homozygous for all traits, the best choice is  
(A) cell suspension culture  
(B) callus culture  
(C) anther/ pollen culture  
(D) plant organ culture
43. Dye injected into a plant cell might be able to enter an adjacent cell through  
(A) tight junction  
(B) microtubule  
(C) desmosome  
(D) plasmodesma
44. If you want to use a plant tissue culture as a chemical factory for vitamins, which of the following will you choose?  
(A) Suspension cultures  
(B) Callus cultures  
(C) Organ cultures  
(D) Anther/pollen cultures
45. In which one of the following fermentations an inhibitor is added to increase the productivity?  
(A) Rifamycin B fermentation  
(B) Tetracycline fermentation  
(C) Glutamic acid fermentation  
(D) Citric acid fermentation
46. In which of the following cases, the enzyme substrate complex is irreversible in nature?  
(A) Competitive inhibition  
(B) Non-competitive inhibition  
(C) Un-competitive inhibition  
(D) Both competitive and non-competitive inhibition
47. A computer separates an organization's internal network from the public part through a  
(A) firewall  
(B) circuit-level gateway  
(C) security domains  
(D) interior node
48. A set of closely related genes or genetic markers that are inherited as a single unit is  
(A) cistron  
(B) gene families  
(C) Haplotype  
(D) Haploid
49. The mouse model for type II diabetes mellitus is  
(A) NZB mouse  
(B) SCID mouse  
(C) Nude mouse  
(D) NOD mouse
50. Which of the following stages of embryos is used for transfer into cows?  
(A) Mid morula stage  
(B) Late morula stage  
(C) Very early morula stage  
(D) Blastocyst stage

## Section B

51. Balanced genetic polymorphism occurs when there is selection against
- (A) heterozygotes
  - (B) all genotypes
  - (C) all homozygotes
  - (D) only homozygous recessive
52. Which one of the following statements is not true about chemokines?
- (A) They are small molecular weight proteins
  - (B) They may bind to more than one receptor type
  - (C) They are secreted only by activated T-cells
  - (D) They are secreted by leukocytes
53. Xth nerve is an example of
- (A) mixed cranial nerve
  - (B) sensory cranial nerve
  - (C) spinal nerve
  - (D) motor nerve
54. The symbiotic bacteria responsible for producing bioluminescence is
- (A) *Vibrio cholerae*
  - (B) *Pseudomonas putida*
  - (C) *Vibrio fischeri*
  - (D) *Chromobacterium* sp.
55. Which among the following viruses is known for its antigenic variation?
- (A) Rabies
  - (B) Influenza
  - (C) Yellow fever
  - (D) Japanese encephalitis
56. Independently folded functional unit of a protein is called a
- (A) motif
  - (B) fold
  - (C) domain
  - (D) module
57. Homology modelling can be used to predict the 3D structure of only
- (A) paralogs
  - (B) orthologs
  - (C) xenologs
  - (D) homologs
58. A mapping method for identifying markers linked to a trait of our interest in a natural population is called
- (A) linkage mapping
  - (B) association mapping
  - (C) transcriptome mapping
  - (D) RFLP mapping
59. In an antigen-antibody interaction study using Surface Plasmon Resonance technique, it was observed that the antigen concentration was 9 times the dissociation constant,  $K_d$ . The percentage of the antibody in the bound form would be
- (A) 10%
  - (B) 90%
  - (C) 99%
  - (D) 100%
60. The Philadelphia chromosome is
- (A) an example of gene amplification
  - (B) a product of a reciprocal translocation
  - (C) a characteristic of Burkitt's lymphoma
  - (D) an example of duplication
61. If an X-linked recessive disorder is in Hardy-Weinberg equilibrium and the incidence in males is 1 in 100, then the expected incidence of affected homozygous females would be
- (A) 1 in 1000
  - (B) 1 in 4000
  - (C) 1 in 10 000
  - (D) 1 in 40 000
62. In a Robertsonian translocation fusion occurs at the
- (A) telomeres
  - (B) centromeres
  - (C) end of short arms
  - (D) end of long arms
63. For extraction of penicillin from fermentation broth pH is decreased. This is done due to
- (A) more ionization of penicillin is required for extraction
  - (B) less ionization of penicillin is required for extraction
  - (C) pH is decreased to reduce the contamination
  - (D) pH is decreased to precipitate the antibiotic
64. In Ramachandran plot, the values of the dihedral angle  $\psi$  (psi) is based on rotation around
- (A) N-C $^{\alpha}$  bond
  - (B) C $^{\alpha}$ -C' bond
  - (C) C'-N bond
  - (D) N-H bond

65. P-value/E-value provided by sequence similarity search algorithms is a  
 (A) measure of similarity  
 (B) measure of distance  
 (C) parameter to distinguish true relationships  
 (D) measure of % homology
66. A hypothetical relaxed circular plasmid has 4500 bp. If for supercoiled form of this plasmid the twist is 440 and the writhe is -20, then the plasmid can be considered as a  
 (A) nicked circular plasmid  
 (B) positively supercoiled plasmid  
 (C) negatively supercoiled plasmid  
 (D) relaxed circular plasmid
67. Restriction enzymes produced by *E. coli*, do not cut self DNA because cells are  
 (A) RecA<sup>+</sup>  
 (B) Dam<sup>+</sup>  
 (C) RecA<sup>-</sup>  
 (D) Dam<sup>-</sup>
68. Which of the following bacteria is not naturally competent?  
 (A) *Bacillus subtilis*  
 (B) *E. coli*  
 (C) *Streptococcus pneumoniae*  
 (D) *Hemophilus influenzae*
69. The enzyme used in SoLiD sequencing technology is  
 (A) sequenase  
 (B) DNA polymerase  
 (C) DNA Ligase  
 (D) Taq Polymerase
70. Which one of the following methods helps to analyse energy architecture of proteins using 3D structure and thereby evaluating the quality of protein structure?  
 (A) ProsaII  
 (B) Procheck  
 (C) Ramachandran plot  
 (D) Phyre
71. The stability of a recombinant protein can be enhanced by  
 (A) altering the C-terminal region of the protein  
 (B) exclusion of PEST sequences from the protein  
 (C) production of compound similar to detergents to prevent formation of inclusion bodies  
 (D) altering the N-terminus by adding leucine or phenyl alanine by genetic manipulation
72. Which of the following RNAs functions by seed pairing?  
 (A) mRNA  
 (B) tRNA  
 (C) rRNA  
 (D) miRNA
73. Which of the following does *not* participate in the formation of antigen-antibody/ligand-receptor complexes?  
 (A) Hydrophobic bonds  
 (B) Covalent bonds  
 (C) Electrostatic interactions  
 (D) Hydrogen bonds
74. Which of the following features is not found in heterogeneous nuclear RNAs (hnRNAs)?  
 (A) intron  
 (B) polycistronic coding  
 (C) polyadenylation at 3'-end  
 (D) 5-' cap structure
75. PRINTS database contains  
 (A) Single motifs  
 (B) Multiple motifs  
 (C) Single domains  
 (D) Multiple domains
76. Which of the following conditions does not favour denaturation of double-stranded DNA?  
 (A) heating to 100 degrees Celsius  
 (B) adding high concentration of sodium chloride  
 (C) decreasing the ionic strength of the solution  
 (D) treatment with alkali to raise the pH to 10
77. The average length attained by a chromosome varies from  
 (A) 30 to 1000 nm  
 (B) 0.5 to 30 μm  
 (C) 30 μm to 1 mm  
 (D) 1 mm to 10 mm
78. The cytological representation of Klinefelter syndrome is  
 (A) 44A + XO  
 (B) 44A + XXO  
 (C) 44A + XXY  
 (D) 43A + XYY

79. Which of the following can induce polyploidy?  
 (A) Cytochalasin  
 (B) Colchicine  
 (C) Quinine  
 (D) Hydrazin
80. Deoxy position of deoxyribose in DNA is at  
 (A) 1<sup>st</sup> Carbon  
 (B) 3<sup>rd</sup> Carbon  
 (C) 2<sup>nd</sup> Carbon  
 (D) 5<sup>th</sup> Carbon
81. *E. coli* with mutation in operator region of lac operon and containing suppressors will  
 (A) produce  $\beta$  galactosidase even when lactose is absent  
 (B) produce  $\beta$  galactosidase only in the presence of lactose  
 (C) will not produce  $\beta$  galactosidase even in the presence of lactose  
 (D) will produce  $\beta$  galactosidase even in the presence of glucose
82. Which of the following non-coding RNAs is involved in RNA editing?  
 (A) Sn RNA  
 (B) Si RNA  
 (C) gRNA  
 (D) Mi RNA
83. In an experimental condition, *in vitro* translation of repeating sequence of CAA produced three polypeptides, polyglutamine, polyasparagine and polythreonine. If the codon for glutamine and threonine are CAA and ACA respectively, what will be the codon for asparagine?  
 (A) AAC  
 (B) CAC  
 (C) CCA  
 (D) ACC
84. Which one of the following statements about prion proteins is incorrect?  
 (A) Prion proteins form cross-beta filaments  
 (B) Prion proteins are heat resistant  
 (C) Prion proteins are protease sensitive  
 (D) Prion proteins can convert the normally folded prion protein to pathological form
85. RT-PCR reaction sequentially uses  
 (A) RNA dependent DNA polymerase & DNA dependent DNA polymerase  
 (B) RNA dependent DNA polymerase & DNA polymerase 1  
 (C) RNA polymerase & DNA dependent DNA polymerase  
 (D) RNA polymerase & DNA polymerase 1
86. The linear and circular forms of the same DNA molecule can be distinguished using  
 (A) Absorbance at 260 nm  
 (B) Endonuclease digestion  
 (C) Viscosity of the solution  
 (D) Exonuclease digestion
87. Protein-protein interaction can be evaluated by all of the following except  
 (A) Far-Western blotting  
 (B) Chromatin immunoprecipitation  
 (C) Yeast-two hybrid system  
 (D) Co-immunoprecipitation
88. Which of the following directly reverses DNA damage?  
 (A) AP endonuclease  
 (B) Uvr-ABC  
 (C) MutS and MutL  
 (D) Methyltransferase
89. When DNA molecules from a complex genome are denatured and then returned to conditions that favor duplex formation, the strands reanneal. Which of the following statements about the renaturation is incorrect?  
 (A) strands with the same overall A+T composition will anneal in the fastest category  
 (B) the slowly annealing fraction contains most of the genes  
 (C) only strands with complementary base sequences will anneal stably  
 (D) strands derived from highly repeated sequences anneal rapidly because the rate of the reaction is concentration dependent
90. If you were to use *E. coli* DNA polymerase instead of Taq Polymerase in a classical PCR-reaction, you will have to  
 (A) add fresh enzyme after each denaturation step  
 (B) carry out denaturation step at 50°C instead of 95°C  
 (C) use different primers  
 (D) use water bath instead of thermal block

91. A BLAST hit with STS division of GenBank helps you to understand
- only location of the sequence in the genome
  - only expression of the sequence
  - both location and expression of the sequence
  - first pass survey sequences
92. In pET expression vectors, high level of expression of cloned gene is achieved using
- T7 promoter
  - SP6 promoter
  - $\lambda$ -P<sub>L</sub> promoter
  - Trp promoter
93. Which of the following techniques can be used to determine the alpha-amylase gene polymorphism?
- Southern blot
  - Slot blot
  - Dot blot
  - Northern blot
94. Which of the following transgenic crops occupies the largest area in the world?
- Herbicide tolerant soybean
  - Herbicide tolerant maize
  - Insect resistant cotton
  - Insect resistant potato
95. In order to develop iron-rich rice which of the following genes was used for creating genetically modified plants?
- Ferritin
  - Phytic acid
  - Phytic acid and Ferritin
  - Transferrin and Ferritin
96. Viable seeds can be produced without fertilization of the egg in a process called
- Apospory
  - Apomixis
  - Parthenogenesis
  - Meiosis
97. Which of the following genes in *Arabidopsis* mediates interactions between floral meristem and floral organ identity genes?
- SRE
  - MADS box
  - UFO
  - AP2
98. LEAs are classified as
- shoot development proteins
  - seed storage proteins
  - mutant derived proteins
  - leaf development proteins
99. Engineering plants using chitinase gene leads to development of
- viral resistance
  - bruchid resistance
  - bacterial resistance
  - cold tolerance
100. Grain number (Gn1) in rice is regulated by
- OsMADS1
  - cytokinin oxidase
  - gibberellin oxidase
  - histidine kinase
101. Glyphosate-resistant gene *gox* is isolated from
- Arthrobacter sp.*
  - Achromobacter sp.*
  - Bacillus sp.*
  - Streptomyces sp.*
102. The gene responsible for dwarfing character in rice is
- Tift 23A
  - Norin 10
  - Dee-geo-woo-gen
  - Opaque 2
103. The first GM potato developed at Central Potato Research Institute, Shimla, for increasing protein content in tubers contains a transgene from
- Chickpea
  - Pigeon pea
  - Cabbage
  - Amaranthus
104. Marker-free plants can be developed by
- Co-transformation
  - Insertion
  - deletion
  - inversion
105. SUMOplot is a software used to predict
- succinyl modification site
  - serine modification site
  - ubiquitin attachment site
  - hydrophobicity graph
106. Which of the following plants contain the largest genome?
- Arabidopsis thaliana*
  - Fritillaria assyriaca*
  - Zea mays*
  - Triticum dicoccum*



107. A hybrid between species followed by polyploidy or chromosome doubling is known as  
 (A) Autopolyploid  
 (B) Aneuploid  
 (C) Haploid  
 (D) Allopolyploid
108. The zygote : endosperm : maternal tissue ratio in a well developed seed is  
 (A) 1:1:1  
 (B) 2:1:2  
 (C) 1:3:1  
 (D) 1:2:1
109. ABA catabolism is mediated by  
 (A) ABA-8' carboxylase  
 (B) ABA-8' hydroxylase  
 (C) ABA-8' aminotransferase  
 (D) ABA-8' oxygenase
110. Nodulating genes in rhizobium are influenced by the presence of which one of the following in the roots?  
 (A) flavones  
 (B) lignin  
 (C) tannins  
 (D) cellulose
111. Aroma in rice is due to  
 (A) Acetyl choline  
 (B) 4-benzyl pyrroline  
 (C) 2-ethyl pyrroline  
 (D) 2-acetyl-1-pyrroline
112. The most preferred choice for development of hybrid plants from a male sterile line would be  
 (A) Pollen culture  
 (B) Anther culture  
 (C) Ovary culture  
 (D) Meristem culture
113. The transplastomic lines bear no risk of gene escape through pollens because  
 (A) Pollens degenerate before fertilization  
 (B) Transformed mitochondrial DNA is lost during pollen maturation  
 (C) Transformed chloroplast DNA is lost during pollen maturation  
 (D) Transformed genomic DNA is maternally inherited
114. Somatic embryos from cotyledon explant would develop in which of the following sequences?  
 (A) Globular, torpedo, heart, cotyledonary stage  
 (B) Globular, heart, torpedo and cotyledonary stage  
 (C) Cotyledonary, heart, globular and torpedo  
 (D) Cotyledonary, torpedo, heart and globular
115. Which of the following is responsible for the protection of target molecules from reactive oxygen species?  
 (A) Halliwell-Asada pathway  
 (B) Calvin cycle  
 (C) Krebs cycle  
 (D) Pentose phosphate pathway
116. Which of the following enzymes is not responsible for dissipation of hydrogen peroxide?  
 (A) Ascorbate peroxidase  
 (B) Catalase  
 (C) Guaiacol peroxidase  
 (D) Superoxide dismutase
117. Among the following reporter genes which is the best that can be used for studying gene expression in a real time manner in plants?  
 (A) Luciferase  
 (B) GUS  
 (C) Green Fluorescent Protein  
 (D) Chloramphenicol Acetyl Transferase
118. The protein(s) which remains attached to the T-DNA during transfer to plant cells is/are  
 (A) Vir D2  
 (B) Vir E2  
 (C) Vir G  
 (D) Both Vir D2 and E2
119. Clean gene technology means creating  
 (A) transgenic plants with marker genes  
 (B) transgenic plants with provision of removing marker gene after transformation  
 (C) plants obtained with conventional breeding approach  
 (D) transgenic plants obtained through plastid transformation
120. Nitrogen use efficiency of the plants can be regulated by overexpressing which of the following genes?  
 (A) BZip  
 (B) Dof  
 (C) Leucine zipper  
 (D) Zinc finger

121. The herbicide that kills plants by blocking the photosynthetic electron flow of photosystem I is  
 (A) Diuron  
 (B) Paraquat  
 (C) Glyphosate  
 (D) Atrazine
122. In submerged plants the root tip stimulates the activity of  
 (A) ACC synthase  
 (B) ACC oxidase  
 (C) ACC synthase & ACC oxidase  
 (D) ACC kinase
123. In a microbial system, how are true and apparent growth yields related ?  
 (A) True growth yield is more than apparent growth yield  
 (B) True growth yield is less than apparent growth yield  
 (C) True growth yield is equal to apparent growth yield  
 (D) True growth yield and apparent growth yield are not related at all
124. In a CSTR system, at steady state, which one of the following is true?  
 (A) Only product concentration remains constant  
 (B) Only substrate concentration remains constant  
 (C) Cell mass and substrate concentration remain constant  
 (D) Cell mass, substrate and product concentration remain constant
125. For a new chemical entity, to be a good enzyme inhibitor, it should have a  
 (A) higher dissociation constant [  $K_i$  ] for enzyme-inhibitor complex  
 (B) lower dissociation constant [  $K_i$  ] for enzyme-inhibitor complex  
 (C) competitive type of inhibition  
 (D) uncompetitive type of inhibition
126. The deactivation energy of the common contaminants in a fermentation medium is approximately  
 (A) 10-20 Kcal/mole  
 (B) 20-30 Kcal/mole  
 (C) 30-40 Kcal/mole  
 (D) 60-80 Kcal/mole
127. Which one of the following is true for scaling-up medium sterilization process?  
 (A) Nutrient quality is a dependent variable  
 (B) Nutrient quality is an independent variable  
 (C) Nutrient quality does not change at all  
 (D) Number of contaminants is an independent variable
128. In which way agitation does not help aeration in a stirred tank reactor?  
 (A) Agitation breaks the air bubbles into smaller one  
 (B) Agitation increases the residence time of air bubble  
 (C) Agitation increases the bubble escape from the reactor  
 (D) Agitation does not allow the bubbles to coalesce
129. Separation factor in solvent extraction process increases if  
 (A) volume of organic solvent increases  
 (B) volume of organic solvent decreases  
 (C) volume of aqueous phase increases  
 (D) partition coefficient of solute decreases
130. Which one of the following extraction methods will be most suitable in a solvent extraction system with a solute of low partition coefficient ?  
 (A) Multistage batch extraction  
 (B) Single batch extraction  
 (C) Counter current extraction  
 (D) Co-current extraction
131. Which of the following statements is correct?  
 (A) Hidden auxotrophy is not desirable for an industrial strain  
 (B) Hidden auxotrophy is highly desirable for an industrial strain  
 (C) Hidden auxotrophy does not play any role in an industrial strain  
 (D) Hidden auxotrophy is not at all associated with an industrial strain
132. In the case of adsorption/ desorption kinetics which of the following is true  
 (A) The rate of adsorption decreases from the beginning  
 (B) The rate of adsorption increases from the beginning  
 (C) The rate of desorption decreases from the beginning  
 (D) The adsorption and desorption rates are always in equilibrium
133. Which of the following is not obtained from plant sources  
 (A) Nattokinase

- (B) Papain  
(C) Bromelain  
(D) Dornase  $\alpha$
134. The 'Head space' volume kept in the aerobic reactor ideally is  
(A) 10 -15% of reactor volume  
(B) 40-50% of reactor volume  
(C) 20-25% of reactor volume  
(D) 10% of reactor volume
135. At equilibrium the receptor occupancy is related to drug concentration by  
(A) Henderson-Haselbach equation  
(B) Hill-Langmuir equation  
(C) Lineweaver-Burk equation  
(D) Langmuir adsorption isotherm
136. Which of the following plant hormones is synthesized from an amino acid precursor?  
(A) Ethylene  
(B) Auxins  
(C) Cytokinin  
(D) Abscisic acid
137. The kinetics of microbial growth in a batch culture system is represented by  
(A) Henry's law  
(B) Michaelis-Menten equation  
(C) Arrhenius equation  
(D) Monod equation
138. The first, second, third and fourth number in EC stands for  
(A) Class name, subclass, hydroxyl group acceptor, phosphoryl group acceptor  
(B) Class name, subclass, phosphoryl group acceptor, acetyl group acceptor  
(C) Class name, subclass, phosphoryl group acceptor, hydroxyl group acceptor  
(D) Class name, subclass, acetyl group acceptor, hydroxyl group acceptor
139. A prochiral ketone can be reduced by oxidoreductase up to a maximum of  
(A) 25% reduction  
(B) 50% reduction  
(C) 75% reduction  
(D) 100% reduction
140. Phenyl acetic acid in penicillin fermentation is used as  
(A) Inhibitor  
(B) Inducer  
(C) Osmoregulator  
(D) Precursor
141. The quantity of heat required to evaporate 1 kg of a saturated liquid is called  
(A) Specific heat  
(B) Volumetric heat  
(C) Sensible heat  
(D) Latent heat
142. In a mass transfer system the unit of diffusivity is  
(A)  $m^2/h$   
(B)  $m/h$   
(C)  $m.K/h$   
(D)  $h/m^2$
143. A stagnant liquid film of 0.4 mm thickness is held between two parallel plates. The top plate is maintained at  $40^\circ C$  and the bottom plate is maintained at  $30^\circ C$ . If the thermal conductivity of the liquid is  $0.14 W/(m K)$ , then the steady state heat flux ( $W/m^2$ ) assuming one-dimensional heat transfer is  
(A) 3.5  
(B) 350  
(C) 3500  
(D) 7000
144. Maintaining a constant residual substrate concentration in *E. coli* fed batch cultivation by exponential feeding is a  
(A) Steady state process  
(B) Unsteady state process  
(C) Process with multiple steady states  
(D) Quasi steady state process
145. Which of the following cytokines is secreted by both Th1 and Th2 cells?  
(A) IL-2  
(B) IL-3  
(C) IL-4  
(D) IFN- $\gamma$
146. C in CATH database stands for  
(A) Conformation  
(B) Configuration  
(C) Classification  
(D) Conservation
147. Which of the following types of genetic changes is least likely to be found in an oncogene in a tumor?  
(A) gene amplification  
(B) chromosome translocation  
(C) missense mutation

- (D) nonsense mutation
148. Hemophilia A and Hemophilia B have nearly identical phenotypes, but they result from mutations in different genes on the X chromosome. This is an example of
- (A) Locus heterogeneity  
(B) Epistatic interaction  
(C) Double heterozygosity  
(D) Variable expressivity
149. Molecular analysis is performed on the three copies of chromosome 21 in a child with Down's syndrome using markers of DNA polymorphism for which both parents are heterozygous for different alleles. Two of the chromosomes (#21) have the same mother's alleles. Based on this information, when did the non-disjunction event most likely occur?
- (A) Maternal meiosis I  
(B) Maternal meiosis II  
(C) Paternal meiosis I  
(D) Paternal meiosis II
150. Heterozygotes for the sickle cell anemia gene occur in a population with a frequency of about 1 in 10. If two phenotypically normal people from the population marry, what is the probability that their first child will have sickle cell anemia?
- (A) 1/10  
(B) 1/40  
(C) 1/100  
(D) 1/400
151. Which one of the following is an example of structural chromosomal aberration?
- (A) Edward's syndrome  
(B) Down's syndrome  
(C) Turner's syndrome  
(D) Cru-du-chat syndrome
152. The frequency of autosomal dominant familial hypercholesterolemia, secondary to heterozygosity for an LDL-R mutation, is approximately 1/500. A 32-year-old affected man marries a genetically unrelated 20-year-old woman. What is the probability that their child will be affected with severe familial hypercholesterolemia secondary to compound heterozygosity for LDL-R mutation?
- (A) 1/1,000,000  
(B) 1/2,000  
(C) 1/1,000  
(D) 1/250
153. The "triplet repeat" in Huntington Disease refers to
- (A) A nucleic acid repeat consisting of: T-A-G  
(B) An amino acid repeat consisting of: Gly-X-Y  
(C) An amino acid repeat consisting of: C-A-G  
(D) A nucleic acid repeat consisting of: C-A-G
154. Myotonic dystrophy may show increasing severity and earlier age of onset in successive generations. This phenomenon is known as
- (A) Locus heterogeneity  
(B) Compound heterozygosity  
(C) Variable expressivity  
(D) Anticipation
155. Which one of the following statements is true about super antigens?
- (A) They are processed in cytosol  
(B) They are processed in endosome  
(C) They do not require processing  
(D) They activate large number of macrophages
156. Leukocyte adhesion deficiency leads to frequent incidences of
- (A) cancer  
(B) autoimmune disorder  
(C) bacterial infection  
(D) viral infection
157. Immunologically privileged sites are
- (A) Thymus, eyes and Peyer's patches  
(B) Testicles, eyes and lymphnodes  
(C) Testicles, eyes and brain  
(D) Anterior eye chamber, Thymus and Bone marrow
158. Naive B cells express
- (A) IgM and IgA  
(B) IgD and IgE  
(C) IgM and IgD  
(D) IgM and IgG
159. IL-4 induces the expression of
- (A) IgM, IgG3 and IgG2a  
(B) IgG1 and IgE  
(C) IgM, IgG1 and IgA  
(D) IgG3, IgG2b and IgE
160. Mice are immunologically mature at
- (A) 12 weeks

- (B) 10 weeks  
(C) 6 weeks  
(D) 4 weeks
161. Cyclosporin A is used in the treatment of organ transplant patients because it  
(A) inhibits TCR expression  
(B) down regulates IL-2 production  
(C) induces T-cell anergy  
(D) down regulates antibody production
162. Natural Killer cells can be detected in human peripheral blood using  
(A) anti-cd3 antibody  
(B) anti-cd25 antibody  
(C) anti-cd69 antibody  
(D) anti-cd16 antibody
163. Which of the following cells secrete E-selectins?  
(A) Eosinophils  
(B) Endothelial cells  
(C) Microglial cells  
(D) Epithelial cells
164. A 6 month old child presents with fever, crepitation, ronchi and prolonged expiratory phase. What is the most common aetiological agent of this disease?  
(A) Adenovirus  
(B) Rhinovirus  
(C) Respiratory syncytial virus  
(D) Coronavirus
165. A patient presents with yellow colored urine, fever, nausea and loss of appetite, the following tests were done. Which of these is a diagnostic of acute viral hepatitis B?  
(A) Presence of anti HBc IgM  
(B) Presence of HBs antigen  
(C) Presence of anti HBs  
(D) Presence of delta antigen
166. Which of the following is/are selective media for *Vibrio cholerae*?  
(A) Thayer –Martin medium  
(B) Cefoxitin cycloserine fructose agar  
(C) Skirrow's medium  
(D) Thiosulfate-citrate-bile-sucrose agar
167. Routine laboratory diagnosis of bacterial pharyngitis needs to include procedures only for the detection of  
(A) *Bordetella pertussis*  
(B) *Corynebacterium diphtheriae*  
(C) *Corynebacterium haemolyticum*  
(D) Group A *Streptococcus* (GAS)
168. Which of the following is true regarding influenza viruses?  
(A) Mutations are responsible for pandemics  
(B) No effective vaccine is available  
(C) HA protein is responsible for release of virus particles from infected cell  
(D) Genome has eight segments
169. In embryonated hens' eggs  
(A) Allantoic inoculation is best for primary isolation of influenza virus  
(B) Chorioallantoic membrane is used for growing rubella virus  
(C) The air sac is suitable for growing respiratory syncytial virus  
(D) Yolk sac is used for growing rickettsiae
170. Rifampicin is a specific inhibitor of  
(A) Bacterial RNA polymerase  
(B) RNA polymerase II  
(C) RNA polymerase I  
(D) RNA polymerase III
171. A newly diagnosed adult TB patient is put on anti - tubercular therapy - isoniazid, rifampin, ethambutol and pyrazinamide. He develops tingling sensation and numbness in his limbs due to deficiency of  
(A) Protein  
(B) Zinc  
(C) Pyridoxine (B6)  
(D) Riboflavin
172. Which of the following would be present in abnormal quantity in Burkitt's lymphoma patients' urine?  
(A) Bence-Jones-Proteins  
(B) Human Chronic Gonadotropin  
(C) Carcinoembryonic antigen  
(D) Alpha-fetoprotein
173. Human Herpes Virus 8 (HHV – 8) is associated with  
(A) Erythema infectiosum  
(B) Kaposi's Sarcoma  
(C) Oral leukoplakia

- (D) Infectious mononucleosis-like illness
174. The intervention, by which a specific point deep inside the brain may be accurately targeted by an object e.g., an electrode, is known as  
 (A) stereoscopy  
 (B) stereotaxic surgery  
 (C) craniotomy  
 (D) laparoscopy
175. Which of the following neurotransmitters containing neurons is maximally present in the dorsal raphe ?  
 (A) Dopaminergic  
 (B) Adrenergic  
 (C) Serotonergic  
 (D) Cholinergic
176. Cerebellar damage would primarily lead to  
 (A) difficulty in smelling  
 (B) postural disturbance  
 (C) loss of taste  
 (D) memory loss
177. In case of nerve impulse propagation between neurons, the first site of fatigue is at  
 (A) axon  
 (B) electrical synapse  
 (C) chemical synapse  
 (D) dendrite
178.  $\text{Na}^+$ - $\text{K}^+$  ATPase exchanges  $\text{Na}^+$  and  $\text{K}^+$  across cell membrane. The enzyme is a  
 (A) tetramer and consumes two ATP molecules in every cycle  
 (B) dimer and consumes two ATP molecules in every cycle  
 (C) monomer and consumes one ATP molecule in every cycle  
 (D) tetramer and consumes one ATP molecule in every cycle
179. Which of the following types of neurons is predominantly lost in Narcolepsy ?  
 (A) Cholinergic  
 (B) Orexinergic  
 (C) Noradrenergic  
 (D) Histaminergic
180. Retrograde transport may be used for  
 (A) nerve path tracing  
 (B) determining nerve fiber diameter  
 (C) determining soma size  
 (D) estimating number of dendrites
181. The conscious state of an individual may be best understood by studying ones  
 (A) electromyogram  
 (B) electrocardiogram  
 (C) electroretinogram  
 (D) electroencephalogram
182. Which of the following electrodes will be preferred for recording intracellular potential ?  
 (A) glass capillary electrode  
 (B) steel micro-electrode  
 (C) copper micro-electrode  
 (D) solid glass electrode
183. For recording fast physiological response e.g., action potential in neurons, one needs a  
 (A) Cathode Ray Oscilloscope  
 (B) Polygraph  
 (C) Spectrophotometer  
 (D) Confocal microscope
184. In vertebrates, nerve bundle usually contains  
 (A) many myelinated axons of different diameters as well as large number of unmyelinated fibres  
 (B) many unmyelinated fibres as well as large number of myelinated axons of same diameter  
 (C) only myelinated axons of same diameter  
 (D) only unmyelinated axons of different diameter
185. At certain condition (X), a neuron showed intracellular potential  $-50\text{mV}$ ; while after some treatment (Y), it was  $-70\text{mV}$ . Given such a condition, which of the following statements is correct?  
 (A) The neuron is hyperpolarized under condition (X) as compared to that of the condition (Y)  
 (B) To induce a response, higher intensity stimulation is needed at condition (X) than in condition (Y)  
 (C) the treatment (Y) caused depolarization of the neuron  
 (D) the treatment (Y) induced hyperpolarization of the neuron
186. Sleeping sickness is caused by  
 (A) *Plasmodium vivax*  
 (B) *Leishmania donovani*  
 (C) *Trypanosoma cruzi*

- (D) *Entamoeba histolytica*
187. Which of the following sets of cranial nerves falls under parasympathetic system?  
 (A) I, IV, V and X  
 (B) III, VII, IX and X  
 (C) II, VIII, IX, XI  
 (D) VI, XII, I and IV
188. Areas of low productivity are termed as  
 (A) oligotrophic  
 (B) heterotrophic  
 (C) hypotrophic  
 (D) eutrophic
189. Organisms that are plankton in the juvenile stage, but nekton or benthos in the adult stage are called  
 (A) meroplankton  
 (B) macroplankton  
 (C) holoplankton  
 (D) picoplankton
190. A giant bacterium measuring up to 0.75 mm and referred to as the "Sulfur Pearl" is  
 (A) *Thioploca* sp  
 (B) *Epulopiscium fishelsoni*  
 (C) *Thiomargarita nambiensis*  
 (D) *Beggiatoa* sp
191. How deep could the zone of detectable, ambient light extend in sea water?  
 (A) not more than 10 meters  
 (B) up to 100 meters only  
 (C) in the range of 100 to 1000 meters  
 (D) greater than 1000 meters
192. The autochthonous probiotic bacteria used in aquaculture are isolated from  
 (A) microbial flora associated with seaweeds  
 (B) the gastrointestinal tract of aquaculture animals  
 (C) the sediments, especially from the intertidal region  
 (D) the microbial flora associated with mangrove plants
193. Foraminiferans and radiolarians are  
 (A) non-photosynthetic protists  
 (B) photosynthetic protists  
 (C) microscopic bacteria.  
 (D) biogenic sediments.
194. With regard to ocean waters, which one of the following is not a depth-wise division?  
 (A) Epipelagic  
 (B) Mesopelagic  
 (C) Abyssopelagic  
 (D) Neritopelagic
195. Organisms which can be used for producing silicon like component for use in the field of nanotechnology are  
 (A) diatoms  
 (B) rhabdovirus  
 (C) *Gracilaria corticata*  
 (D) *Sargassum tennerimum*
196. Marine bacteria that can grow over a wide range of temperature are referred to as  
 (A) thermophiles  
 (B) thermotolerants  
 (C) stenothermals  
 (D) eurythermals
197. In polar oceans, the main factor affecting the phytoplankton growth is  
 (A) depletion of nutrients in water  
 (B) vertical migration of nutrients  
 (C) shortage of sunlight  
 (D) depletion of phosphates
198. Which one of the following is a peptide toxin?  
 (A) Saxitoxin  
 (B) Bryostatin  
 (C) Cephalotoxin  
 (D) Dolastatin
199. Organisms which reproduce in sea water and live as adults in fresh water are called  
 (A) catadromous  
 (B) anadromous  
 (C) migratory  
 (D) epipelagic
200. Which one of the following compounds is not produced by *Octopus* ?  
 (A) Maculotoxin  
 (B) Cephalotoxin  
 (C) Maiotoxin  
 (D) Eledoisin
201. Which of the following statements about krill is not true?  
 (A) They are crustacean and have an exoskeleton made of chitin  
 (B) Very few species are herbivorous  
 (C) Commercial fishing of krill is

- done in Southern Ocean and in the waters around Japan  
(D) Most species are bioluminescent
202. Carrageenan is composed of repeating units of  
(A) galactose  
(B) glucose  
(C) glucose and galactose  
(D) mannose
203. Which one of the following factors does not influence the rate of oxygen transfer in an aerobic fermentation system?  
(A) Agitation rate  
(B) Viscosity of the broth  
(C) Temperature of the broth  
(D) pH of the broth
204. During protoplast isolation from *Gracilaria corticata*, which one of the following is added as an osmoticum?  
(A) glucose  
(B) mannose  
(C) mannitol  
(D) fructose
205. The first group of organisms that colonize the hydrothermal vents are  
(A) tube worms  
(B) chemolithotrophic bacteria  
(C) chemoautotrophic sulfur bacteria  
(D) crabs
206. What are zooxanthallae?  
(A) Deep sea dwelling brightly pigmented fish  
(B) Algae living in corals  
(C) A species of crab  
(D) *Xanthomonas*-infected zooplankton
207. Which of the following statements is not true for giant tube worms observed at hydrothermal vents?  
(A) Digestive tract of tube worms produces combination of thermostable proteases and polysaccharases  
(B) The tube worms obtained their nutrients from symbiotic chemolithotrophic bacteria  
(C) The tube worms have the fastest growth rate compared to any known marine invertebrates  
(D) The hemoglobin present in tube worm binds both  $H_2S$  and  $O_2$
208. Isolation of large number of protoplasts from *Gracilaria* sp. is achieved by treating with  
(A) cellulase only  
(B) papain enzyme  
(C) macerozyme and agarase  
(D) carrageenase
209. Marine snow is  
(A) a continuous shower of organic detritus falling from the upper layer of water  
(B) formation of ice crystals in the upper layer of ocean during winter  
(C) a common name given to a cephalopod sp in Antarctica which has the ability to grow at low temperatures  
(D) a common name for white crabs which are observed in the Arctic region
210. Glofish is  
(A) a patented zebra fish which has been genetically modified with GFP  
(B) a commercial name given to tuna fish created by cloning growth hormone gene  
(C) an angler fish harboring bioluminescent bacteria  
(D) a cutter-shark fish which catches its prey with the help of bioluminescent bacteria residing near the gills
211. DsRed is a  
(A) red fluorescent protein observed in *Aequorea victoria*  
(B) common name given to red tide observed on the coast of Taiwan  
(C) red fluorescent protein isolated from coral *Discosoma* genus  
(D) red bioluminescent bacteria seen in certain species of copepod
212. The bacterial pathogen which is most detrimental to shrimp aquaculture is  
(A) *Vibrio* sp.  
(B) *Pseudomonas* sp.  
(C) *Flavobacterium* sp.  
(D) *Micrococcus* sp.
213. Abortions in infectious bovine rhinotracheitis are sequelae of  
(A) genital form  
(B) respiratory form  
(C) enteric form  
(D) gastric form



214. Infectious bronchitis virus infects  
 (A) chicken  
 (B) chicken and duck  
 (C) duck and turkey  
 (D) chicken and peacock
215. "Rat-tail" like appearance of horse tail is due to  
 (A) *Strongylus vulgaris*  
 (B) *Anoplocephala perfoliata*  
 (C) *Haemonchus species*  
 (D) *Oxyuris equi*
216. Which one of the following protozoans is transmitted by ingestion of tick?  
 (A) *Haemoproteus columbae*  
 (B) *Ehrlichia canis*  
 (C) *Hepatozoon canis*  
 (D) *Histomonas meleagridis*
217. Bovine group A rotavirus contains  
 (A) ss RNA  
 (B) ds RNA  
 (C) ss DNA  
 (D) ds DNA
218. Large calf syndrome primarily occurs in  
 (A) naturally born calves  
 (B) transgenic calves  
 (C) calves produced by IVF  
 (D) artificial insemination
219. Scrapie is caused by  
 (A) Fungal protein  
 (B) Bacterial protein  
 (C) Plant lipoprotein  
 (D) Prion
220. Intestinal flora cannot digest  
 (A) Cellulose  
 (B) Lignin  
 (C) Pectin  
 (D) Starch
221. *Xenopsylla cheopis* is the vector for  
 (A) Indian tick typhus  
 (B) Epidemic typhus  
 (C) Plague  
 (D) Kala azar
222. The most important and efficient amplifier of Japanese encephalitis virus is  
 (A) Cow  
 (B) Pig  
 (C) Horse  
 (D) Bird
223. The amino acids in curly brackets in a Prosite pattern mean  
 (A) They are acceptable  
 (B) They are not acceptable  
 (C) Any one amino acid among them is acceptable  
 (D) Any amino acid excluding them is acceptable
224. Most predominant antibody in serum is  
 (A) IgG  
 (B) IgD  
 (C) IgE  
 (D) IgA
225. Sperm DNA is covered by  
 (A) Lipids  
 (B) Protamines  
 (C) Carbohydrates  
 (D) Histones
226. Replication of papillomavirus is restricted to  
 (A) epithelial cells  
 (B) nerve cells  
 (C) fibroblasts  
 (D) reticulo-endothelial cells
227. 'Weak calf syndrome' in pregnant cows at 80-125 days of gestation period is caused by  
 (A) BVD virus  
 (B) Pseudorabies virus  
 (C) IBR Virus  
 (D) MCF virus
228. Blister is an example of which of the following inflammatory exudates?  
 (A) Fibrinous  
 (B) Suppurative  
 (C) Serous  
 (D) Hemorrhagic
229. Bovine keratitis is caused by  
 (A) *Moraxella bovis*  
 (B) *Bordetella pertussis*  
 (C) *Staphylococcus*  
 (D) *Bacteroides*
230. All of the following are malignant neoplasms except  
 (A) Papilloma  
 (B) Liposarcoma  
 (C) Squamous cell carcinoma  
 (D) Neuroblastoma

231. Necrosis that develops in tissues subsequent to denaturation of structural and enzymatic proteins soon after death is appropriately referred to as  
 (A) Fat necrosis  
 (B) Liquefactive necrosis  
 (C) Coagulative necrosis  
 (D) Caseous necrosis
232. The demyelination of the central nervous system white matter produced by the canine distemper virus is an example of  
 (A) Fat necrosis  
 (B) Coagulation necrosis  
 (C) Zenker's necrosis  
 (D) Liquefactive necrosis
233. The discoloration of tissue by iron sulfide after somatic cell death is referred to as  
 (A) Hypostatic congestion  
 (B) Imbibition with hemoglobin  
 (C) Imbibition with bile  
 (D) Pseudomelanosis
234. The specific condition that occurs subsequent to the inhalation of carbon is referred to as  
 (A) Anthracosis  
 (B) Pneumoconiosis  
 (C) Siderosis  
 (D) Acanthosis
235. Severe deficiency of which of the following vitamins leads to hemolytic anemia in animals?  
 (A) Vit A  
 (B) Vit E  
 (C) Vit D  
 (D) Vit K
236. Which of the following chemotherapeutic drugs has neurotoxicity?  
 (A) Vincristine  
 (B) Cyclophosphamide  
 (C) Anthracyclines  
 (D) Adriamycin
237. The program used to convert raw sequence output to an ordered list of bases is called  
 (A) Base calling  
 (B) Neural network  
 (C) Local area network  
 (D) artificial network
238. Which of the following algorithms implements "once a gap, always a gap" policy?  
 (A) ClustalW  
 (B) Needleman & Wunsch  
 (C) Chou & Fasman  
 (D) FASTA
239. The sequence alignment tool for immunoglobulins, T-cell receptors, and HLA molecules available at the ImMunoGeneTics information system (IMGT) is  
 (A) IMGT/Collier-de-perles  
 (B) IMGT/V-Quest  
 (C) IMGT/Allele-align  
 (D) IMGT/Junction Analysis
240. Which of the following scoring matrices of proteins is a distance matrix?  
 (A) MDM series of matrices  
 (B) BLOSUM series of matrices  
 (C) Conformational Similarity Weight matrix  
 (D) Genetic Code Matrix
241. One PAM means one accepted point mutation per  
 (A)  $10^2$  residues  
 (B) 10 residues  
 (C)  $10^3$  residues  
 (D)  $10^4$  residues
242. Which of the following scoring matrices is one of the best to score an alignment of highly conserved protein sequences?  
 (A) BLOSUM 80 or PAM 120  
 (B) BLOSUM 62 or PAM 250  
 (C) BLOSUM 30 or PAM 120  
 (D) BLOSUM 90 or PAM 350
243. Which one of the following programs is used primarily for submission of complete genomes and batch submission of sequences to GenBank?  
 (A) BankIt  
 (B) Sequin  
 (C) tbl2asn  
 (D) WEBIN
244. In reconstruction of phylogenetic trees using molecular sequence data, a singleton site in MSA is considered to be  
 (A) an invariant site  
 (B) an informative variable site  
 (C) an uninformative variable site  
 (D) a conserved site

245. Which of the following identifiers in GenBank changes with sequence revision/updates?  
(A) Accession  
(B) GI  
(C) Date  
(D) Both a & b
246. EST division of EMBL database archives data in  
(A) only 5' to 3' direction  
(B) only 3' to 5' direction  
(C) both 5' to 3' and 3' to 5' to represent clones from two ends  
(D) either 5' to 3' or 3' to 5'
247. Which of the following methods is used to predict the 3D structure of a protein when it has < 20% of sequence similarity with the available templates?  
(A) Homology modelling  
(B) Dynamic programming  
(C) Fold recognition  
(D) Progressive protein programming
248. Which of the following techniques is implemented to locate MUMs in MUMmer algorithm?  
(A) Suffix tree generation  
(B) Hash lookup table  
(C) K-tuple  
(D) Exact word match
249. Which one of the following techniques is used for the evaluation of phylogenetic trees?  
(A) Null hypothesis  
(B) Bootstrapping  
(C) Chi-square  
(D) Probability
250. NiceProt is  
(A) Protein sequence database  
(B) Derived Protein database  
(C) Protein sequence view  
(D) Nucleotide sequence view
-

## Key to the MCQs for BET 2010

### Section A

- |         |         |         |
|---------|---------|---------|
| 1. (C)  | 22. (B) | 43. (D) |
| 2. (A)  | 23. (B) | 44. (A) |
| 3. (B)  | 24. (C) | 45. (A) |
| 4. (C)  | 25. (D) | 46. (C) |
| 5. (B)  | 26. (B) | 47. (A) |
| 6. (C)  | 27. (C) | 48. (C) |
| 7. (B)  | 28. (A) | 49. (D) |
| 8. (C)  | 29. (D) | 50. (B) |
| 9. (B)  | 30. (B) |         |
| 10. (C) | 31. (C) |         |
| 11. (C) | 32. (C) |         |
| 12. (D) | 33. (A) |         |
| 13. (B) | 34. (D) |         |
| 14. (B) | 35. (B) |         |
| 15. (D) | 36. (B) |         |
| 16. (B) | 37. (C) |         |
| 17. (C) | 38. (B) |         |
| 18. (B) | 39. (B) |         |
| 19. (D) | 40. (C) |         |
| 20. (A) | 41. (C) |         |
| 21. (D) | 42. (C) |         |

**Section B**

- |         |         |          |          |
|---------|---------|----------|----------|
| 51. (C) | 73. (B) | 95. (C)  | 117. (C) |
| 52. (C) | 74. (B) | 96. (B)  | 118. (D) |
| 53. (A) | 75. (B) | 97. (C)  | 119. (B) |
| 54. (C) | 76. (B) | 98. (B)  | 120. (B) |
| 55. (B) | 77. (B) | 99. (B)  | 121. (B) |
| 56. (C) | 78. (C) | 100. (B) | 122. (C) |
| 57. (B) | 79. (B) | 101. (B) | 123. (A) |
| 58. (B) | 80. (C) | 102. (C) | 124. (D) |
| 59. (B) | 81. (C) | 103. (D) | 125. (B) |
| 60. (B) | 82. (C) | 104. (A) | 126. (D) |
| 61. (C) | 83. (A) | 105. (C) | 127. (B) |
| 62. (B) | 84. (C) | 106. (B) | 128. (C) |
| 63. (B) | 85. (A) | 107. (D) | 129. (A) |
| 64. (B) | 86. (D) | 108. (D) | 130. (C) |
| 65. (C) | 87. (B) | 109. (B) | 131. (A) |
| 66. (C) | 88. (D) | 110. (A) | 132. (A) |
| 67. (B) | 89. (A) | 111. (D) | 133. (D) |
| 68. (B) | 90. (A) | 112. (C) | 134. (C) |
| 69. (C) | 91. (C) | 113. (C) | 135. (B) |
| 70. (A) | 92. (A) | 114. (B) | 136. (B) |
| 71. (B) | 93. (A) | 115. (A) | 137. (D) |
| 72. (D) | 94. (A) | 116. (D) | 138. (A) |

139. (D)            162. (D)            185. (D)            208. (C)  
140. (D)            163. (B)            186. (C)            209. (A)  
141. (D)            164. (C)            187. (B)            210. (A)  
142. (A)            165. (A)            188. (A)            211. (C)  
143. (C)            166. (D)            189. (A)            212. (A)  
144. (D)            167. (D)            190. (C)            213. (B)  
145. (B)            168. (D)            191. (C)            214. (A)  
146. (C)            169. (D)            192. (B)            215. (D)  
147. (D)            170. (A)            193. (A)            216. (C)  
148. (A)            171. (C)            194. (D)            217. (B)  
149. (B)            172. (A)            195. (A)            218. (C)  
150. (B)            173. (B)            196. (D)            219. (D)  
151. (D)            174. (B)            197. (C)            220. (D)  
152. (B)            175. (C)            198. (D)            221. (C)  
153. (D)            176. (B)            199. (A)            222. (B)  
154. (D)            177. (C)            200. (C)            223. (B)  
155. (C)            178. (D)            201. (B)            224. (A)  
156. (C)            179. (B)            202. (A)            225. (B)  
157. (C)            180. (A)            203. (D)            226. (A)  
158. (C)            181. (D)            204. (C)            227. (A)  
159. (B)            182. (A)            205. (B)            228. (C)  
160. (C)            183. (A)            206. (B)            229. (A)  
161. (B)            184. (A)            207. (A)            230. (A)

231. (C)                    249. (B)  
232. (D)                    250. (C)  
233. (D)  
234. (A)  
235. (B)  
236. (A)  
237. (A)  
238. (A)  
239. (B)  
240. (D)  
241. (A)  
242. (A)  
243. (C)  
244. (C)  
245. (B)  
246. (A)  
247. (C)  
248. (A)

The Biomimics



## Biotechnology Eligibility Test (BET) for DBT-JRF Award (2011-12)

Government of India, Ministry of Science & Technology,  
Department of Biotechnology, New Delhi  
(Coordinated by University of Pune)

April 17, 2011

Total Marks – 300 Duration 10.00 a.m. - 12.30 p.m.

- N.B.**
- 1) All questions in Section A are **compulsory**.
  - 2) Answer any 50 questions from Section B.
  - 3) In case more than 50 are attempted, first 50 will be considered.
  - 4) Each question carries 3 marks; for every wrong answer, one mark will be deducted.
  - 5) Write your seat no. strictly inside the space provided on the Answer sheet.
  - 6) Answers marked inside the question paper will not be evaluated.
  - 7) Please return the question paper along with the Answer sheet.

**Instructions for filling the Answer sheet:**

- 1) There is only one correct answer for each question and once a mark has been made the same cannot be altered.
- 2) All entries in the circle must be made by **BLACK ink Ball Point Pen** only. Do not try to alter the entry.
- 3) Oval should be darkened completely so that the numeral inside the oval is not visible.
- 4) Do not make any stray marks for rough work on the sheet.
- 5) Do not use marker, white fluid or any other device to hide the shading already done.
- 6) More than one entry of an answer will be considered wrong, and negative marking will be done as above.
- 7) Mark your answer as shown in the example.

Examples For Entering Answers			
<b>Wrong Method</b>			
<del>A</del>	B	C	D
A	<del>B</del>	C	D
A	●	C	D
A	B	●	●
<b>Correct Method</b>			
●	B	C	D



## Section A

- Morphogenetic competence in callus tissue is obtained by
  - Vitrification
  - Somaclonal variation
  - Habituation
  - Dedifferentiation
- Which of the following is not relevant to recombinant DNA safety guidelines in India ?
  - IBSC
  - RCGM
  - GEAC
  - NBPGR
- Which of the following statements correctly indicates the relative position of two genes in higher plants?
  - The closer two genes are to each other on a chromosome, the higher the frequency of recombination between them.
  - The more distant two genes are to each other on a chromosome, the higher the frequency of recombination between them
  - If two genes are located on different chromosomes then there will be high frequency of recombination between them.
  - If two genes are located on different chromosomes then there will be low frequency of recombination between them.
- Which of the following is the best method for localization of a protein during transition from vegetative to flowering stage?
  - Place a reporter gene next to the promoter of the gene encoding the protein, and identify the cellular location of the reporter gene
  - Use an antibody against the specific protein
  - Separate the cellular compartments by centrifugation followed by screening with antibodies
  - Tag the protein with fluorescent amino acids and identify the cellular location by fluorescent microscopy.
- An agreement about regulating both tariff rates and quantitative restrictions on global imports and exports is
  - GATT
  - TRIP
  - WIPO
  - PBR
- Gold extraction from mine wastes is carried out by which of the following microbes?
  - Pseudomonas*
  - Nitrifying bacteria
  - Acidophils
  - Acidothiobacillus*
- Library screening based on the biological activity of a gene in plants is referred as
  - Expression cloning
  - Functional cloning
  - Positional cloning
  - Hybridization based screening
- The fluid used as solvent in super critical fluid extraction is a
  - gas
  - mixture of gas and liquid
  - highly compressed gas
  - highly compressed liquid
- Gaucher's disease is caused due to deficiency of
  - glucocerebrosidase
  - streptokinase
  - uricase
  - serratiopeptidase
- During the penicillin extraction process, pH is adjusted to acidic value to
  - enhance the extraction of penicillin
  - increase stability of penicillin
  - decrease the partition coefficient
  - reduce the viscosity of the broth
- Marine bacteria change their morphology in response to the nutrients in their surrounding environment and the phenomenon is referred as
  - Oligotrophism
  - Pleomorphism
  - Heterotrophism
  - Syntrophism
- Marine sediments derived from erosion of rocks are
  - Biogenous sediments
  - Lithogenous sediments
  - Limnologic sediments
  - Magnetic sediments
- Inanimate habitats colonized by organisms are called
  - Seston
  - Pelagic
  - Neuston
  - Epibiotic

14. Probiotics in aquaculture are regularly used to
- increase the size and weight of fish.
  - improve the fecundity of fish.
  - improve the water quality of the pond.
  - for vaccinating the fish against general bacterial infection.
15. A lithoautotroph
- derives energy from reduced compounds of mineral origin.
  - can be bacterial or eukaryotic cell.
  - is always an extremophile.
  - requires light for producing
16. Higher version of BLOSUM can be used to detect
- Closely related sequences
  - Distantly related sequences
  - Unrelated sequences
  - Partially related sequences
17. TBLASTX matches a DNA query sequence, translated into all six reading frames, against a DNA database with
- No gaps allowed
  - Gaps allowed
  - Gaps depending on the input sequence
  - Gaps depending on the database
18. Changing which of the following BLAST parameters would tend to yield fewer search results?
- Turning off the low complexity filter
  - Changing the expected value from 1 to 10
  - Raising the threshold value
  - Changing the scoring matrix from PAM30 to PAM70
19. The Ramachandran map of a protein representation allows you to identify
- The most stable structure
  - The tertiary allowed structure
  - The sterically disallowed conformations
  - the secondary structure elements
20. Which information among the following provides the maximum information to do structure based drug design?
- 3D-structure of a set of active compounds
  - 3D-structure of the target
  - Crystal structure of target-ligand complex
  - Primary structure of the target
21. To display a ligand molecule, one cannot use the rendering style of
- Stick
  - Ball and stick
  - Ribbon
  - CPK/space filling
22. The angle between the two long helical arms of tRNA is about
- 180°
  - 0°
  - 45°
  - 90°
23. The cytokine that down regulates T-cell mediated immune responses is
- IL-8.
  - TGF-beta.
  - TNF-alpha.
  - GM-CSF.
24. The antibody present in the breast milk is
- IgA.
  - IgD.
  - IgM.
  - IgE.
25. Toxin conjugated antibody molecules are known as
- toxoid.
  - immunotoxin.
  - reaginic antibody.
  - lymphotoxin.
26. Which of the following receptors is not a signalling receptor?
- Cytokine receptor
  - Chemokine receptor
  - T-cell receptor
  - Mannose receptor
27. A patient of Grave's disease produces antibody against
- thyroid stimulating hormone.
  - basement membrane of thyroid gland.
  - acetylcholine receptor.
  - Insulin receptor.
28. Survival of mice exhibiting autoimmune lupus-like symptom may be prolonged by treatment with monoclonal antibody specific for
- CD16.
  - CD69.
  - CD4.
  - CD8.

29. The 5<sup>th</sup> human malarial parasite is  
 (A) *Plasmodium yoellii*.  
 (B) *Plasmodium fragile*.  
 (C) *Plasmodium cynomolgi*.  
 (D) *Plasmodium knowlesi*.
30. Osteogenesis imperfecta is caused by a defect in the  
 (A) removal of propeptide from collagen  $\alpha$  chain during protein synthesis.  
 (B) collagen cross-link formation.  
 (C) glycosylation of hydroxyllysine residues in collagen.  
 (D) hydroxylation of proline to hydroxyproline.
31. The most common mode of transmission for diphtheria, pneumonia and tuberculosis is through  
 (A) direct contact.  
 (B) aerosols.  
 (C) contaminated water.  
 (D) insect vectors.
32. Which of the following bacteria causes Rheumatic fever?  
 (A) *Staphylococcus aureus*  
 (B) *Staphylococcus pyogenes*  
 (C) *Campylobacter jejuni*  
 (D) *Shigella flexneri*
33. The purpose of adding phytohemagglutinin to peripheral blood cultures for chromosomal analysis is to facilitate  
 (A) chromosome condensation  
 (B) to synchronize large number of cells at metaphase  
 (C) swelling of cells to permit chromosome visualization  
 (D) stimulation of lymphocyte cell division
34. In human, pointed eyebrows are dominant to smooth eyebrows and "widow's peak" frontal hairline is dominant to continuous hairline. What phenotypic ratio would you expect in the offspring from a marriage between an individual heterozygous for both the genes and an individual homozygous recessive for both the genes?  
 (A) 9 : 3: 3: 1  
 (B) 9: 7  
 (C) 1: 1  
 (D) 1: 1: 1: 1
35. If a man of blood group AB marries a woman of blood group A whose father was of blood group O, to what different blood groups can this man and woman expect their children to belong?  
 (A) A, AB, B  
 (B) A, AB  
 (C) AB, O  
 (D) A, O, B
36. Cytotoxic T cells generally recognise antigen in association with  
 (A) class II MHC determinants  
 (B) class I MHC determinants  
 (C) class III MHC determinants  
 (D) HLA-DR determinants
37. Which one of the following amino acids interrupts  $\alpha$  helices, and also disrupts  $\beta$  sheets?  
 (A) Phe  
 (B) Cys  
 (C) His  
 (D) Pro
38. Which of the following statements concerning the Edman degradation method is incorrect?  
 (A) Phenyl isothiocyanate is coupled to the amino-terminal residue  
 (B) Under mildly acidic conditions, the modified peptide is cleaved into a cyclic derivative of the terminal amino acids and a shortened peptide (minus the first amino acid)  
 (C) Once the PTH amino acid is separated from the original peptide, a new cycle of sequential degradation can begin  
 (D) Phenyl isothiocyanate is coupled to the carboxy-terminal residue
39. The non-oxidative branch of the pentose phosphate pathway does NOT include which of the following reactions?  
 (A) Ribulose 5-P  $\rightarrow$  ribose 5-P  
 (B) Xylulose 5-P + ribose 5-P  $\rightarrow$  sedoheptulose 7-P  $\rightarrow$  glyceraldehydes 3-P  
 (C) Ribulose 5-P + glyceraldehydes 3-P  $\rightarrow$  sedoheptulose 7-P  
 (D) Sedoheptulose 7-P + glyceraldehyde 3-P  $\rightarrow$  fructose 6-P + erythrose 4-P
40. Silk fibroin displays  
 (A) alpha helix  
 (B) loop structure  
 (C) Antiparallel-  $\beta$  pleated sheets  
 (D) parallel  $\beta$  sheet
41. Carnitine is required for  
 (A) Renal function  
 (B) fatty acid synthesis  
 (C) fatty acid oxidation  
 (D) sterol synthesis

42. How many milliliters of 0.05 N HCl are required to neutralize eight grams of NaOH?
- (A) 5000  
(B) 4000  
(C) 4500  
(D) 5050
43. What is the pH of  $10^{-8}$  M solution of HCl?
- (A) 8.99  
(B) 6.99  
(C) 7.99  
(D) 7.00
44. Z DNA helix
- (A) is the primary form in any living organism  
(B) is favoured by an alternating GC sequence  
(C) tends to be formed at 3' end of genes  
(D) formation is inhibited by methylation of bases
45. In H-DNA bases of the third strand pairs with
- (A) Pyrimidines of the double helix  
(B) Purines of the double helix  
(C) Both Purines and Pyrimidines of the duplex  
(D) Remains unpaired
46. Deletion of which of the following genes will result in permanent lysogenic stage of bacteriophage  $\lambda$ ?
- (A) N  
(B) CII  
(C) CI  
(D) Cro
47. Which of the following is a segmented single stranded RNA virus with ambisense genome?
- (A) Rotavirus  
(B) Influenza virus  
(C) Colorado tick fever virus  
(D) Arena virus
48. Which of the following antibiotics inhibits bacterial protein synthesis by interfering with peptidyl transferase activity?
- (A) Streptomycin  
(B) Erythromycin  
(C) Puromycin  
(D) Cycloheximide
49. Disulphide bonds in proteins could be formed by cysteines using
- (A) Iodoacetamide  
(B) oxidized glutathione  
(C) reduced glutathione  
(D)  $\beta$ -mercaptoethanol

50. During DNA replication in *E.coli*, RNA primers are synthesized by
- (A) dna B  
(B) dna G  
(C) dna C  
(D) dna A

## Section B

51. Hydrogen bonds in  $\alpha$ -helices are
- (A) more numerous than van der Waals interactions  
(B) not present at phenylalanine residues  
(C) analogous to the steps in a spiral staircase  
(D) roughly parallel to the helix axis
52. Which one of the following is the correct statement for an active sodium-potassium ATPase?
- (A) it pumps out 3 Na-ions and pumps in 2 K-ions  
(B) it pumps out 3 Na-ions and pumps in 3 K-ions  
(C) it pumps out 3 Ca-ions and pumps in 2 K-ions  
(D) it pumps out 3 Na-ions and pumps in 2 Ca-ions
53. Under which circumstances T cell develops anergy?
- (A) When the number of TCR on the T cell surface is low  
(B) When the CD4/ CD8 molecules present on T cell surfaces do not recognize self MHC II/MHC I molecules  
(C) When the MHCII molecules present on antigen presenting cells bind to the peptides with less avidity  
(D) When co-stimulatory molecules present on the antigen presenting cells fail to interact with T cells
54. Which one of the statements is most appropriate for the ability of an antigen for the induction of TH1 or TH2 response ?
- (A) The nature of naive T cell it encounters  
(B) The nature of epitopes present in it  
(C) The cytokine milieu at the time of activation of T cells  
(D) The nature of antigen presenting cell which presents the peptides derived from the antigen.
55. Allotypic determinants are
- (A) constant region determinants that distinguish each Ig class and subclass within a species.

- (B) generated by the conformation of antigen-specific VH and VL sequences.  
 (C) Not immunogenic in individuals who do not have that allotype.  
 (D) amino acid differences encoded by different alleles for the same H or L chain locus.
56. Junctional diversity affects primarily the amino acid sequence in  
 (A) all CDR equally.  
 (B) CDR1.  
 (C) CDR2.  
 (D) CDR3.
57. Which of the following techniques is used to locate disulfide bonds in a protein?  
 (A) The protein is first reduced and carboxymethylated  
 (B) The protein is cleaved by acid hydrolysis  
 (C) The peptides are separated by SDS-polyacrylamide gel electrophoresis  
 (D) The peptides are separated by two-dimensional electrophoresis with an intervening performic acid treatment
58. Diphtheria toxin  
 (A) is cleaved on the surface of susceptible eukaryotic cells into two fragments, one of which enters the cytosol  
 (B) binds to peptidyl transferase and inhibits protein synthesis  
 (C) reacts with ATP to phosphorylate eIF2 and prevent the insertion of the Met-tRNA<sub>i</sub> into the P site  
 (D) reacts with NAD<sup>+</sup> to add ADP-ribose to eEF2 and prevents movement of the peptidyl-tRNA from A to P site in the ribosome
59. The rate limiting reaction in cholesterol biosynthesis is catalyzed by  
 (A) HMG-CoA reductase  
 (B) HMG-CoA synthase  
 (C) acetoacetate synthase  
 (D) squalene synthase
60. The potent allosteric activator of animal Phosphofructo kinase is  
 (A) Fructose  
 (B) Fructose 2,6 Phosphate  
 (C) Fructose 1,6 Phosphate  
 (D) Pyruvate
61. Antimycins block the respiratory chain by  
 (A) inhibiting cytochrome oxygenase  
 (B) blocking NADH hydrogenase  
 (C) blocking ADP-ATP transport  
 (D) blocking electron flow between cytochrome b and c<sub>1</sub>
62. Which of the following conditions would tend to promote cell cycle progression?  
 (A) A cell with a mutant E2F that cannot bind to DNA  
 (B) A cell with a mutant p16 protein that cannot bind to cdk4  
 (C) A cell with a mutant cdk4 that cannot bind to cyclin D  
 (D) Expression of a mutant pRB that cannot be phosphorylated by cyclin D/cdk4
63. What are the concentrations of HOAc and OAc<sup>-</sup> in 0.2 M "acetate buffer", pH 5.00? The K<sub>a</sub> for HOAc is 1.70 x 10<sup>-5</sup>  
 (A) OAc<sup>-</sup> = 0.126 M, HOAc = 0.074 M  
 (B) OAc<sup>-</sup> = 0.150 M, HOAc = 0.084 M  
 (C) OAc<sup>-</sup> = 0.200 M, HOAc = 0.184 M  
 (D) OAc<sup>-</sup> = 0.250 M, HOAc = 0.284 M
64. Calculate the instantaneous buffering capacity in both directions of 0.05 M Tricine buffer, pH 7.5. Tricine is an N-tris- (hydroxymethyl)-methyl glycine. pK<sub>a</sub> = 8.15 (K<sub>a</sub> = 7.08 x 10<sup>-9</sup>)  
 (A) 0.017 M  
 (B) 0.217 M  
 (C) 0.257 M  
 (D) 0.175 M
65. Hydrolysis of ATP over ADP and AMP generates highest energy because  
 (A) ATP on hydrolysis generates thermodynamically stable structure  
 (B) ATP is highly unstable  
 (C) Hydrolysis of ATP is pH dependent  
 (D) Hydrolysis of ADP and AMP do not generate thermodynamically stable structure
66. The equilibrium constant ((K<sub>eq</sub>) for the reaction S ↔ P is 5. Suppose we have a mixture of [S] = 2 x 10<sup>-4</sup> M and [P] = 3 x 10<sup>-4</sup> M. In which direction will the reaction proceed on addition of appropriate enzyme?  
 (A) Proceeds in a forward direction  
 (B) Proceeds in a reverse direction  
 (C) Proceeds in both the directions  
 (D) Proceeds sometimes in forward and sometimes in reverse direction
67. In the ds-break recombination model, which of the following steps is the first one that happens after formation of the Holliday junction?  
 (A) DNA cleavage catalyzed by RuvC  
 (B) Coating ssDNA with RecA

- (C) C Branch migration catalyzed by RuvAB  
(D) D Dissociation of RecD from RecBCD at a chi site
68. For attachment of sister chromatids to the spindle, which of the following is required?  
(A) Inhibition of M-Cdk  
(B) Association of lamina to nuclear membrane  
(C) Breakdown of nuclear envelope  
(D) Rapid synthesis of cyclin B
69. At 12 hours of post seeding suspension cell culture, the cell density was determined to be  $3.6 \times 10^8$  cells/ml. For viral infections, an aliquot of 4 ml culture was withdrawn at that time and centrifuged. What is the cell concentration if pellet is re-suspended in 9 ml medium?  
(A)  $16 \times 10^8$  cells/ml  
(B)  $2 \times 10^8$  cells/ml  
(C)  $1.6 \times 10^8$  cell/ml  
(D)  $4 \times 10^8$  cell/ml
70. Information for which of the following functions is not encoded in the genome of virus?  
(A) Replication of the genome  
(B) Modulation of host defense  
(C) Envelope membrane biosynthesis  
(D) Assembly and packaging of the genome
71. Order glucose, urea,  $H_2O$ ,  $CO_2$  and steroid hormones according to their ability to diffuse through the lipid bilayer, beginning with the one that crosses the bilayer most readily  
(A)  $CO_2$ , steroid hormone,  $H_2O$ , urea, glucose  
(B)  $CO_2$ ,  $H_2O$ , urea, glucose, steroid hormone  
(C)  $H_2O$ ,  $CO_2$ , glucose, urea, steroid hormone  
(D) steroid hormone,  $CO_2$ ,  $H_2O$ , urea, glucose
72. The therapeutic index of sulphonamides is high because  
(A) Bacteria manufacture their own folate and humans do not synthesize folate  
(B) Humans synthesize folic acid at a very high rate  
(C) Dihydrofolate reductase is not active in bacteria  
(D) Pteridine synthetase is more efficient in humans
73. One of the major causes of *Plasmodium falciparum* resistance to chloroquine is amplification of the gene for  
(A) MsbA transporter  
(B) LacY permease  
(C) AqpZ porin  
(D) ABC transporter
74. Polyproline II structure found in some proteins and having helical orientation is known to have  
(A) 3 residues per turn  
(B) 3.3 residues per turn  
(C) 3.6 residues per turn  
(D) 4 residues per turn
75. Concentration of a protein solution determined using its extinction coefficient resulted in a value of 1 mg/ml. Given that its molecular weight is 100 kDa, its concentration in molar units will be  
(A) 10  $\mu$ M  
(B) 100  $\mu$ M  
(C) 1 mM  
(D) 10 mM
76. If the  $pK_a$  of the  $\epsilon$ -amino group of lysine is 10.5, the side chain at pH 7 is likely to be  
(A) neutral  
(B) half dissociated  
(C) negatively charged  
(D) positively charged
77. The dihedral angle  $\psi$  for a peptide used in the Ramachandran plot is given a value based on rotation around  
(A) N-C $^\alpha$  bond  
(B) C $^\alpha$ -C' bond  
(C) C'-N bond  
(D) C $^\alpha$ -C $^\beta$  bond
78. Urea and guanidine hydrochloride are potent protein denaturants. They work by  
(A) binding to the hydrophobic groups in proteins  
(B) breaking of disulphide bonds  
(C) enhancing the hydrogen bonded network of water  
(D) binding to the peptide bonds of proteins
79. Water has a high dielectric constant value of 80. Because of its presence in biological systems compared with low dielectric solvents like hydrocarbons, it should  
(A) strengthen electrostatic interaction but weaken hydrophobic interactions  
(B) weaken electrostatic interaction but strengthen hydrophobic interactions  
(C) strengthen both electrostatic as well as hydrophobic interactions  
(D) weaken both electrostatic as well as hydrophobic interactions
80. RNAi methodology uses double-stranded pieces of RNA to trigger a breakdown or blocking of mRNA. This is often used

- (A) to increase the rate of production of an enzyme of pharmacological significance  
 (B) to decrease the production from a harmful gain-of-function of mutated gene  
 (C) to mutate an unwanted allele in a homozygous individual  
 (D) to form a knockout organism that will not pass the deleted sequence to its progeny
81. In a lac operon, a mutation is created so that lactose cannot bind. Now, if lactose is provided, what would happen?  
 (A) the  $\beta$ -galactosidase will be over-expressed  
 (B) lac I repressor will remain inactivated.  
 (C) expression of lac operon will remain unaffected  
 (D) lac I repressor would remain bound to operon preventing expression
82. In 1997, Dolly the sheep was cloned. Which of the following processes was used?  
 (A) use of mitochondrial DNA from adult female cells of another ewe  
 (B) replication and dedifferentiation of adult stem cells from sheep bone marrow  
 (C) separation of an early stage sheep blastula into separate cells, one of which was incubated in a surrogate ewe  
 (D) fusion of an adult cell's nucleus with an enucleated sheep egg, followed by incubation in a surrogate ewe.
83. Alkaptonuria resulting from the homozygous expression of a recessive autosomal gene, occurs in about 1 in 1 million persons. Assuming Hardy-Weinberg equilibrium for this trait, what is the approximate proportion of heterozygous "carriers" in the population?  
 (A) 1 in 1000  
 (B) 1 in 500  
 (C) 1 in 20,000  
 (D) 1 in 2000
84. A woman who is heterozygous for both phenylketonuria mutation and for X-linked hemophilia mutation has a child with a phenotypically normal man who is also heterozygous for a phenylketonuria mutation. What is the probability that the child will be affected by both?  
 (A) 1/8  
 (B) 1/4  
 (C) 1/16  
 (D) 3/8
85. In a family a female child is diagnosed with a known genetic disorder. She has four unaffected brothers and sisters. Neither parent nor any of the four biological grandparents of the affected child had the disease. The most likely genetic explanation is that the disease is inherited as  
 (A) autosomal dominant  
 (B) autosomal recessive  
 (C) X-linked recessive  
 (D) X-linked dominant
86. The genotypes of a husband and wife are  $I^A I^A \times I^A I^O$ . Among the blood types of their children, how many different genotypes and phenotypes are possible?  
 (A) 2 genotypes, 3 phenotypes  
 (B) 3 genotypes, 4 phenotypes  
 (C) 4 genotypes, 4 phenotypes  
 (D) 4 genotypes, 3 phenotypes
87. In animal kingdom, the group amniota includes  
 (A) birds and reptiles  
 (B) birds and mammals  
 (C) reptiles and mammals  
 (D) reptiles, birds and mammals
88. In evolutionary biology, 'biological species' concept is based on  
 (A) geographical isolation and karyotypic difference  
 (B) morphological differentiation only  
 (C) ecological differentiation coupled with morphological differentiation  
 (D) primarily reproductive isolation
89. Conjugated bilirubin is  
 (A) transported in blood bound to serum albumin  
 (B) reduced in a deficiency of a UDP-glucuronosyl transferase  
 (C) less soluble in aqueous solution than in conjugated form  
 (D) reduced in serum in biliary tract obstruction
90. The typical length of an integral membrane protein domain (glycophorin fold) is  
 (A) 20-25 amino acids  
 (B) 10-15 amino acids  
 (C) 30-40 amino acids  
 (D) 5-10 amino acids
91. Fluid mosaic nature of a biological membrane can be proved by  
 (A) Patch clamp technology  
 (B) FRAP technique  
 (C) Electron spin resonance technique  
 (D) Cell-cell fusion technique

92. A bottle contains 1 mCi of L-Phenylalanine  $^{14}\text{C}$  (uniformly labelled) in 2.0 ml of solution. Specific activity of the labelled amino acid is given as 150 mCi/m mole. The concentration of L-Phenylalanine in the solution can be calculated as  
 (A)  $2.335 \times 10^{-3}$  M  
 (B)  $3.335 \times 10^{-3}$  M  
 (C)  $3.535 \times 10^{-3}$  M  
 (D)  $2.535 \times 10^{-3}$  M
93. Complete fusion of two cells takes place only when  
 (A) Two outer bilayers of the plasma membrane are fused  
 (B) Two inner bilayers of the plasma membrane are fused  
 (C) Both outer and inner bilayers of the plasma membrane are fused  
 (D) Both outer and inner bilayers of the plasma membrane are fused and aqueous connection is established
94. Which one of the following is the ideal molecular marker of a mature lysosome?  
 (A) Glucose -6-phosphate receptor  
 (B) Endoprotease  
 (C) Mannose-6-Phosphate receptor  
 (D) Endoglycosidase
95. Which of the following has the highest affinity of ligand-receptor interaction?  
 (A) Insulin-insulin receptor  
 (B) Lectin-sugar receptor  
 (C) Biotin-avidin  
 (D) Cytokine-cytokine receptor
96. Lateral diffusion rate of an individual membrane protein in a biological membrane generally depends on  
 (A) The extent of glycosylation  
 (B) The extent of phosphorylation  
 (C) The number of integral membrane domains  
 (D) The extent of its association with cholesterol
97. Maturation of endosome in a living cell is strictly dependent on  
 (A) Appearance of specific glycolipids on its membrane  
 (B) Appearance of specific phospholipids on its membrane  
 (C) Acidification of its aqueous compartment  
 (D) Kinetics of ligand receptor interaction on cell surface
98. Asymmetry of biological membranes is regulated by  
 (A) Phospholipase A  
 (B) Flippase  
 (C) Phospholipase C  
 (D) N-glycosidase
99. Which of the following statements concerning biological membrane is correct?  
 (A) Lipid rafts are fixed in position in membrane  
 (B) Lipid composition of two layers of the membrane equilibrate  
 (C) The membrane is most fluid at the surfaces  
 (D) Lipid transporters catalyze unidirectional movement of specific lipids from one layer to other
100. Signal recognition particle consists of  
 (A) A single large RNA  
 (B) Multiprotein complex  
 (C) A complex of single RNA and multiple proteins  
 (D) A complex of multiple RNA and multiple proteins
101. Which of the following amino acids of a membrane protein are most likely to be buried in the interior of protein structure?  
 (A) Aspartic acid and phenylalanine  
 (B) Isoleucine and glutamic acid  
 (C) Aspartic acid and glutamic acid  
 (D) Methionine and Tyrosine
102. A grafting of a dorsal lip of the blastopore from an early xenopus gastrula onto the ventral side of an early embryo will result in  
 (A) The formation of two separate and independent embryos  
 (B) The formation of two complete embryos joined along the ventral axis  
 (C) The formation of two sets of anterior structures joined along the ventral axis: a two headed embryo  
 (D) The formation of two sets of posterior structures joined along the ventral axis: a two headed embryo
103. In which of the following processes eukaryotic mitochondria is known to be least involved?  
 (A) ATP production  
 (B) Apoptosis  
 (C) Tricarboxylic acid cycle  
 (D) Fatty acid biosynthesis
104. Which one of the following statements is not correct?  
 (A) PCR is more sensitive than branched DNA assays  
 (B) Branched DNA is more sensitive than Ligase chain reaction



- (C) Linear amplification occurs in branched DNA  
(D) PCR is extremely liable to contamination
105. Chemokine receptor used by HIV for attachment during infection of T cells  
(A) CXCR 4  
(B) CXCR 3  
(C) CCR5  
(D) CXCR 1
106. The colloidal pressure of vertebrate blood is mainly due to  
(A) Neutrophil  
(B) Albumin  
(C) Fibrinogen  
(D) Globulin
107. In a conjugation experiment, the order in which the markers from Hfr donor appeared in F-recipient was : *mal* (10 min) *thi* (22 min)*met* (17 min) *trp* (57 min)*thr* (33 min). What will be the order of markers on the chromosome?  
(A) *mal-thi-met-trp-thr*  
(B) *trp-thr-thi-met-mal*  
(C) *mal-met-thi-thr-trp*  
(D) *thr-trp-mal-met-thi*
108. Which method is used to generate clonally amplified DNA fragments to be used as templates in Pyrosequencing?  
(A) Ligation PCR  
(B) Shot gun cloning  
(C) BAC cloning  
(D) Emulsion PCR
109. Twin membrane proteins vSNARE and tSNARE act as anchors when two vesicles fuse into one during molecular transport in the cell. These snare proteins are found in membranes of all except  
(A) Mitochondria  
(B) Golgi complex  
(C) Early endosome  
(D) Endoplasmic reticulum
110. In a ligation reaction, what amount of insert DNA of 750 bp is required to clone into 5000 bp vector with a concentration of 80 ng/  $\mu$ l at a molar ratio of vector to insert 1:3?  
(A) 12 ng  
(B) 36 ng  
(C) 40 ng  
(D) 24 ng
111. Addition of activated charcoal to plant tissue culture medium is done in order to  
(A) Reduce phenolic leachates  
(B) Increase osmolarity of medium  
(C) Supplement vitamins  
(D) Resist pH changes
112. Which of the following chemicals prevents precocious germination, promotes embryo maturation and increases desiccation tolerance of somatic embryos?  
(A) Abscisic acid  
(B) Silver nitrate  
(C) 2,4-Dichloro phenoxy acetic acid  
(D) Sodium chloride
113. Wild type *Agrobacterium tumefaciens* does not contain one of the following classes of genes in the T-DNA region. These are  
(A) Auxin biosynthesis genes  
(B) Opine synthesis genes  
(C) Opine catabolism genes  
(D) Cytokinin biosynthesis genes
114. One way of overcoming homologous gene silencing by a transgene is  
(A) Using CaMV35S promoter to drive transgene expression  
(B) Inserting transgene into plastid genome instead of nuclear genome  
(C) Removing the antibiotic resistance-conferring genes from transformed plants  
(D) Placing an intron between the promoter and coding sequence of the transgene
115. Which of the following genes is a non-antibiotic, non-herbicide marker that is used for positive selection in plant genetic transformation?  
(A) Neomycin phosphotransferase II  
(B) Dihydrofolate reductase  
(C) Glyphosate oxidoreductase  
(D) Mannose 6-phosphate isomerase
116. Which of the following is formed without fertilization in diplosporic apomicts?  
(A) Embryo  
(B) Seed  
(C) Endosperm  
(D) Embryo sac
117. NCED (9-cis epoxy-carotenoid dioxygenase) is involved in  
(A) ABA biosynthesis  
(B) GA biosynthesis  
(C) Auxin biosynthesis  
(D) Ethylene biosynthesis

118. The single-stranded nick in DNA during T-DNA transfer is initiated by  
 (A) Vir C  
 (B) Vir B  
 (C) Vir D  
 (D) Vir E
119. Target protein for Glyphosate (Roundup®) is  
 (A) acetolactate synthase  
 (B) Glutamine synthase  
 (C) 5-Enolpyruvyl shikimate 3-phosphate synthase  
 (D) Glutamate dehydrogenase
120. Application of molecular biological technique for commercial production of recombinant products in plants is referred as  
 (A) Transgenic technology  
 (B) Biotech crops technology  
 (C) Molecular Farming  
 (D) Recombinant DNA technology
121. Which of the following is not a function of molecular chaperon in protein folding?  
 (A) Molecular chaperones assist in protein folding into their correct structure  
 (B) Molecular chaperones specify the tertiary structure of a protein  
 (C) Molecular chaperones can stabilize partially folded proteins and prevent them aggregating with other proteins  
 (D) Molecular chaperones can shield and protect exposed hydrophobic regions of proteins
122. Transgenic for terminator seed is due to a lethal gene along with two other genes. Which of the following is the product of the lethal gene?  
 (A) Recombinase  
 (B) Ribosomal inhibiting protein  
 (C) Repressor protein  
 (D) Protein for late embryogenesis
123. The haploid chromosome number of rice is 12. Which tissue will have 36 chromosomes?  
 (A) Coleoptile  
 (B) Scutellum  
 (C) Endosperm  
 (D) Nucellus
124. Which one of the following phytohormones is produced under water-deficit and plays an important role in tolerance against drought?  
 (A) Abscisic acid  
 (B) Cytokinin  
 (C) Ethylene  
 (D) Gibberellin
125. Phytoalexins are chemical compounds that are produced by plants. The following statements refer to these compounds:  
 1. These compounds are stress related factors produced in plants due to physical chemical or microbial stress  
 2. A large number of secondary metabolites belong to this class.  
 3. Some genes are derepressed because of these factors.  
 Of the statements given above  
 (A) Only 1 is true  
 (B) Only 1 and 2 are true  
 (C) Only 1 and 3 are true  
 (D) All are true
126. Barley RIP gene was demonstrated to provide protection in tobacco plant against  
 (A) *Rhizoctonia solani*  
 (B) Alternaria blight  
 (C) *Phytophthora infestans*  
 (D) Tobacco Mosaic Virus
127. CO<sub>2</sub> acceptor in C<sub>3</sub> plants is  
 (A) Phosphoglyceric acid  
 (B) Ribulose monophosphate  
 (C) Ribulose 1,5- bisphosphate  
 (D) Phosphoenol pyruvate
128. Why haploids are preferred for plant breeding experiments?  
 (A) Dominant characters are expressed  
 (B) Recessive characters are expressed  
 (C) Induction of mutation is easy  
 (D) Incomplete dominance is expressed
129. C<sub>4</sub> rice has been developed by transforming rice with  
 (A) PEPC and PPK  
 (B) PEPC and RUBISCO  
 (C) PEPC and MDH  
 (D) PEPC and Carbonic anhydrase
130. Active form of Gibberellin in plants is  
 (A) GA1  
 (B) GA3  
 (C) GA15  
 (D) GA9
131. Which of the following is the seed specific promoter used in plant genetic engineering?

- (A) CaMV35S promoter  
(B) Ubiquitin promoter  
(C) ABRE promoter  
(D) Glutelin promoter
132. Which of the following requires back crossing?  
(A) Generation of RILs  
(B) Generation of DH population  
(C) Generation of NILs  
(D) Generation of F<sub>2</sub>s
133. AAO gene family in plants is involved in  
(A) ABA biosynthesis  
(B) GA biosynthesis  
(C) Auxin biosynthesis  
(D) Ethylene biosynthesis
134. Oilseed mustard overexpressing 18:1 delta 12 desaturase will show increased levels of the following fatty acid in the seed oil  
(A) Oleic acid  
(B) Linoleic acid  
(C) Stearic acid  
(D) Erucic acid
135. A signal sequence KDEL is removed from a ER resident protein. Assuming that there is no change in tertiary structure of such plant protein and no other signal sequences present in protein, the changed protein will now have following fate  
(A) It will remain in ER and be degraded  
(B) It will be targeted to Golgi apparatus  
(C) It will be secreted outside the cell  
(D) It will be targeted to lysosome for degradation
136. Which of the following objectives cannot be achieved by using cybrids?  
(A) Transfer of cytoplasmic male sterility  
(B) Recombination of cytoplasmic genes with nuclear gene of another species.  
(C) Introgression of Chromosome segment  
(D) Development of true hybrid line
137. Amylase inhibitor gene is transferred to plants for providing resistance against  
(A) Fungi  
(B) Viruses  
(C) Insects  
(D) Bacteria
138. PHB biosynthetic pathway for bioplastic production involves manipulation of *phaA*, *phaB* and *phaC* genes of  
(A) *Escherichia coli*  
(B) *Aspergillus nidulans*  
(C) *Alcaligenes eutrophus*  
(D) *Bacillus megaterium*
139. Sodium alginate is used in  
(A) Protoplast culture  
(B) Artificial seed formation  
(C) Cryopreservation  
(D) Media as gelling agent
140. Heating coils inside a fermentor serve additional roles as  
(A) Shaft of the agitator  
(B) Blades of the agitator  
(C) Baffle of the fermentor  
(D) Heating surface of the fermentor
141. A stirrer has a power number (N<sub>p</sub>) 10. If the stirrer speed (N) is 1 s<sup>-1</sup>, its diameter D= 1 m and the density of the medium is 1000 kg/m<sup>3</sup>, the ungassed power input (P) in watts is  
(A) 100  
(B) 1000  
(C) 10,000  
(D) 10
142. Producing biodiesel from algae is a process which is  
(A) carbon negative  
(B) carbon positive  
(C) carbon and nitrogen positive  
(D) carbon neutral
143. A pitched-blade turbine draws ..... a straight blade turbine of same the diameter.  
(A) more power than  
(B) less power than  
(C) same power as  
(D) very high power as
144. In SI system, the unit of thermal conductivity is  
(A) W/ m<sup>2</sup>. K  
(B) W/ m. K  
(C) W/K  
(D) W/ m<sup>2</sup>
145. For efficient heat transfer in a jacketed reactor, the reactor configuration should have  
(A) low surface-to-volume ratio  
(B) high surface-to-volume ratio  
(C) intermediate surface-to-volume ratio  
(D) low height to diameter ratio
146. Filtration involving incompressible cake, the specific cake resistance  
(A) increases with time  
(B) decreases with time  
(C) remains constant  
(D) depends on the filter design
147. Which of the following characteristics refers to an ideal plug flow reactor?

- (A) Less back mixing of the reactants and products  
 (B) Complete back mixing of the reactants and products  
 (C) Uniform temperature, pressure and composition across any section normal to the fluid motion  
 (D) Uniform temperature, pressure and composition across any section parallel to the fluid motion
148. If  $V_s$  = Volume of solvent,  $V_r$  = Volume of raffinate and  $\alpha$  = Distribution factor, then Separation factor  $S$  in liquid-liquid extraction is given by  
 (A)  $S = V_s / V_r$   
 (B)  $S = \alpha (V_s / V_r)$   
 (C)  $S = V_r / V_s$   
 (D)  $S = 1 / \alpha (V_s / V_r)$
149. Most important factor that affects the cell disruption in a Dyno-mill is  
 (A) osmotic pressure difference  
 (B) temperature of disruption  
 (C) dimension of beads  
 (D) flow of cells through the chamber
150. The decrease in apparent viscosity of a liquid with increasing shear rate, is known as  
 (A) dilatant  
 (B) pseudoplastic  
 (C) casson body  
 (D) bingham plastic
151. In heat transfer through a heat exchanger in co-current or counter-current flow, which of the assumptions is not correct?  
 (A) The overall heat transfer coefficient ( $U$ ) is constant  
 (B) Temperature difference between hot and cold fluid should not be high  
 (C) Heat losses from the system is negligible  
 (D) The system is at steady state
152. Growth yield coefficient of microbes is defined as  
 (A) amount of substrate consumed/amount of cell mass formed  
 (B) specific growth rate/specific rate of substrate utilization  
 (C) specific growth rate/specific rate of product formation  
 (D) specific rate of substrate utilization/ specific rate product formation.
153. If the separation factor of two different centrifuges for a particular solid suspension is same, which of the following will be true?  
 (A) The applied centrifugal force for the two centrifuges are same  
 (B) The relative centrifugal force for the two centrifuges are same  
 (C) The relative centrifugal force for the two centrifuges are not same  
 (D) The applied centrifugal force for the two centrifuges are not same
154. Which of the following strategies is not adopted to minimize secretion of acetate in a recombinant protein producing *E. coli*?  
 (A) Converting acetyl CoA to acetoin  
 (B) Altering the rate of glucose transport inside the cell  
 (C) Blocking the acetate synthesis pathway  
 (D) Increasing the flux in pentose phosphate pathway
155. In general, the critical dilution rate ( $D_c$ ) in a chemostat is  
 (A) higher than  $\mu_m$   
 (B) less than  $\mu_m$   
 (C) equal to  $\mu_m$   
 (D) not related to  $\mu_m$
156. In microbial cultivation, the expression for product synthesis  $r_p = \alpha\mu X + \beta X$  denotes  
 (A) Growth associated  
 (B) Non growth associated  
 (C) Impaired growth associated  
 (D) Mixed growth associated
157. In autocatalytic reactions,  
 (A) one of the reactants acts as a catalyst  
 (B) one of the products acts as a catalyst  
 (C) catalysts have very high selectivity  
 (D) both reactants and products act as catalyst
158. Rate of absorption of a sparingly soluble gas in a liquid can be increased by  
 (A) increasing the gas side mass transfer coefficient  
 (B) decreasing the gas side mass transfer coefficient  
 (C) increasing the liquid side mass transfer coefficient  
 (D) decreasing the liquid side mass transfer coefficient
159. Concentration of limiting substrate can be maintained at a very low level in  
 (A) fed batch culture  
 (B) batch culture  
 (C) both batch and fed batch culture  
 (D) plug flow culture

160. In microbial fermentation, factor which does not affect cellular oxygen demand is  
 (A) type of microorganism  
 (B) culture growth phase  
 (C) nature of carbon source  
 (D) fermenter design
161. Aqueous two phase extraction system has a combination of  
 (A) two water soluble polymers or a polymer and salts in water below critical concentration  
 (B) two water soluble polymers or a polymer and salt in water above critical concentration  
 (C) two water insoluble polymers or a polymer and salt in water above critical concentration  
 (D) two water soluble polymers or a polymer and salt in two immiscible liquid
162. Which one of the following systems should be adopted to resolve a mixture of antibiotic and an impurity with partition coefficient 6 and 2, respectively,  
 (A) cocurrent extraction system with polar solvent  
 (B) counter current extraction system with polar solvent  
 (C) cocurrent extraction system with nonpolar solvent  
 (D) counter current extraction system with nonpolar solvent
163. Which type of filtration equipment, especially with precoat is classically used for the removal of mycelial cell?  
 (A) Micro filtration  
 (B) Centrifugal filtration  
 (C) Ultra filtration  
 (D) Rotary vacuum filtration
164. BOD of distillery waste water (mg/l) is approximately  
 (A) 15,000-20,000  
 (B) 350  
 (C) 550  
 (D) 4000-7000
165. The dissolved oxygen concentration during the measurement of  $K_L a$  by sodium sulphite method is  
 (A) zero  
 (B) maximum  
 (C) 10 mg/ml  
 (D) minimum
166. In reactions with immobilized enzymes/whole cells, one generally measures  
 (A) True reaction rate  
 (B) Observed reaction rate  
 (C) Both true and observed reaction rates  
 (D) True reaction rate in the beginning and then observed reaction rate
167. Use of eutomer is always desirable for drug synthesis as it  
 (A) is more soluble in body fluids  
 (B) is less expensive compared to distomer  
 (C) has direct access to cell receptors  
 (D) slowly recognizes the drug target
168. Biogenerics or follow-on protein drugs are defined as any  
 (A) natural protein or nucleic acid drugs  
 (B) genetically engineered protein or nucleic acid drugs  
 (C) protein or nucleic acid or carbohydrate drugs  
 (D) active pharmaceutical ingredients (API)
169. Which statement is correct in the biotransformation of prochiral ketones to the desired enantiomeric alcohol?  
 (A) The enantiomeric excess should be maximum  
 (B) The conversion should be maximum  
 (C) Both the conversion and the enantiomeric excess should be maximum  
 (D) The conversion should be maximum with lowest enantiomeric excess
170. Which order of reaction it follows when one measures the activity of an enzyme using a standard protocol?  
 (A) Zero order reaction  
 (B) First order reaction  
 (C) Second order reaction  
 (D) Mixed order reaction
171. One cannot estimate the volumetric oxygen transfer coefficient ( $K_L a$ ) by dynamic gassing method if the organism is  
 (A) micro aerophilic  
 (B) obligate aerobe  
 (C) chemolithotrophic  
 (D) highly aerobic
172. Sterilization of oil using steam is a process involving  
 (A) wet heat  
 (B) moist heat  
 (C) dry heat  
 (D) both dry heat and wet heat
173. The byssus threads produced by the mussel, *Mytilus edulis*, is composed of  
 (A) A complex biopolymer made of polysaccharides resembling chitinaceous and gelatin like material with extensive substitution.

- (B) A bundle of water resistant threads made of cellulose containing substituted ester, ether and alkoxyl groups.
- (C) A mixture of different types of adhesive proteins with a high proportion of DOPA (3,4-dihydroxyphenyl-L-alanine).
- (D) A bundle of threads made of fucoidin that is water resistant
174. *Riftia pachyptila*, a vestimentiferan, present only near the hydrothermal vent systems obtain their primary nutrition
- (A) from the decomposing detritus on which the tubeworm grows
- (B) from the organic molecules synthesized by the chemosynthetic bacteria that oxidize hydrogen sulfide, using dissolved oxygen from water.
- (C) from the planktons that are ingested with the help of plume.
- (D) by trapping marine snow that descend from photic zone using plume.
175. The role of oceanic Dimethyl sulfide (DMS) emitted by phytoplankton in influencing earth's climate may be attributed to the fact that
- (A) DMS produces sulfate aerosols that act as cloud condensation nuclei which in turn reflect incoming solar radiation.
- (B) excessive DMS traps heat contributing partly to global warming.
- (C) DMS reacts with atmospheric CO<sub>2</sub> to form organosulfur compounds such as DMSO and sulpholane which has the characteristic smell of decaying organic matter (carbon sink).
- (D) The acidification of sea water due to production of sulfuric acid as a by-product due to oxidation of DMS in seawater acts as carbon sink.
176. The most abundant photopicoplankton that has the capability to grow in oligotrophic niches of oceans under low-light or high light conditions is
- (A) *Synechococcus* sp.
- (B) *Prochlorococcus* sp.
- (C) *Nodularia* sp.
- (D) *Oscillatoria* sp.
177. One of the following statements is false with regard to the DsRed and GFP.
- (A) GFP was isolated from *Aequorea* jelly fish whereas DsRed was isolated from *Dicosoma* coral.
- (B) DsRed has higher extinction coefficient and greater resistance to pH extremes in comparison to GFP.
- (C) Unlike DsRed, GFP forms oligomers *in vivo* leading to drop in fluorescence signal.
- (D) Both proteins have beta-can structure that confer stability to protein
178. Electro-mineral accretion is a process of
- (A) applying a low voltage current to a metallic structure in ocean leading to crystallization of limestone on which coral planulae can attach and grow.
- (B) *in vitro* method of isolating trace minerals from seawater by applying suitable potential difference across the electrodes.
- (C) Dissolution of minerals from sea bed rocks by applying high electrical current (instead of blast in deep sea that damages marine life) promoting easier drilling activity for oil extraction.
- (D) Depositing a layer of mineral on ocean floor for promoting spawning of some marine fishes.
179. The neurotoxin that is produced by marine diatoflagellates and is responsible for paralytic shell fish poisoning in humans by acting on voltage-gated sodium channels of nerve cell is
- (A) Shigatoxin
- (B) Saxitoxin
- (C) Amatoxin
- (D) Gliotoxin
180. The SAR11 clade is
- (A) A lineage of bacteria belonging to alpha-proteobacteria that is extremely common in ocean around the world.
- (B) A clade consisting of 11 sulfate assimilating *rhodobacter* species observed in deep sea environment.
- (C) A marine *Roseobacter* clade comprising several genera of marine bacteria
- (D) Name of a south Asian research vessel for conducting studies in Indian ocean.
181. Which of the following factors is not responsible for coral bleaching?
- (A) 1-2°C rise in ocean temperature for 5-6 weeks.
- (B) 3-5 °C decline in ocean temperature for 5-10 days.
- (C) Increase level of CO<sub>2</sub> in seawater.
- (D) Overgrazing by manta ray and snapper fish.
182. The true source of tetrodotoxin production reported in puffer fish, porcupine fish and polyclad flat worm is attributed to
- (A) Small cone snails attached to puffer fish.

- (B) Presence of *Microbulbifer elongatus* in digestive tract.
- (C) Presence of *Vibrio alginolyticus*.
- (D) *Stachybotrys chartarum* a known pathogen infecting above organisms.
183. Cameleons are
- (A) Coral reef associated fish that change colour depending on the color of corals.
- (B) Chimeric protein consisting of calmodulin and mutant GFP.
- (C) Fluorescent proteins isolated from *Demospongiae* that depict different color fluorescence depending on the presence of metal ions.
- (D) Deep sea spotted Rat fish which puffs up mimicking a puffer fish to ward off predators.
184. Scombrototoxic fish poisoning is due to
- (A) histamine and histamine-like products generated in fin-fishes due to contamination by members of *Enterobacteriaceae* family.
- (B) toxins produced by *Noctiluca* that resides commonly in fishes.
- (C) toxin generated by *Shigella flexneri*
- (D) toxin generated by *Clostridium botulinum*
185. Beta-glucan, a structural element in fungal cell walls has been used in fish aquaculture
- (A) as an immunostimulant
- (B) to stimulate natural bacterial flora for bioremediation of waste matter.
- (C) for inhibiting bacterial cell wall synthesis and thus preventing their growth.
- (D) as a biofloculant for precipitation of waste in aquaculture ponds.
186. “Crabyon” an anti-smell, non-allergic soft fibre used in sports- wear is a blend of
- (A) Crab shells and rayon.
- (B) Modified chitosans.
- (C) Crustacean shells and calcium.
- (D) Chitin and Cellulose
187. Giant bacteria are normally associated with sulphur compounds however the only species so far reported to store calcite in their cells is
- (A) *Thiomargarita* sp.
- (B) *Epulopiscium* sp.
- (C) *Achromatium* sp.
- (D) *Thioploca* sp.
188. Halocins isolated from halophilic archae can be exploited as
- (A) Sunscreen agent
- (B) Protein antibiotics
- (C) Enzyme stabilizers
- (D) Skin moisturisers.
189. A psychrophilic organism which confers pink color to snow and is referred as snow algae
- (A) *Ulva latuca*
- (B) *Polaromonas* sp.
- (C) *Chlamydomonas nivalis*
- (D) *Achromobacter* sp.
190. The model marine organism that is widely used in assay system for the detection of antifouling substance is
- (A) *Mytilus edulis*
- (B) *Crassostrea* sp.
- (C) *Peneaus monodon*.
- (D) *Sardinella longiceps*.
191. A novel group of archaea isolated from the hydrothermal vent and responsible for setting the upper temperature threshold for known life to 113°C is
- (A) *Thermus thermophilus*
- (B) *Pyrolobus fumarii*.
- (C) *Pyrococcus furiosus*
- (D) *Spirochaeta americana*
192. Which one of the following property is not associated with *Halomonas salaria*, a piezophile?
- (A) Require a pressure of 1000 atm.
- (B) Grows at temperature of 3°C.
- (C) They require complete darkness for growth.
- (D) They have an efficient DNA repair mechanism that function at high pressure.
193. Thraustochytrids
- (A) have been shown to contribute to red tide formation
- (B) have been recently isolated from deep sea hydrothermal vents and are a potential marine bacterial source of bioactive compounds
- (C) are a class of marine osmoheterotrophic protists
- (D) comprise of a newly identified group of filamentous algae known to uniquely produce polyunsaturated fatty acids.
194. The technique of estimation of chlorophyll in water bodies through remote sensing satellites uses electromagnetic radiations in the approximate wavelength range
- (A) 1 to 100 cm
- (B)  $10^{-5}$  to  $10^{-4}$  cm
- (C)  $10^{-9}$  to  $10^{-12}$  cm
- (D) 1 to 10 nm

195. The high concentration of myoglobin in marine mammals allows them to
- respire at a lower rate
  - remain underwater for longer periods of time
  - reduce the effects of osmotic pressure due to extra oxygen load in their body
  - with stand large changes in CO<sub>2</sub> concentration in muscle.
196. Which of the following mixture of organisms could be cultured to demonstrate integrated multi-trophic aquaculture for treatment of effluent rich in nitrogen and phosphorous?
- Phytoplankton-*Porphyra yezoensis*-*Pythium porphyrae*
  - Phytoplankton-shell fish (oyster and clams)-Marine fishes.
  - Gracilaria corticata*-star fish-clams.
  - Phytoplanktons-starfish-catfish.
197. Which of the following statements is false with regards to zooanthids.
- they feed by photosynthesis as well as by capturing planktons and particular matter from ocean.
  - Some of them produce palytoxin which is the most toxic organic compound in world.
  - Some zooanthids often grow on other invertebrates.
  - All zooanthids harbor phytoplankton *coccolithophore* for photosynthesis.
198. Carbon sequestration in ocean relates to
- technique of iron fertilization to encourage phytoplankton growth which would remove carbon from atmosphere over a period of time.
  - mechanism by which the carbon from bacteria and phytoplankton is recycled by lytic marine bacteriophage.
  - formation of marine snow that is transported from photic zone to deep sea by ocean upwelling.
  - study of the intricate food web chain in the marine ocean.
199. Which of the following statements is true regarding *Shigella* dysentery?
- Shigella* infection is an invasive disease
  - Shigella* bacterial invasion lead to dissemination of bacteria to different organs
  - Large number of bacteria is required to cause the disease
  - Infection with *Shigella bacilli* will always cause symptomatic infection
200. Which of the following conditions promotes tumour growth?
- increased expression of MHC
  - increased expression of Th2 cytokines
  - increased expression of co-stimulatory molecules
  - decreased expression of CTLA-4
201. Ciprofloxacin specifically cleaves
- nuclear DNA
  - apicoplast DNA
  - both nuclear and apicoplast DNA
  - mitochondrial DNA
202. The aggregating peptides/proteins in the diseased conditions contain extensive
- Alpha-helical segments
  - beta-sheet conformation
  - random structures
  - beta-helices
203. First successful vaccine against cancer has been prepared for
- Oral cancer
  - Cervical cancer
  - Breast cancer
  - Colon Cancer
204. Recently gene therapy for mutated gene has been experimentally proven in mouse utilizing
- Winged P elements
  - Cre-Lox system
  - Non-homologous recombination
  - Ac-Ds element
205. Leukemia inhibiting factor has been utilized in animal cell culture for
- Stimulating growth of cells
  - Differentiation
  - Mophogenesis
  - Arrest cells at mitosis
206. Which is least likely to occur for removal of cancer cells?
- T-cell based cytotoxicity
  - Complement fixation
  - Autophagy
  - Phagocytosis
207. The virus inserted in genome can be recognized by
- FISH
  - Northern blot
  - Microarray
  - Southern blot
208. Unsynchronized signals in EEG are generated during
- Deep Sleep
  - Active and non-quiete
  - Slow wave but quite sleep
  - REM sleep



209. The vector responsible for JEV is  
 (A) *Culex tritaeniorhynchus*  
 (B) *C. pusillus*  
 (C) *C. pipiens*  
 (D) *C. jenseni*
210. Which of the following types of necrosis is found in granulomatous lesions of pulmonary tuberculosis  
 (A) Coagulative  
 (B) Liquefactive  
 (C) Caseous  
 (D) Fat
211. The accumulation of pus in thoracic cavity is called as  
 (A) Hydrothorax  
 (B) Haemothorax  
 (C) Pyothorax  
 (D) Patchy thorax
212. In which of the following conditions testes do not descend and are retained in the abdominal cavity?  
 (A) Cryptorchidism  
 (B) Hypochondrism  
 (C) Orchitis  
 (D) Prostate cancer
213. Which of the following cells form multinucleated giant cells in chronic inflammations?  
 (A) Neutrophils  
 (B) Macrophages  
 (C) Eosinophils  
 (D) Lymphocytes
214. Which of the following is not true about Macrophages?  
 (A) Macrophages have longer lifespan than neutrophils.  
 (B) Macrophages at inflammatory sites are responsible for phagocytosis of cellular debris and help in keeping the tissue clean.  
 (C) Macrophages contain many lysosomes and have cytoplasmic extensions called "pseudopodia".  
 (D) Macrophages appear at the site of inflammation earlier than neutrophils.
215. Which of the following conditions do not have exudates?  
 (A) Pus  
 (B) Catarrhal inflammation  
 (C) Serous inflammation  
 (D) Granulomatous inflammation
216. Viral infections in the central nervous system are usually associated with  
 (A) Suppurative exudation  
 (B) Serous exudation  
 (C) Fibrinous exudation  
 (D) Lymphocytic exudation
217. Which of the following is not used as anti-coagulant?  
 (A) Trisodium citrate  
 (B) Tripotassium ethylenediamine tetraacetic acid  
 (C) Trisodium chloride  
 (D) Heparin
218. The anemia with increase in size of RBC with reduced haemoglobin concentration is termed as  
 (A) Microcytic hypochromic anemia  
 (B) Normocytic hypochromic anemia  
 (C) Microcytic normochromic anemia  
 (D) Piglet anemia
219. The highly pathogenic Avian Influenza in chickens is caused by  
 (A) Avian Paramyxovirus  
 (B) (B) Avian Morbillivirus  
 (C) Avian Orthomyxovirus  
 (D) (D) Avian Pestivirus
220. Hump sore in cattle is caused by  
 (A) Parafilaria bovicola  
 (B) Dirofilaria immitis  
 (C) Stephanofilaria assamensis  
 (D) Stephanurus dentatus
221. *Bunostomum trigonocephalum* is the hookworm of  
 (A) Cattle  
 (B) Dog  
 (C) Cat  
 (D) Sheep and goat
222. Dick test is used to detect susceptibility for  
 (A) Tetanus  
 (B) Diphtheria  
 (C) Sore throat  
 (D) Scarlet fever
223. Which artery is commonly involved in MI?  
 (A) Right coronary artery  
 (B) Anterior interventricular branch of left coronary artery  
 (C) Posterior interventricular branch of left coronary artery  
 (D) Circumventricular artery
224. Sub acute combined degeneration is a manifestation of  
 (A) Vitamin B12 deficiency  
 (B) Folic acid deficiency  
 (C) Iron deficiency Anemic  
 (D) Biotin deficiency

225. An egg cell in a plant has 12 chromosomes. In the seed of the same plant, cells of embryo and endosperm will show the following number of chromosomes, respectively  
 (A) 12 and 24  
 (B) 24 and 36  
 (C) 36 and 24  
 (D) 24 and 48
226. A human male (XY) carrying an allele for a trait on the X chromosome is  
 (A) hemizygous  
 (B) homozygous  
 (C) heterozygous  
 (D) monozygous
227. "Living fossils" are the  
 (A) organisms which have become fossilized in recent geological era.  
 (B) organisms that have become fossilized recently and all the structural proteins are not yet completely denatured.  
 (C) ancient organisms persisting to modern times without further morphological evolution.  
 (D) ancient organisms persisting to modern times with further morphological evolution.
228. In animal kingdom, the group amniota includes  
 (A) birds and reptiles  
 (B) birds and mammals  
 (C) reptiles and mammals  
 (D) reptiles, birds and mammals
229. A female rat homozygous for a recessive X-linked mutation is mated to a male with wild type phenotype. The phenotypes of the F1 progeny will be  
 (A) all wild type  
 (B) 50% mutant irrespective of sex  
 (C) all females wild type and all males mutant  
 (D) all males wild type and all females mutant
230. Red green colour blindness is X-linked in human. If a male is red green colour blind and both parents have normal colour vision, which of the male's grandparents is most likely to be red green colour blind?  
 (A) maternal grandmother  
 (B) maternal grandfather  
 (C) paternal grandmother  
 (D) paternal grandfather
231. If an individual was producing dicentric chromosome you would suspect  
 (A) a deletion  
 (B) a duplication  
 (C) an inversion  
 (D) a translocation
232. What is the difference between RefSeq and GenBank?  
 (A) RefSeq includes publicly available DNA sequences  
 (B) GenBank includes nonredundant curated data  
 (C) GenBank sequences are derived from RefSeq  
 (D) RefSeq sequences are derived from GenBank
233. Hemoglobin, myoglobin and globin v protein sequences will be stored in PIR-PSD database as a  
 (A) Sub-family  
 (B) Superfamily  
 (C) Group  
 (D) GenPept
234. The method of maximum parsimony is also known as  
 (A) Maximum evolution method  
 (B) Minimum evolution method  
 (C) Zero evolution method  
 (D) Moderate evolution method
235. The pI calculated from the sequence may differ from the experimentally determined value because  
 (A) pI is not accurately determined experimentally  
 (B) pKa of the amino acid side chains depend on the micro structural environment  
 (C) pI calculation from the sequence does not take the N and C termini into account  
 (D) pH is not known theoretically
236. Which of these sets of amino acids are not capable of forming hydrogen bonds through their side chains  
 (A) Val, Ile, Phe  
 (B) Trp, Tyr, His  
 (C) Ser, Thr, Asn  
 (D) Arg, Lys, Asp
237. Hydrogen bonds in anti parallel  $\beta$ -sheets  
 (A) occur in more number than van der Waals interactions  
 (B) are not present at Phe residues  
 (C) occur roughly perpendicular to the polypeptide chain direction  
 (D) are about five Angstroms in length
238. The hydrophobic moment is  
 (A) Zero for amphiphilic secondary structures  
 (B) Negative for amphiphilic secondary structures  
 (C) Positive for amphiphilic secondary structures  
 (D) Indeterminate for amphiphilic secondary structures

239. Generally ---- puckered sugar residues are found in A-DNA structures.
- C3'-Exo
  - C3'-Endo
  - O4'-Exo
  - C4'-Endo
240. Arrange the three residues, glycine, phenylalanine and proline, in the decreasing order of backbone flexibility
- Gly > Phe > Pro
  - Pro > Gly > Phe
  - Phe > Pro > Gly
  - It is not possible to comment
241. The number of different isomers of a pentose sugar (saccharide) are
- 4
  - 8
  - 16
  - 32
242. The term  $k$  in the following energy expression  $E = \frac{1}{2} k (b-b_0)^2$  represents
- van der Waals radius
  - Stretching constant for bond length variation
  - Torsional potential
  - Kinetic energy of an atom
243. Energy minimization can be employed as a technique for
- Studying receptor binding kinetics
  - Optimizing molecular geometry
  - Converting a straight chain of a polypeptide to its tertiary structure
  - Decreasing the size of a molecule
244. The term 'N50' in the area of genome assembly refers to
- The largest value of  $n$  for which 50% of the basepairs in the bin is in supercontigs with length  $n$  basepairs or longer
  - The smallest value of  $n$  for which 50% of the basepairs in the bin is in supercontigs with length  $n*10$  basepairs or longer
  - 50% of bases in the whole genome
  - 50% of correct bases in the whole genome
245. Methotrexate, an analogue of dihydrofolate, is an inhibitor of dihydrofolate reductase. Methotrexate would be expected to
- Decrease the  $V_m$  of the enzyme
  - Increase the  $K_m$  of the enzyme for the substrate
  - Decrease both the  $K_m$  and  $V_m$  of the enzyme
  - Increase the affinity of the enzyme for the substrate
246. Principal components analysis (PCA)
- Minimizes entropy to visualize the relationships among genes and proteins
  - Can be applied to test the hypothesis of gene expression data from microarrays
  - Can be performed by agglomerative or divisive strategies
  - Reduces highly dimensional data to show the relationships among genes or among samples
247. The biggest problem in predicting protein coding genes from genome sequencing algorithm is that
- The software is difficult to use
  - The false negative rate is high; many exons are missed
  - The false-positive rate is high; many exons are falsely assigned
  - The false-positive rate is low; many exons have unknown function.
248. Artificial intelligence technique is used to predict secondary structure of globular protein. Which of the following methods uses this technique to predict secondary structures of globular proteins?
- Chou and Fasman
  - GOR
  - PHD
  - Ab-initio
249. The bacterial genome of size 2MB is being sequenced with a read size of 650 bases and coverage of 99%. What is the minimum number of times random reads need to be generated?
- 8 x 2MB
  - 4 x 2MB
  - 2 x 2MB
  - 16 x 2MB
250. Large RNA molecules show greater backbone conformational variation than DNA double helices because of
- Presence of unusual modified bases
  - The occurrence of single stranded regions
  - The presence of ribose sugar
  - Presence of triplex regions

## Key to the MCQs for BET 2011

### Section A

- |         |         |         |
|---------|---------|---------|
| 1. (D)  | 22. (D) | 43. (B) |
| 2. (D)  | 23. (B) | 44. (B) |
| 3. (B)  | 24. (A) | 45. (B) |
| 4. (B)  | 25. (B) | 46. (D) |
| 5. (A)  | 26. (D) | 47. (D) |
| 6. (D)  | 27. (A) | 48. (B) |
| 7. (B)  | 28. (C) | 49. (B) |
| 8. (C)  | 29. (D) | 50. (B) |
| 9. (A)  | 30. (A) |         |
| 10. (A) | 31. (B) |         |
| 11. (B) | 32. (B) |         |
| 12. (B) | 33. (D) |         |
| 13. (D) | 34. (D) |         |
| 14. (C) | 35. (A) |         |
| 15. (A) | 36. (B) |         |
| 16. (A) | 37. (D) |         |
| 17. (A) | 38. (D) |         |
| 18. (C) | 39. (C) |         |
| 19. (C) | 40. (C) |         |
| 20. (C) | 41. (C) |         |
| 21. (C) | 42. (B) |         |

**Section B**

- |         |         |          |          |
|---------|---------|----------|----------|
| 51. (D) | 73. (D) | 95. (C)  | 117. (A) |
| 52. (A) | 74. (A) | 96. (C)  | 118. (C) |
| 53. (D) | 75. (A) | 97. (C)  | 119. (C) |
| 54. (C) | 76. (D) | 98. (B)  | 120. (C) |
| 55. (D) | 77. (B) | 99. (D)  | 121. (B) |
| 56. (D) | 78. (D) | 100. (C) | 122. (B) |
| 57. (D) | 79. (B) | 101. (C) | 123. (C) |
| 58. (D) | 80. (B) | 102. (C) | 124. (A) |
| 59. (A) | 81. (D) | 103. (D) | 125. (A) |
| 60. (B) | 82. (D) | 104. (B) | 126. (A) |
| 61. (D) | 83. (B) | 105. (A) | 127. (C) |
| 62. (B) | 84. (C) | 106. (B) | 128. (B) |
| 63. (A) | 85. (B) | 107. (C) | 129. (A) |
| 64. (A) | 86. (D) | 108. (D) | 130. (A) |
| 65. (A) | 87. (C) | 109. (A) | 131. (D) |
| 66. (A) | 88. (D) | 110. (B) | 132. (C) |
| 67. (C) | 89. (B) | 111. (A) | 133. (A) |
| 68. (C) | 90. (A) | 112. (A) | 134. (B) |
| 69. (C) | 91. (B) | 113. (C) | 135. (C) |
| 70. (C) | 92. (B) | 114. (B) | 136. (D) |
| 71. (A) | 93. (D) | 115. (D) | 137. (C) |
| 72. (A) | 94. (C) | 116. (C) | 138. (C) |

139. (B)            162. (D)            185. (A)            208. (B)  
140. (C)            163. (D)            186. (D)            209. (A)  
141. (C)            164. (A)            187. (C)            210. (C)  
142. (D)            165. (A)            188. (B)            211. (C)  
143. (B)            166. (B)            189. (C)            212. (A)  
144. (B)            167. (C)            190. (A)            213. (B)  
145. (B)            168. (B)            191. (B)            214. (D)  
146. (C)            169. (C)            192. (D)            215. (D)  
147. (C)            170. (A)            193. (C)            216. (D)  
148. (B)            171. (D)            194. (B)            217. (C)  
149. (C)            172. (C)            195. (B)            218. (A)  
150. (B)            173. (C)            196. (B)            219. (C)  
151. (B)            174. (B)            197. (D)            220. (C)  
152. (B)            175. (A)            198. (A)            221. (D)  
153. (B)            176. (B)            199. (A)            222. (D)  
154. (D)            177. (C)            200. (B)            223. (B)  
155. (B)            178. (B)            201. (B)            224. (A)  
156. (D)            179. (B)            202. (B)            225. (B)  
157. (B)            180. (A)            203. (B)            226. (A)  
158. (C)            181. (D)            204. (B)            227. (C)  
159. (A)            182. (C)            205. (B)            228. (C)  
160. (D)            183. (B)            206. (C)            229. (C)  
161. (B)            184. (A)            207. (A)            230. (B)

231. (D)            249. (A)  
232. (D)            250. (C)  
233. (B)  
234. (B)  
235. (B)  
236. (A)  
237. (C)  
238. (C)  
239. (B)  
240. (A)  
241. (B)  
242. (B)  
243. (B)  
244. (A)  
245. (B)  
246. (D)  
247. (C)  
248. (C)

The Biomimics



## Biotechnology Eligibility Test (BET) for DBT-JRF Award (2012-13)

Government of India, Ministry of Science & Technology,  
Department of Biotechnology, New Delhi  
(Coordinated by University of Pune)

April 15, 2012

Total Marks – 300 Duration 10.00 a.m. - 12.30 p.m.

- N.B.**
- 1) All questions in Section A are **compulsory**.
  - 2) Answer any 50 questions from Section B.
  - 3) In case more than 50 are attempted, first 50 will be considered.
  - 4) Each question carries 3 marks; for every wrong answer, one mark will be deducted.
  - 5) Write your seat no. strictly inside the space provided on the Answer sheet.
  - 6) Answers marked inside the question paper will not be evaluated.
  - 7) Please return the question paper along with the Answer sheet.

**Instructions for filling the Answer sheet:**

- 1) There is only one correct answer for each question and once a mark has been made the same cannot be altered.
- 2) All entries in the circle must be made by **BLACK ink Ball Point Pen** only. Do not try to alter the entry.
- 3) Oval should be darkened completely so that the numeral inside the oval is not visible.
- 4) Do not make any stray marks for rough work on the sheet.
- 5) Do not use marker, white fluid or any other device to hide the shading already done.
- 6) More than one entry of an answer will be considered wrong, and negative marking will be done as above.
- 7) Mark your answer as shown in the example.

### Section A

Examples For Entering Answers			
<b>Wrong Method</b>			
<del>A</del>	(B)	(C)	(D)
(A)	<del>B</del>	(C)	(D)
(A)	●	(C)	(D)
(A)	(B)	●	●
<b>Correct Method</b>			
●	(B)	(C)	(D)



## Section A

- The immunoglobulin fold is made up of
  - seven alpha-helical segments
  - a beta-barrel
  - a sandwich of two parallel beta sheets
  - a sandwich of two antiparallel beta sheets
- RNA is analyzed for the location of hairpin folds. Which of the following sequences could form a mini-hairpin?
  - AGGUUCCU
  - AAAAAAAAA
  - AGGUUUGGA
  - AGGUUAGG
- Increasing the concentration of which of the following would most effectively antagonize the inhibition of protein synthesis by puromycin?
  - ATP
  - eIF2.GTP
  - aminoacyl-tRNAs
  - peptidyl-tRNAs
- Enzymes catalyze reactions by
  - binding regulatory proteins
  - covalently modifying active-site residues
  - binding substrates with great affinity
  - selectively binding the transition state of a reaction with high affinity
- Which of the following is a common reaction used for the formation of phosphatidyl ethanolamine in bacteria?
  - decarboxylation of phosphatidyl serine
  - demethylation of phosphatidyl choline
  - reaction of ethanolamine with CDP-diacylglycerol
  - reaction of CDP-ethanolamine with CDP-diacylglycerol
- Holiday junction is observed during
  - Mitosis
  - Interphase
  - Recombination
  - DNA Repair
- In humans, XX males and XY Females are rare, such rare sexes are due to
  - Deletion of X chromosome
  - Deletion of Y chromosome
  - XY translocation
  - Duplication of X chromosomes
- Induction of  $\beta$ -galactosidase activity by IPTG is due to
  - Stimulation of lac repressor function
  - IPTG binding to lac operon & inducing transcription
  - IPTG binding to lac I gene product and inhibiting its activity
  - Inhibition of  $\beta$ -galactosidase degradation
- Which of the following enzymes doesn't require a primer?
  - RNA dependent DNA polymerase
  - DNA dependent DNA polymerase
  - DNA dependent RNA polymerase
  - Taq DNA polymerase
- Which one of the following antibiotics attaches to 50S ribosome and inhibits its peptidyl-transferase activity?
  - Penicillin
  - Chloramphenicol
  - Trimethoprim
  - Amphotericin
- DNA from a host sample can be amplified by a process known as the polymerase chain reaction (PCR). Which of the following is required for PCR?
  - Knowledge of the genetic sequence to be amplified
  - A single nucleotide primer
  - A universal probe to detect the amplified product
  - A heat-sensitive DNA polymerase enzyme
- Gluconeogenesis is not capable of making glucose from
  - adenine
  - lactate
  - Acetyl CoA
  - palmitate
- Glycosylation of proteins occurs in the
  - peroxisome
  - Mitochondrion
  - lysosome
  - endoplasmic reticulum
- The 20 different amino acids found in proteins are normally coded by
  - 59 codons
  - 60 codons
  - 61 codons
  - 63 codons
- How many microliters of 0.1 M solution of sodium chloride will make 10 ml of 5 mM sodium chloride?
  - 200
  - 100
  - 500
  - 10
- Which of the following is NOT found inside the eukaryotic nucleus?
  - Nucleolus
  - Cajal bodies
  - PML bodies
  - Centrosomes
- Haemolytic disease of the newborn due to Rhesus incompatibility depends upon the
  - mother possessing Rh antigens not present on the baby's red cells
  - transplacental passage of IgM anti-Rh antibodies
  - transplacental passage of IgG anti-Rh antibodies
  - production of cytotoxic antibodies in the baby

18. Hemoglobin shows sigmoidal curve for oxygen saturation. What is the shape of curve for myoglobin oxygen-binding ?  
 (A) Linear  
 (B) Hyperbolic  
 (C) Sigmoidal  
 (D) Bell shape
19. For transcription to occur in the lactose operon, an inducer must be present so that  
 (A) the repressor can bind to the operator  
 (B) the repressor does not bind to the operator  
 (C) the inducer can bind to the operator  
 (D) the inducer does not bind to the operator
20. Which of the following is not a feature of mutagenic action of 5-Bromo-deoxyuridine?  
 (A) It acts on growing cells  
 (B) It forms base pair with A in its rare form  
 (C) It induces transitions  
 (D) It affects only one strand of DNA
21. The action potential results from  
 (A) decrease in negative charge inside the nerve fibre  
 (B) increase in positive charge outside the nerve fibre  
 (C) opening of voltage-gated sodium channels  
 (D) activation of the sodium-potassium pump
22. A recombinant vaccine is available for which one of the following cancers?  
 (A) Adult T cell leukemia  
 (B) Colon carcinoma  
 (C) Glioblastoma  
 (D) Cervical carcinoma
23. A patch-clamp device is used to  
 (A) measure the strength of an electrochemical gradient  
 (B) study the properties of individual neurotransmitters  
 (C) infuse different kinds of ions into an axon  
 (D) study the properties of individual membrane channels
24. Which type of neurons among the following are predominantly lost in Alzheimer's disease?  
 (A) Cholinergic  
 (B) Serotonergic  
 (C) Noradrenergic  
 (D) Histaminergic
25. Circadian rhythm is regulated by the  
 (A) hypothalamus  
 (B) suprachiasmatic nucleus  
 (C) amygdala  
 (D) basal ganglia
26. Which one of the following is the natural host for pseudo-rabies virus?  
 (A) Dog  
 (B) Man  
 (C) Swine  
 (D) Horse
27. Which one of the following is the causative agent of fowl cholera?  
 (A) *V. cholera*  
 (B) *P. multocida*  
 (C) *E. coli*  
 (D) *S. Pullorum*
28. The wavelengths of light that penetrate the least into the ocean are  
 (A) red and violet  
 (B) red and yellow  
 (C) blue and brown  
 (D) green and blue
29. Zooplankton that spend only a portion of their lives as plankton are called  
 (A) holoplankton  
 (B) meroplankton  
 (C) benthoplankton  
 (D) hemiplankton
30. Most of the sand and mud dwelling benthic organisms are  
 (A) grazers  
 (B) producers  
 (C) detritus feeders  
 (D) predators
31. The oceanic depth that represents equilibrium between oxygen and carbon dioxide production is termed the \_\_\_\_\_ depth.  
 (A) equilibrium  
 (B) compensation  
 (C) decomposition  
 (D) anaerobic
32. Which of the following is not an adaptation of salt-water fish to the environment in which they live having a higher salinity than their bodies?  
 (A) They constantly drink seawater  
 (B) They excrete salt through their gills  
 (C) They produce a small amount of urine  
 (D) They store salt in their skin
33. C<sup>α</sup>-C<sup>α</sup> distance plot might be useful in  
 (A) Identifying secondary structures in proteins  
 (B) Identifying globular domains in a protein  
 (C) Identifying active sites in enzymes  
 (D) For docking of inhibitors on protein's surface
34. A coin is tossed three times, what is the probability that exactly one heads turns up  
 (A) 0.333  
 (B) 0.25  
 (C) 0.50  
 (D) 0.375
35. WebIn is a sequence submission tool provided by  
 (A) NCBI

- (B) EMBL  
(C) EBI  
(D) RCSB
36. National Center for Biotechnology Information (NCBI) was established on November 4, 1988 as a division of the  
(A) National Library of Medicine (NLM)  
(B) National Institutes of Health (NIH)  
(C) European Bioinformatics Institute  
(D) ExPASy
37. The parts of proteins having the highest flexibility are  
(A)  $\alpha$ -helices  
(B)  $\beta$ -sheets  
(C) peptide bonds  
(D) surface side chains
38. In a typical *E. coli* fermentation, the major barrier to the transport of oxygen from gas bubble to the cells in the broth is in the  
(A) gas film  
(B) liquid film  
(C) interphase between gas and liquid film  
(D) diffusion of oxygen at the cell surface
39. Identify the method from the following that is not used for  $K_La$  determination.  
(A) Pulse and shift method  
(B) dynamic method of gassing out  
(C) static method of gassing out  
(D) overall gas balancing method
40. In a chemostat operated at steady state following Monod growth kinetics, the inlet substrate feed concentration is doubled at time  $t=0$ , then in the new steady state concentration of biomass (X) and residual substrate (S) in a chemostat will be such that  
(A) S is higher, X does not change  
(B) X is higher, S does not change  
(C) Both X and S are higher  
(D) Both X and S remain the same
41. The film heat transfer coefficient (h) for cooling water flowing in the cooling tubes of a bioreactor will..... as the water flow rate is doubled  
(A) double  
(B) not change  
(C) decline  
(D) increase less than two fold
42. For water flowing in a circular pipe, the flow rate increased so that it goes from laminar to turbulent flow then the ratio of the velocity at the centre line to velocity near the wall will  
(A) increase  
(B) decrease  
(C) remain unchanged  
(D) be unpredictable
43. Liquid is being pumped using a centrifugal pump, if the outlet valve is suddenly closed then,  
(A) The outlet pipe would burst  
(B) The outlet pressure would increase  
(C) The pump would stop running  
(D) The outlet pressure would remain the same
44. When terminal velocity is reached, the net downward force due to gravity, on the object is  
(A) greater than the upward buoyancy force and drag force  
(B) lesser than the upward buoyancy force and drag force  
(C) not related directly to upward buoyancy force and drag force  
(D) exactly balanced by the upward buoyancy force and drag force
45. A chemostat is run with a feed rate of 1 litre/h when the volume of the reactor is also 1 litre. At steady state the doubling time of the cells in the chemostat is .....h  
(A)  $\ln 2$   
(B)  $\log 2$   
(C) one  
(D) two
46. Which one of the following promoters is not derived from *Agrobacterium*?  
(A) CaMV 35S  
(B) nos  
(C) ipt  
(D) virD
47. Which of the following is incorrect with respect to modification of Mendelian dihybrid ratio?  
(A) Complementary gene interaction : 9:7  
(B) Recessive epistasis: 9:3:4  
(C) Dominant epistasis: 12:3:1  
(D) Additive gene interaction: 10:6
48. An example of a co-dominant marker is  
(A) AFLP marker  
(B) ISSR marker  
(C) RAPD marker  
(D) SSR marker
49. A mapping method for identifying markers linked to trait of our interest in a natural population is  
(A) Linkage mapping  
(B) Association mapping  
(C) Transcriptome mapping  
(D) Physical mapping
50. The number of phenotypes in the F<sub>2</sub> of the dihybrid will be  
(A) 2  
(B) 3  
(C) 4  
(D) 8

## Section B

51. Suppressor tRNA mutations are those in which  
(A) Transcription of tRNA genes is suppressed  
(B) Translation from mRNA is suppressed due to absence of tRNA  
(C) Amino acid is incorporated in place of a stop codon due to mutation in anticodon region of tRNA  
(D) Charging of tRNA with cognate amino acids is suppressed due to mutation in amino acyl tRNA synthase enzyme
52. Which of the following media is best suited for the selective growth of *E. coli* with genotype: Str<sup>+</sup> his<sup>-</sup> leu<sup>-</sup> lys<sup>-</sup> ?  
(A) Minimal medium with thiamine, histidine, leucine and lysine  
(B) Luria Agar  
(C) Minimal medium with thiamine and streptomycin  
(D) Minimal medium with thiamine, histidine, leucine, lysine and streptomycin
53. Which of the following amino acids is coded by maximum number of codons ?  
(A) Leucine  
(B) Tryptophan  
(C) Valine  
(D) Alanine
54. In cell cycle, paternal and maternal chromosomes exhibit a “bouquet stage” during  
(A) Leptotene  
(B) Zygotene  
(C) Pachytene  
(D) Diplotene
55. Which of the following cytokines is secreted by both Th1 and Th2 type of cells ?  
(A) IL-2  
(B) IL-3  
(C) IL-4  
(D) IFN- $\gamma$
56. Processing of transfer RNA involves  
(A) cleavage of extra bases from both 3' and 5' ends  
(B) nucleotide sequence specific methylation of bases  
(C) addition of sequences CCA by a nucleotidyl transferase  
(D) addition of methylated guanosine at 5' end
57. Somatic mutation of Immunoglobulin gene accounts for  
(A) Allelic exclusion  
(B) Class switching from IgM to IgG  
(C) Affinity maturation  
(D) V(D)J recombination
58. Which of the following enzymes is NOT used in pyrosequencing?  
(A) DNA Polymerase  
(B) Pyrophosphatase  
(C) Luciferase  
(D) ATP sulfurylase
59. Which of the following statements is not true for HFr strains of *E. coli* ?  
(A) F factor is integrated in the genome  
(B) Chromosomal markers are transferred from donor to recipient  
(C) They act as donors in the cross  
(D) Progeny of the cross always becomes F<sup>+</sup>
60. Which of the following organisms contains a 11 bp specific DNA sequence that acts as self-recognition sequence in natural transformation ?  
(A) *Streptococcus pneumoniae*  
(B) *Bacillus subtilis*  
(C) *E. coli*  
(D) *Hemophilus influenzae*
61. The amino acid sequence of a novel membrane protein contains four immunoglobulin-like domains and six fibronectin-like repeats. This protein is most likely a  
(A) Hormone responsive ion channel  
(B) Cell adhesion molecule  
(C) G-protein  
(D) transcription factor
62. Which one of the following viruses is not transmitted by the fecal-oral route ?  
(A) Hepatitis A Virus  
(B) Hepatitis E Virus  
(C) Hepatitis D Virus  
(D) Enterovirus
63. The earliest marker of the B-cell lineage which first appears during maturation of the precursor B cells and remains throughout the life span of the B cell is  
(A) B7  
(B) CR1  
(C) Class II MHC

- (D) B220 (or CD45)
64. Which of the following repair mechanisms is absent in a cell arrested in cell cycle?  
 (A) Transcriptional coupled repair mechanism  
 (B) Excision repair mechanism  
 (C) DNA synthesis annealing repair mechanism  
 (D) Recombination repair mechanism
65. Intracellular transport in mammalian cells through vesicular fusion is regulated by which among the following GTPases ?  
 (A) Rho  
 (B) Ran  
 (C) Rab  
 (D) Ras
66. HSP70 chaperons are not present in which among the following organelles?  
 (A) Endoplasmic reticulum  
 (B) Golgi bodies  
 (C) Nucleus  
 (D) Mitochondria
67. Major gluconeogenesis occurs in  
 (A) Liver and kidney  
 (B) Liver and heart  
 (C) Liver and skeletal muscle  
 (D) Liver and adrenal gland
68. A change in which of the following genes is responsible for Fragile X syndrome?  
 (A) FMR1  
 (B) RELB  
 (C) FXR1  
 (D) FAD2
69. Molecular basis of Chediak-Higashi syndrome is  
 (A) mutation in a protein involved in regulation of intracellular trafficking  
 (B) due to deficiency of adenosine deaminase  
 (C) error in antigen processing  
 (D) reversal of anergy in self-reactive clones
70. Type III hypersensitivity is mediated by  
 (A) immune complex deposition  
 (B) antigen specific T cells  
 (C) complement cascade  
 (D) perforin and granzyme
71. Junctional diversity affects primarily the amino acid sequence in  
 (A) all CDR equally  
 (B) CDR1  
 (C) CDR2  
 (D) CDR3
72. A child stung by a bee experiences respiratory distress within minutes and lapses into unconsciousness. This reaction is probably mediated by  
 (A) IgE antibody  
 (B) IgG antibody  
 (C) sensitized T cells  
 (D) complement
73. Neutrophils are attracted to an infected area by  
 (A) IgM  
 (B) vascular permeability  
 (C) phagocytosis of IgE-coated bacteria  
 (D) aggregation of C4 and C2
74. In the immune response to a hapten-protein conjugate, in order to get anti-hapten antibodies it is essential that  
 (A) the hapten be recognized by helper T cells  
 (B) the protein be recognized by helper T cells  
 (C) the protein be recognized by B cells  
 (D) the hapten be recognized by suppressor T cells
75. Chromatin loops are formed by periodic attachment of the following onto the nuclear skeleton  
 (A) Histones  
 (B) MARs  
 (C) Promoters  
 (D) Introns
76. Telomeric DNA does not contain  
 (A) G-rich sequences  
 (B) Quadruplex  
 (C) T and D loops  
 (D) AT rich sequences
77. The ATP required for ligation during base excision repair is generated from  
 (A) NAD  
 (B) Poly (ADP-ribose)  
 (C) DNA  
 (D) AMP
78. The covalent modification of histones that is not known to play a role in regulation of gene expression is  
 (A) Poly (ADP-ribosylation)  
 (B) Acetylation  
 (C) Methylation  
 (D) glycosylation
79. Okazaki fragments are  
 (A) RNA primers for DNA synthesis

- (B) Short DNA fragments after nuclease digestion  
 (C) Newly synthesized DNA fragments  
 (D) Short stretches of DNA attached to RNA primers on lagging strand
80. The changes in the electrical potential of a neuron that constitute the action potential occur in the following order  
 (A) depolarization → resting potential → hyperpolarization → resting potential  
 (B) resting potential → depolarization → hyperpolarization → resting potential  
 (C) resting potential → hyperpolarization → resting potential → resting potential  
 (D) resting potential → hyperpolarization → resting potential → depolarization
81. Suppose you were to treat a normal mammalian cell with a substance that inhibits the Na-K ATPase, what would be the most immediate effect upon the cell?  
 (A) there would be no change at all  
 (B) the cell's osmotic balance would be disrupted and the cell would begin to swell  
 (C) the cell membrane potential would immediately drop to zero  
 (D) the cell would very quickly run out of ATP
82. In a population that is in equilibrium, the proportion of individuals showing the dominant trait at a given locus having two alleles is 84%. The frequency of the recessive allele in the population is  
 (A) 0.4  
 (B) 0.3  
 (C) 0.2  
 (D) 0.16
83. Developing T cells that react strongly with self-peptides bound to self-MHC molecules are  
 (A) eliminated in the thymus  
 (B) eliminated in the bone marrow  
 (C) suppressed in peripheral blood circulation  
 (D) allowed to function normally
84. Which of the following statements is correct?  
 (A) T lymphocytes are conditioned by the bone marrow  
 (B) B lymphocytes are conditioned by thymus  
 (C) B cells produce plasma and memory cells  
 (D) T cells do not produce cytokines
85. What is the force among the following that is primarily responsible for stabilizing the tertiary structure of globular proteins?  
 (A) disulfide bonding  
 (B) the hydrophobic effect  
 (C) hydrogen bonding  
 (D) ionic interactions
86. Which of the following sequences describes the passage of an action potential in the neuron?  
 (A) Axon, cell body, dendrite, synaptic cleft  
 (B) synaptic cleft, axon, dendrite, cell body  
 (C) dendrite, synaptic cleft, cell body, axon  
 (D) dendrite, cell body, axon, synaptic cleft
87. In the biological treatment of waste, bacteria such as species of Acinetobacter and Zoogloea are considered to play a key role in floc formation  
 (A) by the synthesis and secretion of polysaccharides  
 (B) since they are acid producers  
 (C) as they are slow-growing methanogens  
 (D) since they break down acetic acid into methane and CO<sub>2</sub>
88. During primary sedimentation and biological treatment of waste water, vast quantities of sludge are generated which are assessed by sludge volume index (SVI), defined as the volume occupied by 1 g of sludge after settling for 30 min in a 1L Imhoff cone which measures the  
 (A) sludge thickening  
 (B) sludge stabilization  
 (C) sludge dewatering  
 (D) rate of acid utilization
89. Some extremozymes are found to remain active and stable up to 140°C. The decreased flexibility and rigidity of the molecule is due to  
 (A) highly nonpolar core  
 (B) reduction in glycine content  
 (C) presence of unsaturated fatty acids  
 (D) ornithine content
90. Solid state fermentations (SSF's) involve solid substrates at low moisture levels or water activities where  
 (A) the water content is > 95%  
 (B) the water content is between 40-80%  
 (C) the water content is between 4-8%  
 (D) the water content is 10%
91. The common type of duplication generates a second copy of the gene  
 (A) in close proximity of the first copy  
 (B) in a distant location on a same chromosome  
 (C) on a different chromosome

- (D) in any chromosome at random probability
92. A silent substitution  
 (A) creates a premature stop codon, thus silencing expression of the gene  
 (B) substitutes one amino acid for a different amino acid with similar properties so it does not affect protein function  
 (C) changes only one DNA base in a codon without changing the amino acid sequence  
 (D) occurs outside the protein coding region in the 5'- or 3' untranslated region and thus does not affect protein function
93. Satellite DNAs are not typically found within which of the following parts of a chromosome?  
 (A) heterochromatin  
 (B) euchromatin  
 (C) telomeres  
 (D) centromeres
94. What is the sugar-sugar linkage among the following in the 5' cap on mRNA molecules?  
 (A) 5'-3'  
 (B) 3'-5'  
 (C) 3'-3'  
 (D) 5'-5'
95. Introduction of a non-sense mutation in a eukaryotic protein coding gene often leads to  
 (A) retention of mRNA in a nucleus so it is not translated  
 (B) increased degradation of the mRNA in the nucleus  
 (C) increased degradation of the mRNA in the cytoplasm  
 (D) decreased ribosome binding in the cytoplasm in mRNA due to its shorter size
96. What effect would 'N' mutation have on phage lambda infection?  
 (A) no effect, infection would proceed as normal to either lytic or lysogeny pathway  
 (B) lytic pathway blocked only lysogeny possible  
 (C) lysogeny pathway blocked only lytic pathway possible  
 (D) complete abolishment of infection, neither lytic nor lysogeny pathway is possible
97. The bacterial ftsZ gene is required for  
 (A) septum formation  
 (B) periseptal annulus formation and localization  
 (C) DNA replication  
 (D) transport of DNA
98. Two plasmids are of the same compatibility group if they  
 (A) can co-exist in the same bacterial cell  
 (B) cannot co-exist in the same bacterial cell  
 (C) carry the same antibiotic gene  
 (D) carry the same toxin gene
99. Replication defective retroviruses are most commonly generated by  
 (A) recombination and rearrangement of sequences  
 (B) mutation at critical sites in viral genes  
 (C) deletion of a segment of the viral genome  
 (D) Insertion of the sequences in the viral gene
100. Alu elements are  
 (A) SINES  
 (B) LINES  
 (C) retroposon  
 (D) DNA transposon
101. Telomeres consist of simple sequence repeats of  
 (A) CA rich strands that interact with protein  
 (B) GC rich strands that interact with protein  
 (C) CT rich strands that interact with protein  
 (D) TA rich strands that interact with protein
102. True activators of transcription are transcription factors that bind to  
 (A) other proteins to enhance transcription  
 (B) promoters  
 (C) enhancers  
 (D) promoters and enhancers
103. Position effect variegation describes  
 (A) phenotypically identical cells with different genetic elements  
 (B) phenotypically identical cells with similar genetic elements  
 (C) genetically identical cell with different phenotypes  
 (D) genetically identical cells with identical phenotype
104. The U2 snRNA basepairs with  
 (A) a sequence spanning the exon intron splicing site  
 (B) the 3' splice site of the intron  
 (C) a sequence spanning the intron exon splicing site  
 (D) the branched sequence in the intron
105. Isoelectric point of lysozyme is 9.2. When the enzyme solution at this pH in water was titrated with HCl to give a pH of 5, it was observed that six ionized glutamic acid side chains got

- protonated. The net charge on the enzyme at pH 6 would therefore be
- (A) +5  
(B) +6  
(C) -5  
(D) -6
106. KCN is considered to be one of the potent poisons. You are doing an animal (mouse) experiment to test a new KCN sample synthesized by a chemist. The experiment is intravenous injection of KCN and checking the death of mouse. The sample was tested by many researchers and found to be pure and as potent as it should be. Although your experimental procedures were correct you failed to obtain desired results due to which one of the following.
- (A) KCN resistant mice were used  
(B) Dose of KCN is much below the LD50 dose needed to kill the mice  
(C) KCN is being degraded in mice  
(D) KCN is immediately filtered by kidney.
107. 6M Guanidium hydrochloride is known to denature a number of proteins. Such a high concentration is able to break down the noncovalent forces sustaining the structure of proteins by affecting
- (A) Electrostatic interactions only  
(B) Electrostatic and hydrophobic interactions  
(C) Intrapeptide hydrogen bonding only  
(D) Electrostatic, hydrophobic, and hydrogen bonding interactions.
108. Which of the following amino acids is critical in the folding of proteins due to the slow isomerization of the peptide bond preceding this amino acid depending upon the solvent environment?
- (A) Tryptophan  
(B) Leucine  
(C) Proline  
(D) Histidine
109. In peptides the values of dihedral angle  $\phi$  is based on rotation around
- (A) N-C $\alpha$  bond  
(B) C $\alpha$ -C' bond  
(C) C'-N bond  
(D) N-H bond
110. A ribonuclease stock solution at pH 3.0 in 10 mM glycine-HCl buffer is diluted 20 fold with the buffer and resulting absorbance of solution is taken in a quartz cuvette of path length 1 cm was 0.38 at its wavelength maximum. If the extinction coefficient of the protein is 0.74 ml/mg.cm, the concentration of the stock protein solution would be
- (A) 5 mg/ml  
(B) 10 mg/ml  
(C) 20 mg/ml  
(D) 50 mg/ml
111. Which of the following techniques cannot be used to determine the molecular weight of a protein?
- (A) UV absorption  
(B) Viscosity  
(C) Light scattering  
(D) Sedimentation equilibrium
112.  $\beta$ -lactoglobulin which is a monomer at neutral pH is known to tetramerise at acidic pH of 2. Which one of the following techniques could be effectively employed to demonstrate the formation of a tetramer ?
- (A) Native gel electrophoresis  
(B) Anion exchange chromatography  
(C) SDS-polyacrylamide gel electrophoresis  
(D) Reverse phase chromatography
113. If two heterozygous individuals suffering from an autosomal dominant disorder marry, what is the occurrence risk for this disorder in their offspring ?
- (A) 100%  
(B) 75%  
(C) 50%  
(D) 25%
114. A man who is affected with hemophilia A marries a woman who is a carrier of this disorder. What proportion among the following of this couple's daughters will be affected and what proportion of the daughters will be carriers ?
- (A) 0.75; 0.25  
(B) 0.25; 0.75  
(C) 0 ; 1  
(D) 0.5 ; 0.5
115. Which one of the following is an incorrect association?
- (A) Lysosome : synthesizes molecules for extracellular protein degradation  
(B) Mitochondria : cellular respiration  
(C) Endoplasmic reticulum: synthesizes proteins and sends them into Golgi- apparatus  
(D) Polysomes : make large quantities of a particular protein



116. Which of the following statements about heritability ( $H^2$ ) is true?
- It is a measure of level of gene linkage
  - It is a measure of inbreeding
  - It is a measure of heterozygotes in a population
  - It is a measure of the proportion of variation which is contributed by genetic factors.
117. A threshold trait is one which is
- expressed on a continuous scale
  - present in a few discrete classes but is influenced by environmental factors
  - caused by only a single gene, with no environmental influence
  - associated with superior survival of the heterozygote
118. Which of the following describes a type of polymorphism that occurs within the gene that causes Huntington's disease?
- short tandem repeat polymorphism
  - balanced polymorphism
  - restriction fragment length polymorphism
  - frameshift mutation
119. 5-Bromouracil induces mutations because it
- replaces a T and binds to G rather than A
  - replaces a G and binds to A rather than C
  - changes the binding affinity of G
  - changes the binding affinity of T
120. A homeotic mutation is one which
- is present only in one form in an individual
  - results in developmental block of any tissue-specific gene expression
  - substitutes one body part for another during development
  - results from transposon mediated mutagenesis
121. Cystic fibrosis is a recessive condition that affects about 1 in 2,500 babies in the Caucasian population. The frequency of heterozygotes or carriers of cystic fibrosis is
- 1 in 12500
  - 1 in 25
  - 1 in 625
  - 1 in 125
122. Which of the following would cause deviation from the Hardy-Weinberg equilibrium?
- small population size
  - random mating
  - lack of selection pressure
  - no mutation
123. A woman who is a heterozygous carrier of an X-linked recessive disease gene mates with a phenotypically normal male. The disease gene has a penetrance of 80%. On an average what proportion among the following of this couple's sons will be affected with the disorder?
- 0.8
  - 0.4
  - 0.2
  - 0.5
124. In a certain tribal population of India, the prevalence of sickle cell disease, an autosomal recessive condition is 1/100. Based on this value, what proportion of the population would be heterozygous carriers of the sickle cell disease gene in that tribal population?
- 18%
  - 10%
  - 75%
  - 25%
125. Cell division cycle is divided into 4 phases G<sub>1</sub>, S, G<sub>2</sub> and M. Standard eukaryotic cell cycles are of 12 h or longer duration. Early embryonic cell cycles are extremely rapid having time duration of less than an hour. Which of the following phases are drastically reduced in embryonic cell cycles?
- G<sub>1</sub> & G<sub>2</sub>
  - G<sub>1</sub> & S
  - M & S
  - G<sub>2</sub> & M
126. Ballast water is a serious issue due to possibility of
- introduction of polluted water from one site to another site
  - introduction of marine alien invasive species
  - release of water from the ship leading to severe upwelling, causing disturbances in ocean currents
  - several ships anchored near the harbors causing transient localized depletion of water due to uptake of seawater after offloading cargo
127. White spot syndrome virus (WSSV) is a major shrimp viral pathogen. Among the WSSV structural proteins, VP28 protein located in the viral envelop plays a major role in invasion of WSSV into shrimp. What would be the ideal strategy for protection against the WSSV infection based on the above information?

- (A) Adding streptomycin or its analogues that would interfere with the production of VP28 envelop protein
- (B) Creating a transgenic shrimp that would produce an alkaline protease that in turn would degrade the tail of WSSV virus
- (C) Supplementing shrimp feed with glucan encapsulating VP28-siRNA
- (D) Introducing *Lima lima* bivalves (filter feeders) which would selectively eliminate the WSSV due to affinity of mantle protein to VP28
128. When numbers of organisms and amounts of living material in successively higher trophic levels are compared, the values usually take the form of a pyramid, with the largest numbers and greatest biomass in the producer trophic level. However, in some marine ecosystems, the consumer trophic levels contain significantly greater amounts of living material than does the primary-producer trophic level. Which of the following is the best explanation for this?
- (A) The main primary producers in marine ecosystems are microscopic algae with extremely high rates of population turnover
- (B) Most consumers in marine ecosystems are filter feeders that must maintain large Basket-like structures for extracting food from the water
- (C) The increased availability of solar radiation in marine ecosystems means that fewer primary producers are required to support marine food chains
- (D) The largest consumers in marine ecosystems, the baleen whales, are essentially filter feeders
129. Microbial rhodopsins are a widespread family of photoactive proteins. Archaeobacteria belonging to Halobacteria predominantly contain
- (A) bacteriorhodopsin only
- (B) halorhodopsin only
- (C) sensory rhodopsin only
- (D) bacteriorhodopsin, halorhodopsin and sensory rhodopsin
130. The Marshall hydrothermal recovery system is a patented proposal
- (A) to exploit hydrothermal vents for their energy and minerals using dynamically positioned ship or platform position over vent and harnessing the mineral using conventional pipeline
- (B) to repopulate the dead hydrothermal vents with marine organisms that would scavenge the decaying matter
- (C) to recover and exploit the shrimps for mariculture
- (D) with a technology to convert white smokers (low temperature plumes) to black smokers
131. Shellfish poisoning resulting in permanent short-term memory loss, brain damage and death in severe cases in humans is due to intake of
- (A) the marine biotoxin called domoic acid produced naturally by marine diatoms and which bioaccumulates in shellfish
- (B) the marine toxin Okadaic acid that is produced by marine sponge and is accumulated in bivalves
- (C) shellfish contaminated by brevetoxins or brevetoxin analogs that are produced by dinoflagellates
- (D) Saxitoxin produced by harmful algal blooms and accumulated in some shellfish
132. The most resistant population of mangroves which normally grow in high salinities inhabit the
- (A) *Ceriops* zone
- (B) *Bruguiera* zone
- (C) *Rhizophora* zone
- (D) woodland
133. Chitosan, a deacetylated form of chitin (a natural carbohydrate polymer in crab, lobster and shrimps) is used in medicine
- (A) as a fungicide
- (B) in plastic surgery to arrest bleeding
- (C) to remove heavy metals from the skin
- (D) as an antiseptic cream
134. A Slocum Glider, also referred to as an Autonomous Underwater Vehicle (AUV) is used at varying depths in marine waters
- (A) to monitor microbial films
- (B) to detect harmful algal blooms
- (C) for marine biodiversity analysis
- (D) to study the primary productivity
135. A marine bryozoan, normally causing a problem as a biofouler on boats, harbors a bacterium that has shown promise in cancer treatment as well as a memory enhancer for patients with Alzheimer's. Choose the correct answer from the following.
- (A) *Bugula neritina*
- (B) *Bugula dentate*
- (C) *Cephalosporium acremonium*

- (D) *Ectoprocta* sp.
136. Which of the following regions typically has the highest primary productivity per unit surface area of the ocean?
- zones of upwelling
  - coastal water
  - the centres of ocean gyres
  - tropical waters
137. Biofilms interrupt the flow of ions and water to and from the substrate surface by acting as a diffusion barrier. The reduction of localised oxygen can accelerate the corrosion of a metallic substrate and is called microbially induced corrosion (MIC). An example of MIC is
- sulphides from SRB which cause the pitting of steel surfaces
  - remains of old barnacle exoskeletons
  - electrostatic interactions and Van der Waal's forces
  - crosslinks using cysteine residues
138. Antifouling systems that do not use heavy metals are called foul release coatings (FRC). The most effective FRC presently used in the marine environment is
- tributyltin (TBT)
  - biocides such as lead, arsenic, mercury
  - fluoropolymer and silicone based polymer coatings
  - spray coatings
139. *Porites* from Scleractinian (stony) corals have been found to be biocompatible and hence used in human systems
- as structural requirements for bone substitute in cranial surgery
  - as a muscle substitute in heart surgery
  - in the manufacture of biodegradable sutures
  - in corneal transplants
140. The first marine derived anti-cancer drug, "Cytosar- U" used for the treatment of leukemia and lymphoma was isolated from
- Southeast Asian corals
  - a Caribbean sea sponge
  - Indian sea hare
  - Australian waters
141. In a pairwise alignment, an optimal alignment is one that
- either minimizes the implied number of evolutionary changes or minimizes a particular scoring function
  - either maximizes the implied number of evolutionary changes or minimizes a particular scoring function
  - either minimizes the implied number of evolutionary changes or maximizes a particular scoring function
  - either maximizes the implied number of evolutionary changes or maximizes a particular scoring function
142. FASTA was the first database search program that
- is much faster than Smith-Waterman
  - is much slower than Smith-Waterman
  - sensitivity and speed of the database search with FASTA are directly related
  - calculates similarity index
143. RMSD between the coordinates of the amino acid gly and its mirror image after superposition will be
- 0.0 Angstrom
  - More than 1.5 Angstrom
  - More than 3.5 Angstrom
  - More than 6.0 Angstrom
144. The radius of the following helix types in proteins follows the order
- pi helix>alpha helix>310 helix
  - 310 helix>alpha helix>pi helix
  - 310 helix>pi helix>alpha helix
  - alpha helix> 310 helix> pi helix
145. Needleman-Wunsch algorithm, is an example of dynamic programming, which does not involve
- scoring a matrix
  - setting up a matrix
  - local alignment
  - identifying the optimal alignment
146. RCSB is
- An Information Portal to Protein database
  - An Information Portal to DNA database
  - An Information Portal to Biological Macromolecular Structures
  - An Information Portal to microarray
147. To identify the presence of repeats in a protein, the simplest and fastest way is to perform a
- self dot-plot
  - dot-plot with another protein with same repeats
  - dot-plot with another protein with any repeat
  - BLAST search

148. The double-helical Watson-Crick structure of DNA was first obtained from
- Fiber diffraction only
  - Fiber diffraction and molecular modeling
  - X-ray diffraction from single crystals
  - Diffraction from single crystals and molecular modeling
149. Molecular dynamics differs from molecular mechanics by taking into account
- the velocities of the constituent particles
  - the effect of the solvent medium
  - the non-bonded interactions
  - the periodic boundary condition
150. Which of the following amino acid sequences belong to collagen fibers?
- Gly-Ala-Gly-Thr-Gly-Ala-Gly-Thr-Gly-Ala-Gly-Thr-
  - Gly-Ala-Glu-Ser-Leu-Gly-Ala-Glu-Ser-Leu-Gly-Ala-
  - Gly-Ala-Pro-Gly-Pro-Pro-Gly-Thr-Pro-Gly-Ala-Pro-
  - Gly-Ala-Glu-Ser-Leu-Gly-Asn-Gly-Ala-Gly-Ala-Glu-Ser-Leu-Gly-Asn-
151. The secondary structural elements in a protein domain are in the sequence beta-beta-beta-alpha-beta-beta-beta-alpha-alpha. It will be classified as
- alpha+beta protein
  - alpha/beta protein
  - mostly beta protein
  - membrane protein
152. The major and minor grooves of B-form DNA correspond to the following feature of A-form RNA
- minor and major grooves
  - major and minor grooves
  - deep and shallow grooves
  - wide and shallow grooves
153. Which is the amino acid among the following that can occupy positions in the Ramachandran map that are disallowed for other 19 amino acids, but allowed for D-amino acids?
- Ala
  - Gly
  - Pro
  - Cys
154. If side chains of amino acids interact with each other, which of the following would be termed as a salt bridge?
- Tyr- Phe
  - Cys- Cys
  - Lys- Glu
  - Ala- Val
155. Fifth order Markov model assumes that probability of occurrence of an element depends on
- Previous five positions
  - Previous four positions
  - Following four positions
  - Following five positions
156. In a batch cultivation, during logarithmic growth phase, specific growth rate of culture virtually remains constant primarily because
- medium composition is fixed
  - substrate concentration is decreasing gradually
  - The  $K_s$  value is much smaller than  $S_0$  (initial substrate concentration)
  - specific nutrient uptake rate is constant
157. The continuous High Temperature Short Time sterilization processes help in maintaining media quality primarily because of
- short holding time and continuous nature of the process
  - high temperature of operation of the process combined with flash cooling
  - higher value of  $\Delta E$  for thermal inactivation of spores compared to the  $\Delta E$  for media deactivation
  - High pressure obtained in these processes killing the spores more effectively
158. Identify the parameter among the following used for scale up of a shear sensitive cells in a fermentation process
- $K_L a$
  - Power per unit volume
  - Impeller tip speed
  - Air flow rate in vvm
159. Sterilization of air by absolute filtration mechanism is primarily based on
- Impaction
  - Electrostatic interaction
  - Diffusion
  - Size exclusion
160. In turbulent regime, power number is .....the Impeller Reynolds number
- directly proportional to
  - directly proportional to the square of
  - independent of
  - non linearly related to

161. When the carbon source used is changed from glucose to methanol in a bioprocess, you would definitely expect higher
- biomass yield
  - specific heat production
  - specific growth rate
  - product yield
162. Triglycerides are accumulated by several algal species, if
- nitrogen source is limited
  - carbon source is limited
  - oxygen is limited
  - temperature is lowered below the optimal range
163. *Acetobacter aceti* produced 7.5 g/l  $\text{CH}_3\text{COOH}$  from a medium containing initial 10 g/l  $\text{C}_2\text{H}_5\text{OH}$  when the residual  $\text{C}_2\text{H}_5\text{OH}$  concentration is 2 g/l. What will be the overall yield of  $\text{CH}_3\text{COOH}$  from  $\text{C}_2\text{H}_5\text{OH}$  compared to the theoretical yield?
- 70% of the theoretical yield
  - 72% of the theoretical yield
  - 84% of the theoretical yield
  - 94% of the theoretical yield
164. Exponential phase is between acceleration and deceleration phase of growth. The value of  $\mu$  in both the phases except the exponential phase is
- $\mu = \mu_{\text{max}}$
  - $\mu > \mu_{\text{max}}$
  - $\mu < \mu_{\text{max}}$
  - $\mu \geq \mu_{\text{max}}$
165. Cooling water enters at 20° C in a counter current heat exchanger and leaves at 40° C while hot water enters from the other side at 70° C and leaves at 50° C The LMTD for this process will be.....(for calculating temperature difference in the equation  $Q = UA \Delta T$ ).
- indeterminate
  - 20° C
  - 30° C
  - 50° C
166. Out of various derivatives of rifamycin groups of antibiotics, which one is biologically inactive
- Rifamycin SV
  - Rifamide
  - Rifamycin B
  - Rifamycins
167. In a fed batch process with concentrated constant feed and high maintenance coefficient of the cells, growth of the cells will
- show linear increase
  - taper off asymptotically
  - not increase
  - increase exponentially
168. Which of the following organisms typically get their carbon for biosynthesis from carbon dioxide
- Glucose fermenting bacteria
  - Anaerobic glucose respiring bacteria
  - Aerobic glucose respiring bacteria
  - Ammonia oxidizing bacteria
169. In centrifugation, if the angular speed is constant, the time required for pelleting cells in a rotor of larger size
- will be longer
  - will be shorter
  - will remain unchanged
  - will not depend on angular speed or size
170. Dynamic kinetic resolution yields a maximum of
- 50% conversion
  - 100% conversion
  - 75% conversion
  - 25% conversion
171. Which of the following groups of enzymes is not used for the kinetic resolution of racemates?
- Lipases
  - Nitrases
  - Oxidoreductases
  - Epoxide hydrolases
172. In drug development, "Racemic switch" is introduced for the synthesis of
- Meso compounds
  - Racemic mixture
  - Eutomer
  - Distomer
173. Which of the following pairs of amino acids is responsible for feed-back inhibition of lysine biosynthesis in *Corynebacteria*?
- Lysine and methionine
  - Lysine and leucine
  - Lysine and threonine
  - Lysine and isoleucine
174. Which of the metal ions series is crucial in citric acid biosynthesis ?
- Fe, Zn and Mn
  - Fe, Cu and Zn
  - Cu, Co and Mn
  - Zn, Cu and Fe

175. In breakthrough curve for batch adsorption, steeper the curve \_\_\_\_\_ is the adsorbent  
 (A) more specific  
 (B) less specific  
 (C) more porous  
 (D) less porous
176. A 1.5 ml of a bacterial culture consisting of  $10^8$ /ml is used to inoculate 100 ml of medium where the cells reach a density of  $5 \times 10^7$  cells/ml. How many generations did the cells go through approximately?  
 (A) 1  
 (B) 5  
 (C) 10  
 (D) 15
177. Which of the following traits is most critical for a microorganism used in an industrial bioprocesses producing ethanol?  
 (A) High specific productivity  
 (B) High product yield  
 (C) High substrate consumption rate  
 (D) High specific growth rate
178. The degree for reduction of biomass  $CH_{1.8} N_{0.2} O_{0.5}$  growing on glucose and ammonia is  
 (A) 6.2  
 (B) 5.2  
 (C) 4.2  
 (D) 3.2
179. The best example of product formation kinetics following Leudeking-Piret model is  
 (A) Alcohol production  
 (B) Antibiotics production  
 (C) Lactic acid production  
 (D) Recombinant protein production
180. The addition of silicone antifoam to a production fermenter has the disadvantage of  
 (A) reducing  $K_L a$   
 (B) producing undesirable byproducts  
 (C) increasing gas hold up  
 (D) makes PID control of DO difficult
181. In a two-step fermentation process to produce vinegar, starting from molasses, the metabolic product produced as an intermediate is  
 (A) acetaldehyde  
 (B) ethyl alcohol  
 (C) citric acid  
 (D) pyruvate
182. For Monod equation with substrate inhibition given by  $\mu = \mu_m S / (K_s + S + S^2 / K_i)$ , there are two theoretically possible steady state solutions in a CSTR. Out of these  
 (A) both are stable steady states  
 (B) the lower substrate concentration represents the stable steady state  
 (C) the higher substrate concentration represents the stable steady state  
 (D) both are unstable
183. The substrate concentration used in Monod kinetics is the  
 (A) carbon source  
 (B) limiting nutrient  
 (C) nutrient in excess  
 (D) nitrogen source
184. For high cell density cultivation of recombinant *E. coli* using fed batch techniques to maintain a constant specific growth rate, the feed of concentrated substrate is  
 (A) kept at a constant value  
 (B) increased linearly  
 (C) increased exponentially  
 (D) controlled by feed back based on temperature
185. In depth filtration, the material widely used is..... fiber  
 (A) polypropylene  
 (B) polytetrafluoroethylene (PTFE)  
 (C) glass wool  
 (D) absorbent cotton
186. In a fermenter without cooling coils and a single agitator if the height to diameter ratio is decreased,  
 (A) area of heat transfer is decreased  
 (B) residence time of the bubble is increased  
 (C) agitator power consumption increased  
 (D) Both (a) and (c)
187. The product concentration in an enzyme catalyzed reaction increases linearly with time. From this we can conclude that the  
 (A) enzyme is deactivating  
 (B) reaction is product inhibited  
 (C)  $K_m$  values are very high  
 (D) reaction is zero order
188. Generic drugs are introduced in the market as generic versions because they are  
 (A) Low cost  
 (B) easy to manufacture  
 (C) less toxic  
 (D) more active

189. In an aerated bioreactor, the major increase in the oxygen transfer rate, when the stirrer speed is increased is because
- increasing shear decreases the bubble size
  - size of the boundary layer surrounding a bubble is decreased
  - gas side mass transfer coefficient is increased
  - cells come in close contact with the bubble
190. Which of the following penicillins in current use represents an unmodified naturally occurring product?
- Ampicillin
  - Penicillin G
  - Methicillin
  - Amoxicillin
191. A type of apomixis in which embryo sac develops from vegetative cells of the ovule is called
- Apospory
  - Apogamy
  - Diplospory
  - Polyembryony
192. Banana bunchy top disease is transmitted by
- Ferrisia virgata*
  - Aphis gossypii*
  - Pentalonia nigronervosa*
  - Thrips tabaci*
193. The first product of photosynthesis in C<sub>3</sub> plants is
- Glycerate 3 phosphate
  - Malate
  - Glycerate
  - Phospho-enol pyruvate
194. Which one of the following requires back crossing?
- generation of Recombinant Inbred Lines (RILs)
  - generation of Doubled Haploids (DH)
  - generation of F<sub>2</sub>s
  - generation of Near isogenic Lines (NILs)
195. nptII gene imparts resistance to
- Ampicillin
  - Hygromycin
  - Kanamycin
  - Chloramphenicol
196. Agrobacterium mediated transformation of monocots requires the use of \_\_\_\_\_ for the induction of vir genes.
- Agarose
  - Acetophenone
  - Acetosyringone
  - Cefotaxime
197. Which of the following techniques is used to obtain hybrids between two species with pre-fertilization barrier?
- Embryo rescue
  - Protoplast fusion
  - Ovary culture
  - Embryo implantation
198. Which of the following is used most commonly in the plant tissue culture medium to induce multiple shoots?
- Benzylaminopurine
  - Naphthalene Acetic acid
  - 2,4-Dichlorophenoxy acetic acid
  - Indole butyric acid
199. The chemical nature of GA<sub>3</sub> is
- Phenolic
  - Terpene
  - Purine
  - Indole
200. Rice grains are deficient in
- Lysine
  - Glycine
  - Isoleucine
  - Alanine
201. Lysimeter is used in the measurement of
- Light
  - Transpiration
  - Lysine content
  - Water potential
202. Aerenchyma formation is related to which of the following hormones?
- ABA
  - Ethylene
  - Cytokinin
  - Auxin
203. Barnase has-----activity
- Dnase
  - RNase
  - Protease
  - Restriction
204. \_\_\_\_\_ is used as a bacteriostat in the Agrobacterium mediated plant transformation experiments
- Kanamycin
  - Hygromycin

- (C) Cefotaxime  
(D) Ampicillin
205. Variation in clonally reproducing crop arises from  
(A) Genetic recombination  
(B) Chromosomal segregation  
(C) Alternative splicing  
(D) Mutation
206. In the incomplete dominance of a monohybrid, the number of phenotypes in the F<sub>2</sub> will be  
(A) 1  
(B) 2  
(C) 3  
(D) 4
207. Seeds germinating in dark beneath the surface of the soil undergo  
(A) Skotomorphogenesis  
(B) Photomorphogenesis  
(C) Embryogenesis  
(D) Dessication
208. The substrate for photorespiration is  
(A) Glycine  
(B) Phospho Glycolic Acid  
(C) Glycolic acid  
(D) Phospho-glyceric acid
209. Mating between individuals which are closely related by ancestry is called  
(A) Genetic assortative mating  
(B) Genetic disassortative mating  
(C) Random mating  
(D) Poly cross
210. Engineering plants using chitinase gene leads to development of  
(A) Viral resistance  
(B) Fungal resistance  
(C) Bacterial resistance  
(D) Cold tolerance
211. The first GM potato developed at CPRI, India for increasing protein content in tubers consists of genes from  
(A) Chick pea  
(B) Pigeon pea  
(C) Cabbage  
(D) Amaranthus
212. Hybridization between species followed by polyploidy is known as  
(A) Autopolyploid  
(B) Allopolyploid
- (C) Aneuploid  
(D) Species differentiation
213. Source of dwarfing genes in wheat is  
(A) Ganga 101  
(B) Norin 10  
(C) Dee-geo-woo-gen  
(D) Sonalika
214. Form of IPR that helped India win Basmati case is  
(A) Novelty  
(B) Trade mark  
(C) Geographical indication  
(D) Industrial design
215. The probable Geographic Origin of the following crops is called: Wheat and barley, flax, lentils, chickpea, figs, dates, grapes, olives, lettuce, onions, cabbage, carrots, cucumbers, melons and fruits and nuts  
(A) South America  
(B) Mesoamerica and North America  
(C) The Fertile Crescent  
(D) South-east Asia
216. Administration of the DPT vaccine (diphtheria toxoid, pertussis products, and tetanus toxoid) would stimulate which of the following types of immunity?  
(A) Artificial active  
(B) Artificial passive  
(C) Natural active  
(D) Natural passive
217. Which of the following events occurs first in the differentiation sequence of human B cells in the bone marrow?  
(A) Immunoglobulin light chain gene rearrangement  
(B) Immunoglobulin heavy chain gene rearrangement  
(C) Expression of surface IgD and IgM  
(D) Expression of surface IgM
218. Loss of which of the following classes of molecules on the surface of a tumor cell target would result in loss of susceptibility to killing by host immune cells?  
(A) CD3  
(B) CD4  
(C) MHC class I  
(D) MHC class II



219. Which of the following cell types will be involved in an immediate hypersensitivity reaction due to an insect sting?
- Neutrophils
  - Eosinophils
  - Basophils
  - Mast cells
220. Which one of the following is NOT a function of glia?
- providing support to the neural tissue
  - conduction and processing of electrical signal
  - myelination of neurons
  - help in neuronal growth
221. Vagus nerve is a
- sensory nerve
  - sensory-motor mixed nerve
  - motor nerve
  - lumbar nerve
222. Pain sensation is a subjective and conscious feeling. However, although the autonomic organs viz. brain, heart etc. do not get represented in the cerebral cortex, one feels pain in those parts as well. This is because
- these parts receive less blood supply
  - of increased pH in those parts
  - of the phenomenon known as referred pain
  - these organs are not superficially located
223. In a gastrocnemius-sciatic (nerve-muscle) preparation electrical stimulation of the nerve caused twitching of the muscle. Direct stimulation of the muscle also caused twitching. When curare (a cholinergic antagonist) was applied in the bath where the preparation was maintained and the nerve was stimulated, the muscle twitch was not seen. However, under these conditions, if the muscle was stimulated directly, it twitched. These observations suggest that
- stimulation of the nerve was directly communicated to the muscle for contraction
  - stimulation of the nerve was communicated to the muscle through the mediation of acetylcholine
  - after application of curare the stimulation of the nerve did not evoke muscle twitch because the nerve was fatigued
  - after application of curare the stimulation of the nerve did not evoke muscle twitch because muscle was fatigued
224. Nerve bundles in vertebrates are likely to contain
- many myelinated axons of different diameters as well as a large number of unmyelinated fibres
  - many unmyelinated fibres as well as a large number of myelinated axons of same diameters
  - only myelinated axons of same diameter
  - only unmyelinated axons of different diameter
225. In Parkinson's disease, there is a predominant loss of dopaminergic neurons primarily in
- substantia nigra
  - cerebellar cortex
  - cerebral cortex
  - locus coeruleus
226. A tissue was responding when treated with a chemical for a brief period. However, when the treatment was continued for a longer time, the response stopped. After washing and leaving for some time, the tissue started responding to the same chemical at the same dose. The reason for the reduced response is likely to be due to
- increased apoptosis of the treated cells
  - increased necrosis of the treated cells
  - fixation of the treated cells
  - desensitization/down-regulation of the receptors on the treated cells
227. Salmon return to their specific home stream to spawn. This is an example of
- pheromone action
  - reflex action
  - imprinting
  - circadian rhythm
228. Mark the correct statement for a normal living excitable cell at rest. The ionic concentrations across the cell membrane are such that
- they are at equi-potential
  - the intracellular potential is positive relative to that of the extracellular
  - the intracellular potential is negative relative to that of the extracellular
  - the intracellular potential is positive relative to that of the intracellular potential of another cell
229. If the sequence of the DNA sense strand is 5' GATCCTATGCTAC 3', then the transcribed mRNA sequence will be
- 5' GAUCCUAUGCUAC 3'

- (B) 5' CUAGGUAUCGAUC 3'  
 (C) 5' CAUCGUAUACCUAG 3'  
 (D) 5' GUAGCAUAGGAUC 3'
230. Which of the following cells is important for generation of antigen-specific effector T-cells?  
 (A) Macrophages  
 (B) B-cells  
 (C) Dendritic cells  
 (D) NK cells
231. Which one of the following cells does not require processed antigen to lyse tumour cells?  
 (A) CD8<sup>+</sup> T-cells  
 (B) CD4<sup>+</sup> T-cells  
 (C) NK Cells  
 (D) Macrophage
232. Cyclosporin A is administered to patients undergoing transplantation because it  
 (A) downregulates TCR expression  
 (B) downregulates IL-2 production  
 (C) downregulates antigen presentation  
 (D) prevents recruitment of CD8<sup>+</sup> T-cells in the grafted tissue
233. In flow cytometry 'compensation' is used to remove  
 (A) cell debris  
 (B) apoptotic cells  
 (C) overlap of fluorescence spectra  
 (D) signal noise
234. The binding of IL-2 to its receptor in an activated T-cell is mediated by  
 (A)  $\alpha$  and  $\gamma$  chains  
 (B)  $\gamma$  and  $\beta$  chains  
 (C)  $\alpha$  and  $\beta$  chains  
 (D)  $\gamma$  chain alone
235. The D gene segment of the TCR and BCR encodes for a part of the  
 (A) CDR3 region of both TCR & BCR  
 (B) CDR2 region of both TCR & BCR  
 (C) CDR1 region of only the BCR  
 (D) CDR3 region of only the TCR
236. Super antigens bind to  
 (A) C  $\beta$  domain of TCR and non-polymorphic region of MHC II  
 (B) V  $\alpha$  domain of TCR & polymorphic region of MHC II  
 (C) V  $\beta$  domain of TCR and non-polymorphic region of MHC II  
 (D) V  $\beta$  domain of TCR & non-polymorphic region of MHC I
237. ELISPOT assay is used for measuring  
 (A) cytokine concentration in serum  
 (B) antibody titre in serum  
 (C) frequency of B cell responses  
 (D) frequency of T cell responses
238. Latency is a feature of which one of the following viruses?  
 (A) Herpes Simplex virus  
 (B) Corona virus  
 (C) Polio virus  
 (D) Rabies virus
239. Which one of the following codons is used for selenocysteine during protein biosynthesis?  
 (A) UGA  
 (B) UAG  
 (C) UGC  
 (D) UCG
240. Which of the following mechanisms is useful for removal of autoreactive T-cells by the immune system?  
 (A) clonal selection  
 (B) clonal deletion  
 (C) phagocytosis  
 (D) autophagy
241. In bovines which one of the following is a milk borne infection?  
 (A) Ephemeral fever  
 (B) Milk fever  
 (C) Undulant fever  
 (D) Botulism
242. Which one of the following diseases in animals is eradicated from India?  
 (A) PPR  
 (B) RP  
 (C) IBR  
 (D) IBD
243. Which one of the following diseases is contracted by human beings mainly through agricultural occupation?  
 (A) Leptospirosis  
 (B) Hydatid disease  
 (C) Black quarter

- (D) Malta fever
244. COFAL test is used for the diagnosis of  
(A) equine infectious anemia  
(B) human immunodeficiency virus  
(C) avian leukosis  
(D) bovine leukosis
245. Blue tongue virus  
(A) agglutinates guinea pig RBCs  
(B) agglutinates chicken RBCs  
(C) agglutinates mouse RBCs  
(D) do not produce hemagglutination
246. Buparvoquone is the drug of choice against  
(A) Theileriosis  
(B) Babesiosis  
(C) Giardiasis  
(D) Coccidiosis
247. Which one of the following is not the characteristic of Aflatoxicosis in chick?  
(A) immunosuppression  
(B) wing paralysis  
(C) enlargement of liver  
(D) loss of condition
248. Vomiting, grey foul smelling diarrhea and gastroenteritis in young dogs are characteristics of  
(A) Infectious canine hepatitis  
(B) Canine parvovirus  
(C) Canine distemper virus  
(D) Canine corona virus
249. Most commonly affected species with papillomavirus is  
(A) Cattle  
(B) Equine  
(C) Dog  
(D) Human
250. The animal that excretes most of the virus in foot and mouth disease by aerosols even before the appearance of clinical signs is  
(A) cattle  
(B) pig  
(C) sheep and goat  
(D) buffalo
- 

The Biomimics

## Key to the MCQs for BET 2012

### Section A

- |         |         |         |
|---------|---------|---------|
| 1. (D)  | 22. (D) | 43. (B) |
| 2. (A)  | 23. (D) | 44. (D) |
| 3. (C)  | 24. (A) | 45. (A) |
| 4. (D)  | 25. (B) | 46. (A) |
| 5. (A)  | 26. (C) | 47. (D) |
| 6. (C)  | 27. (B) | 48. (D) |
| 7. (C)  | 28. (B) | 49. (B) |
| 8. (C)  | 29. (B) | 50. (C) |
| 9. (C)  | 30. (C) |         |
| 10. (B) | 31. (B) |         |
| 11. (A) | 32. (D) |         |
| 12. (D) | 33. (B) |         |
| 13. (D) | 34. (D) |         |
| 14. (C) | 35. (B) |         |
| 15. (C) | 36. (A) |         |
| 16. (D) | 37. (D) |         |
| 17. (C) | 38. (B) |         |
| 18. (B) | 39. (A) |         |
| 19. (B) | 40. (B) |         |
| 20. (B) | 41. (D) |         |
| 21. (C) | 42. (B) |         |

**Section B**

- |         |         |          |          |
|---------|---------|----------|----------|
| 51. (C) | 73. (C) | 95. (C)  | 117. (B) |
| 52. (D) | 74. (B) | 96. (D)  | 118. (A) |
| 53. (A) | 75. (B) | 97. (A)  | 119. (A) |
| 54. (A) | 76. (D) | 98. (B)  | 120. (C) |
| 55. (B) | 77. (B) | 99. (A)  | 121. (B) |
| 56. (A) | 78. (D) | 100. (B) | 122. (A) |
| 57. (C) | 79. (D) | 101. (A) | 123. (B) |
| 58. (B) | 80. (B) | 102. (C) | 124. (A) |
| 59. (D) | 81. (C) | 103. (C) | 125. (A) |
| 60. (D) | 82. (A) | 104. (D) | 126. (B) |
| 61. (B) | 83. (A) | 105. (B) | 127. (C) |
| 62. (C) | 84. (C) | 106. (B) | 128. (A) |
| 63. (D) | 85. (B) | 107. (D) | 129. (D) |
| 64. (C) | 86. (D) | 108. (C) | 130. (A) |
| 65. (C) | 87. (A) | 109. (A) | 131. (A) |
| 66. (B) | 88. (A) | 110. (B) | 132. (A) |
| 67. (A) | 89. (B) | 111. (A) | 133. (B) |
| 68. (A) | 90. (B) | 112. (A) | 134. (B) |
| 69. (A) | 91. (A) | 113. (B) | 135. (A) |
| 70. (A) | 92. (C) | 114. (D) | 136. (A) |
| 71. (D) | 93. (A) | 115. (A) | 137. (A) |
| 72. (A) | 94. (D) | 116. (D) | 138. (C) |

139. (A)            162. (A)            185. (C)            208. (C)  
140. (B)            163. (B)            186. (D)            209. (A)  
141. (C)            164. (C)            187. (D)            210. (B)  
142. (A)            165. (C)            188. (A)            211. (D)  
143. (A)            166. (C)            189. (A)            212. (B)  
144. (A)            167. (B)            190. (B)            213. (B)  
145. (C)            168. (D)            191. (A)            214. (C)  
146. (C)            169. (B)            192. (C)            215. (C)  
147. (A)            170. (B)            193. (A)            216. (A)  
148. (B)            171. (C)            194. (D)            217. (B)  
149. (A)            172. (C)            195. (C)            218. (C)  
150. (C)            173. (C)            196. (C)            219. (D)  
151. (A)            174. (A)            197. (B)            220. (B)  
152. (C)            175. (A)            198. (A)            221. (B)  
153. (B)            176. (B)            199. (B)            222. (C)  
154. (C)            177. (B)            200. (A)            223. (B)  
155. (A)            178. (C)            201. (B)            224. (A)  
156. (C)            179. (C)            202. (B)            225. (A)  
157. (C)            180. (A)            203. (B)            226. (D)  
158. (C)            181. (B)            204. (C)            227. (C)  
159. (D)            182. (B)            205. (D)            228. (C)  
160. (C)            183. (B)            206. (C)            229. (D)  
161. (B)            184. (C)            207. (A)            230. (C)

231. (C)                      249. (A)  
232. (B)                      250. (B)  
233. (C)  
234. (C)  
235. (A)  
236. (C)  
237. (D)  
238. (A)  
239. (A)  
240. (A)  
241. (C)  
242. (B)  
243. (A)  
244. (C)  
245. (D)  
246. (A)  
247. (B)  
248. (B)

The Biometrics

**Biotechnology Eligibility Test (BET)  
for DBT-JRF Award (2013-14)**

**Government of India, Ministry of Science & Technology,  
Department of Biotechnology, New Delhi  
(Coordinated by National Centre for Cell Science)**

**May 5, 2013**

**Total Marks – 300    Duration 150 minutes.**

- N.B.** 1) All questions in Section A are **compulsory**.  
2) Answer any 50 questions from Section B.  
3) In case more than 50 are attempted, first 50 will be considered.  
4) Each question carries 3 marks; for every wrong answer, one mark will be deducted.  
5) Write your Registration no. strictly inside the space provided.

**Section A**

<b>Q.1</b>	<b>Mammalian cells in primary culture experience Heyflick limit after 50-60 cell generation time. However, in a rare situation or employing certain agents, cells can be induced to immortality. Which of the following genes/proteins have a major relationship with this?</b>	
	<b>A</b>	Cdc2
	<b>B</b>	Cyclin
	<b>C</b>	P53
	<b>D</b>	Proteasomes

<b>Q.2</b>	<b>SNARE proteins are found in the membranes of all of the following compartments EXCEPT</b>	
	<b>A</b>	Mitochondria
	<b>B</b>	Golgi complex
	<b>C</b>	Early endosome
	<b>D</b>	Endoplasmic reticulum




Q.3	<b>In the preparation of Golden rice, a few exogenous genes have been used in order to achieve the production of Vitamin A through recombinant DNA technology. This is a true example of</b>	
	A	Metabolic repression
	B	Biochemical engineering
	C	Metabolic extension
	D	Combinatorial biosynthesis

Q.4	<b>All of the following enzymes are linked to reduction of NADH except</b>	
	A	Isocitrate dehydrogenase
	B	Lactate dehydrogenase
	C	Succinate dehydrogenase
	D	Pyruvate dehydrogenase

Q.5	<b>Which of the following are components of a phospholipid?</b>	
	A	cholesterol, glycerol, fatty acids
	B	fatty acids, phosphate group, glycerol
	C	glycerol, amino acids, phosphate group
	D	phosphate group, cholesterol, monosaccharides

Q.6	<b>Which one of the following is a signaling receptor?</b>	
	A	mannose receptor
	B	toll-like receptor
	C	scavenger receptor
	D	LPS receptor

Q.7	<b>Amino acid analysis of 1.0 mg of pure enzyme yielded 58.1 <math>\mu\text{g}</math> of leucine (MW = 131.2). What is the minimum MW of the enzyme based on leucine content?</b>	
	A	2000
	B	2300
	C	2350
	D	2258 

Q.8	<b>The first metabolic intermediate that is common to the</b>
-----	---

	<b>aerobic metabolism of glucose and fatty acids is</b>
<b>A</b>	acetyl CoA
<b>B</b>	aceto-acetyl CoA
<b>C</b>	Pyruvate
<b>D</b>	Citrate

<b>Q.9</b>	<b>While sedimenting a microparticle by centrifugation, instead of increasing the rpm (to attain the desired “g” force), what else can be done to attain the complete sedimentation?</b>
<b>A</b>	Decrease the density of the medium
<b>B</b>	Increasing the density of the medium
<b>C</b>	By changing the Ph
<b>D</b>	Increasing the sample volume

<b>Q.10</b>	<b>For passive vaccination, which antibody type will be most appropriate?</b>
<b>A</b>	Polyclonal antibody
<b>B</b>	Monoclonal antibody
<b>C</b>	Humanized antibody
<b>D</b>	Single chain antibody

<b>Q.11</b>	<b>Which of the following is the best method to determine the phospholipid asymmetry in a plasma membrane?</b>
<b>A</b>	electron microscopy
<b>B</b>	fluorescence spectroscopy
<b>C</b>	lectin binding
<b>D</b>	Thin layer chromatography

<b>Q.12</b>	<b>Prosthetic groups such as iron-sulfur clusters and heme function to</b>
<b>A</b>	Donate electrons to NADH
<b>B</b>	Allow proteins to diffuse within the mitochondrial inner membrane
<b>C</b>	Both accept and donate electrons during electron transport
<b>D</b>	Transport protons across the mitochondrial inner membrane

Q.13	<b>APS (Ammonium persulphate) is used in SDS-PAGE for</b>	
	<b>A</b>	preventing oxidation
	<b>B</b>	cross-linking
	<b>C</b>	its role as a catalyst
Q.14	<b>Which of the following statements about the trp operon is not correct?</b>	
	<b>A</b>	It is normally turned off if tryptophan is present.
	<b>B</b>	Tryptophan acts as the corepressor.
	<b>C</b>	The regulator gene product is inactive by itself.
<b>D</b>	Tryptophan binds to the repressor protein and inactivates it.	

Q.15	<b>Glucose labeled with <math>^{14}\text{C}</math> at C-6 is added to a solution containing the enzymes and cofactors of the oxidative phase of the pentose phosphate pathway. The radioactive label will be observed at</b>	
	<b>A</b>	C5 of ribulose 5-phosphate
	<b>B</b>	C3 of ribulose 5-phosphate
	<b>C</b>	C1 of ribulose 5-phosphate
<b>D</b>	C4 of ribulose 5-phosphate	

Q.16	<b>The molarity of 15 % NaCl is</b>	
	<b>A</b>	2.56
	<b>B</b>	0.256
	<b>C</b>	25.6
<b>D</b>	0.025	

Q.17	<b>Which one of the following antibiotics is used to demonstrate the fresh protein synthesis in response to challenge by an inducer?</b>	
	<b>A</b>	Chloramphenicol
	<b>B</b>	Carbenicillin
	<b>C</b>	Rifampicin
<b>D</b>	Tetracyclin	

<b>Q.18</b>	<b>Identify the mismatch</b>	
	<b>A</b>	Alkaline phosphatase : remove phosphate group present at 5' end of DNA
	<b>B</b>	DNA Polymerase I : nick translation
	<b>C</b>	S1 endonucleases : cleaves only single strand DNA
	<b>D</b>	DNase I : cleaves only double stranded DNA

<b>Q.19</b>	<b>Sciophytes are plants that prefer to grow in</b>	
	<b>A</b>	Sun
	<b>B</b>	Shade
	<b>C</b>	Cold temperature
	<b>D</b>	Water

<b>Q.20</b>	<b>Which one of the following is a micronutrient of plants?</b>	
	<b>A</b>	Mn
	<b>B</b>	P
	<b>C</b>	Ca
	<b>D</b>	Mg

<b>Q.21</b>	<b>pHELLSGATE 12 is a/an</b>	
	<b>A</b>	BAC vector
	<b>B</b>	YAC vector
	<b>C</b>	RNAi Vector
	<b>D</b>	Phagemid

<b>Q.22</b>	<b>In protein 'A' glutamic acid is replaced by glutamine to make protein 'B'. Which technique can resolve these two proteins?</b>	
	<b>A</b>	Isoelectric focusing
	<b>B</b>	Pulse field electrophoresis
	<b>C</b>	SDS-PAGE
	<b>D</b>	Gel filtration

<b>Q.23</b>	<b>Genes related through descent from a common ancestral gene are called</b>	
	<b>A</b>	Orthologous

	<b>B</b>	Homologous
	<b>C</b>	Heterologous
	<b>D</b>	Paralogous

<b>Q.24</b>	<b>The Bohr effect in hemoglobin refers to</b>	
	<b>A</b>	the effect of pH on hemoglobin and myoglobin
	<b>B</b>	higher pH found in actively metabolizing tissues
	<b>C</b>	increased affinity for O <sub>2</sub> at lower Ph
	<b>D</b>	reduced affinity for O <sub>2</sub> at lower pH

<b>Q.25</b>	<b>In a biological system, amplification of signal is a fundamental regulatory principle. Which one of the following is NOT an amplification system?</b>	
	<b>A</b>	Blood clotting
	<b>B</b>	Complement activation
	<b>C</b>	Transmembrane receptor-mediated gene expression
	<b>D</b>	Ciliary movement in cochlea

<b>Q.26</b>	<b>The most pleiotropic colony-stimulating factor is</b>	
	<b>A</b>	M-CSF
	<b>B</b>	G-CSF
	<b>C</b>	IL-3
	<b>D</b>	GM-CSF

<b>Q.27</b>	<b>Which one of the following cells will migrate after injury in the central nervous system?</b>	
	<b>A</b>	Microglia
	<b>B</b>	Oligodendrocytes
	<b>C</b>	Astrocytes
	<b>D</b>	Ependymal cells

<b>Q.28</b>	<b>The pseudounipolar neurons are found in</b>	
	<b>A</b>	Scarpa's ganglion
	<b>B</b>	Dorsal root ganglion
	<b>C</b>	Nodose ganglion
	<b>D</b>	Geniculate ganglion

<b>Q.29</b>	<b>The genetic map for three genes A, B and C is as follows: A-B = 10 map units, B-C = 5 map units and A-C = 15 map units. In an individual of genotype AbC/aBc, the percentage of gametes expected to be of ABC is</b>	
	<b>A</b>	0.5
	<b>B</b>	5
	<b>C</b>	15
	<b>D</b>	50

<b>Q.30</b>	<b>Mendel's law of segregation, as applied to the behavior of chromosomes during cell division means that</b>	
	<b>A</b>	Alleles of a gene separate from each other when homologous chromosomes separate in meiosis
	<b>B</b>	Alleles of a gene separate from each other when chromatids separate in meiosis II
	<b>C</b>	Alleles of a gene separate from each other when homologs separate in meiosis I, or when chromatids separate in meiosis II if there is a cross over between the gene and the centromere.
<b>D</b>	Alleles of a gene separate from each other when chromatids separate in meiosis I, or when homologs separate in meiosis II if there is a cross over between the gene and the centromere.	

<b>Q.31</b>	<b>Which one of the following markers in brain is used for diagnosis of Rabies?</b>	
	<b>A</b>	Bollinger bodies
	<b>B</b>	Negri bodies
	<b>C</b>	Roswell bodies
<b>D</b>	Ketone bodies	

<b>Q.32</b>	<b>Which one of the following cell types is the most characteristic component of the early stages of acute inflammatory reaction?</b>	
	<b>A</b>	Eosinophils
	<b>B</b>	Neutrophils
	<b>C</b>	Basophils
<b>D</b>	Monocytes	

<b>Q.33</b>	<b>Competitive inhibition of an enzyme by a competitive inhibitor can be overcome by simply</b>	
	<b>A</b>	decreasing the concentration of substrate
	<b>B</b>	increasing the concentration of substrate
	<b>C</b>	decreasing the temperature of reaction
	<b>D</b>	increasing the temperature of reaction

<b>Q.34</b>	<b>Other than increase in capital cost, increasing the number of steps in downstream processing of proteins enhances the final cost of the product because</b>	
	<b>A</b>	loss in yield at each step is cumulative
	<b>B</b>	loss in activity/function at each step is cumulative
	<b>C</b>	difficulties in maintaining stringency at later stages of purification
	<b>D</b>	increase in contamination of the product at each step is cumulative

<b>Q.35</b>	<b>Even though many therapeutic proteins require only 95% purity, the final product is often tested for microscopic amounts of specific contaminants. Such contaminants such as endotoxins in a pharmaceutical protein product is an example of</b>	
	<b>A</b>	Adventitious agent
	<b>B</b>	Neglected impurity
	<b>C</b>	Critical impurity
	<b>D</b>	Non-critical impurity

<b>Q.36</b>	<b>Vortexing in a stirred tank reactor can be prevented by using</b>	
	<b>A</b>	axial flow impeller
	<b>B</b>	a turbine impeller
	<b>C</b>	baffles in the reactor
	<b>D</b>	multiple impellers

<b>Q.37</b>	<b>In which of the following reactions, is the unit of rate constant and rate of reaction the same?</b>	
	<b>A</b>	1st order reaction
	<b>B</b>	2nd order reaction
	<b>C</b>	3rd order reaction
	<b>D</b>	Zero order reaction

<b>Q.38</b>	<b>In an enzymatic reaction, if the enzyme concentration is increased from 1mg to 2 mg, which of the following statements is correct?</b>	
	<b>A</b>	Km and Vmax will remain constant
	<b>B</b>	Km will change while Vmax will remain constant
	<b>C</b>	Km will remain constant but Vmax will be more
	<b>D</b>	Km and Vmax will increase

<b>Q.39</b>	<b>Which one of the following receptors perceives blue light in plants?</b>	
	<b>A</b>	Cryptochrome
	<b>B</b>	Phytochrome
	<b>C</b>	Phototropin
	<b>D</b>	Photopsin

<b>Q.40</b>	<b>Paralytic shellfish poisoning (PSP) is caused by the consumption of molluscan shellfish contaminated with</b>	
	<b>A</b>	Brevetoxins
	<b>B</b>	Domoic Acid
	<b>C</b>	Saxitoxins
	<b>D</b>	Okadaic acid

<b>Q.41</b>	<b>The site of production of Gonad Inhibiting Hormone (GIH) in crustaceans is</b>	
	<b>A</b>	Thoracic ganglion
	<b>B</b>	Sinus gland
	<b>C</b>	X-organ
	<b>D</b>	Y-organ

<b>Q.42</b>	<b>The immunoglobulin isotype found both in cartilaginous and bony fishes is</b>	
-------------	--	--



	<b>A</b>	IgD
	<b>B</b>	IgM
	<b>C</b>	IgE
	<b>D</b>	IgG

<b>Q.43</b>	<b>In Bhopal disaster by which hazardous substance the toxicity effect get increased?</b>	
	<b>A</b>	Methylisocyanate
	<b>B</b>	Methylmercury
	<b>C</b>	Methanol
	<b>D</b>	Plyaromatic hydrocarbons

<b>Q.44</b>	<b>Which one of the following microorganisms can be effectively used as a biocontrol agent?</b>	
	<b>A</b>	Bacillus thuringiensis
	<b>B</b>	Bacillus megaterium
	<b>C</b>	Aspergillus niger
	<b>D</b>	Pseudomonas putida

<b>Q.45</b>	<b>Which one of the following gases contributes most to the Greenhouse Effect?</b>	
	<b>A</b>	Acetylene
	<b>B</b>	Carbon dioxide (CO <sub>2</sub> )
	<b>C</b>	Carbon monoxide
	<b>D</b>	Nitrous oxide (N <sub>2</sub> O)

<b>Q.46</b>	<b>Which one of the following best represents the central dogma of Bioinformatics?</b>	
	<b>A</b>	Sequence-Structure-Function
	<b>B</b>	DNA-RNA-Proteins
	<b>C</b>	Motifs-domains-Superfamilies
	<b>D</b>	Data-Databanks-Data mining tools

<b>Q.47</b>	<b>Multiple sequence alignments are NOT used to derive</b>	
	<b>A</b>	Motifs
	<b>B</b>	Primers
	<b>C</b>	PSSMs
	<b>D</b>	HMMs

<b>Q.48</b>	<b>Which one of the following matrices can be used to identify distantly related homologs?</b>	
	<b>A</b>	BLOSUM90
	<b>B</b>	BLOSUM62
	<b>C</b>	BLOSUM45
	<b>D</b>	BLOSUM80

<b>Q.49</b>	<b>Among the different amino acid side chains in proteins, which of the following pairs might form side chain-side chain hydrogen bonding interaction with each other?</b>	
	<b>A</b>	Valine- Glutamic acid
	<b>B</b>	Alanine- Glycine
	<b>C</b>	Asparagine- Serine
	<b>D</b>	Proline- Lysine

<b>Q.50</b>	<b>If a protein is known to bind Ca<sup>2+</sup> ions, which of the following side chains is likely to be involved in Ca<sup>2+</sup> binding?</b>	
	<b>A</b>	Aspartic acid
	<b>B</b>	Lysine
	<b>C</b>	Proline
	<b>D</b>	Methionine

### Section B

<b>Q.51</b>	<b>Which one of the following suggests the multimeric nature of p53?</b>	
	<b>A</b>	It causes pyrimidine-pyrimidine cross linking
	<b>B</b>	Dominant negative mutants are available
	<b>C</b>	p53 activates the genes
	<b>D</b>	Binds to single stranded DNA

<b>Q.52</b>	<b>Which of the following is also called the “suicide enzyme”?</b>	
	<b>A</b>	DNA glycosylase
	<b>B</b>	DNA photolyase
	<b>C</b>	Adenosine deaminase
<b>Q.53</b>	<b>IgG in patients with rheumatoid arthritis has abnormal</b>	
	<b>A</b>	Top of Form Light chain sequence
	<b>B</b>	Disulfide bonds
	<b>C</b>	Glycosylation
	<b>D</b>	Hinge regions

<b>Q.54</b>	<b>Which one of the following pathogens does not use antigenic variation as a major means of evading host defences?</b>	
	<b>A</b>	Top of Form Streptococcus pneumonia
	<b>B</b>	Influenza A
	<b>C</b>	HIV
	<b>D</b>	Trypanosomes

<b>Q.55</b>	<b>Warburg effect is characterised by</b>	
	<b>A</b>	Increased glycolysis
	<b>B</b>	Decreased glycolysis
	<b>C</b>	Absence of glycolysis
	<b>D</b>	Malfunctional glycolysis

<b>Q.56</b>	<b>Amanita phalloides, which is responsible for the majority of fatal mushroom poisonings contains alpha-amanitin that specifically inhibits</b>	
	<b>A</b>	DNA Polymerase
	<b>B</b>	RNA Polymerase
	<b>C</b>	Telomerase
	<b>D</b>	Topoisomerase

<b>Q.57</b>	<b>Phenylmethylsulfonyl fluoride (PMSF) is a/an</b>	
	<b>A</b>	competitive inhibitor of serine proteases
	<b>B</b>	non competitive inhibitor of serine proteases

	<b>C</b>	reversible inhibitor of serine proteases
	<b>D</b>	irreversible inhibitor of serine proteases

<b>Q.58</b>	<b>Deficiency of HGPRT and Glucose-6-phosphatase leads to</b>	
	<b>A</b>	Gaucher's disease
	<b>B</b>	Phenylketoneuria
	<b>C</b>	Gout
	<b>D</b>	Alkaptonuria

<b>Q.59</b>	<b>Which is not an RNA virus?</b>	
	<b>A</b>	Paramyxovirus
	<b>B</b>	HIV
	<b>C</b>	HPV
	<b>D</b>	Picornavirus

<b>Q.60</b>	<b>Secondary metabolites are produced in which of the following stages?</b>	
	<b>A</b>	Lag phase
	<b>B</b>	Log phase
	<b>C</b>	Stationary phase
	<b>D</b>	Death phase

<b>Q.61</b>	<b>Which one of the following amino acids has pKa value near physiological pH?</b>	
	<b>A</b>	Histidine
	<b>B</b>	Arginine
	<b>C</b>	Lysine
	<b>D</b>	Serine

<b>Q.62</b>	<b>Somatic mutation of Immunoglobulin gene accounts for</b>	
	<b>A</b>	Allelic exclusion
	<b>B</b>	Class switching from IgM to IgG
	<b>C</b>	Affinity maturation
	<b>D</b>	V(D)J recombination

<b>Q.63</b>	<b>Many microorganisms can't use CO<sub>2</sub> as their sole source of carbon as</b>	
	<b>A</b>	CO <sub>2</sub> is toxic for them
	<b>B</b>	Reduction of CO <sub>2</sub> is an energy expensive process
	<b>C</b>	Further reduction of CO <sub>2</sub> is not possible
	<b>D</b>	CO <sub>2</sub> is not a good source of carbon

<b>Q.64</b>	<b>There are three groups of photosynthetic bacteria: the cyanobacteria, green bacteria and</b>	
	<b>A</b>	Purple bacteria
	<b>B</b>	Red bacteria
	<b>C</b>	Blue green bacteria
	<b>D</b>	Violet bacteria

<b>Q.65</b>	<b>In human, the inherited autosomal recessive diseases Xeroderma pigmentosum is the result of a defect in the:</b>	
	<b>A</b>	SOS repair
	<b>B</b>	Mismatch repair
	<b>C</b>	Repair in alkylated DNA
	<b>D</b>	Repair of UV damaged DNA

<b>Q.66</b>	<b>Which one of the following methods requires multiple sets of primers to detect more than one organism targeting multiple loci from the genomic DNA?</b>	
	<b>A</b>	ARDRA
	<b>B</b>	AFLP
	<b>C</b>	Multiplex PCR
	<b>D</b>	AP-PCR

<b>Q.67</b>	<b>The advantage of the Edman's reagent (phenyl isothiocyanate-PTH) over Sanger's reagent (fluorodinitrobenzene-FDNB) in peptide analysis is</b>	
	<b>A</b>	complete oxidation of all disulfides
	<b>B</b>	complete denaturation
	<b>C</b>	that the process can be repeated on the remaining peptide
	<b>D</b>	complete hydrolysis

<b>Q.68</b>	<b>The transition state of a catalyzed reaction (<math>EX^\ddagger</math>) is a highly-populated intermediate on the reaction pathway which is</b>	
	<b>A</b>	higher in energy than that of an uncatalyzed reaction
	<b>B</b>	lower in energy than that of an uncatalyzed reaction
	<b>C</b>	lower in energy than the reaction substrate
	<b>D</b>	bound very weakly to the catalyst

<b>Q.69</b>	<b>ETC has a potential to produce highly reactive free radicals that can damage the cells. Which one of the following is useful to prevent oxidative damage in cells?</b>	
	<b>A</b>	superoxide molecule
	<b>B</b>	glutathione peroxidase
	<b>C</b>	Antimycin A
	<b>D</b>	Rotenone

<b>Q.70</b>	<b>Gangliosides derived from glucosylceramide contain one or more molecules of</b>	
	<b>A</b>	Sialic acid
	<b>B</b>	Glycerol
	<b>C</b>	Diacylglycerol
	<b>D</b>	Hyaluronic acid

<b>Q.71</b>	<b>dUMP is converted to TMP by</b>	
	<b>A</b>	Methylation
	<b>B</b>	Carboxylation
	<b>C</b>	Deamination
	<b>D</b>	Decarboxylation

<b>Q.72</b>	<b>Esterification of cholesterol in plasma is catalyzed by</b>	
	<b>A</b>	Lecithin: Cholesterol acyl transferase
	<b>B</b>	Acyl Co A: Cholesterol acyl transferase
	<b>C</b>	Succinyl CoA: Cholesterol acyl transferase
	<b>D</b>	Malonyl CoA : Cholesterol acyl transferase

<b>Q.73</b>	<b>What makes stem cells different from other cell types?</b>	
	<b>A</b>	Most of cell types can divide, but only stem cells can differentiate into a specific cell type
	<b>B</b>	Stem cells divide rapidly to develop a population of cells that will differentiate into a set of cell types
	<b>C</b>	Stem cell divide to give rise to a daughter stem cell an another cell that divides and differentiates into only one cell type.
	<b>D</b>	Stem cell divides asymmetrically to give rise to a daughter cell which remains as a stem cell and a second daughter cell that divides and differentiates into one or more cell types.

<b>Q.74</b>	<b>Which is the correct hierarchy of gene activity in early Drosophila development?</b>	
	<b>A</b>	Maternal, gap, pair-rule, segment polarity.
	<b>B</b>	Gap, maternal, segment polarity, pair-rule.
	<b>C</b>	Maternal, pair-rule, gap, segment polarity.
	<b>D</b>	Gap, segment polarity, pair-rule, homeotic gene.

<b>Q.75</b>	<b>The lineage of all adult somatic cells (cell lineage) has been documented in</b>	
	<b>A</b>	Drosophila melanogaster
	<b>B</b>	Arabidopsis thaliana
	<b>C</b>	Caenorhabditis elegans
	<b>D</b>	Xenopus laevis

<b>Q.76</b>	<b>The Noble Prize in Physiology or Medicine 'for the discovery that mature cells can be reprogrammed to become pluripotent' was awarded to</b>	
	<b>A</b>	Sir John B. Gurdon, Shinya Yamanaka
	<b>B</b>	Sydney Brenner, H. Robert Horvitz, John E. Sulston
	<b>C</b>	Edward B. Lewis, Christiane Nüsslein-Volhard, Eric F. Wieschaus
	<b>D</b>	Elizabeth H. Blackburn, Carol W. Greider, Jack W. Szostak

<b>Q.77</b>	<b>With reference to spontaneous mutations, one of the questions asked by geneticists was whether spontaneous mutations are induced in response to external stimuli or whether variants are present at a low frequency in most populations. In order to answer this, “fluctuation test” was carried out by</b>	
	<b>A</b>	Salvador Luria and Max Delbrück
	<b>B</b>	Francois Jacob and Jacques Monod
	<b>C</b>	Thomas Hunt Morgan
	<b>D</b>	Seymour Benzer

<b>Q.78</b>	<b>Which one of the following experimental designs is most suited to answer whether a newly discovered transposable element in yeast, transposes through an mRNA intermediate?</b>	
	<b>A</b>	Sequence the transcriptome of the yeast cell to see the presence of a corresponding mRNA.
	<b>B</b>	Introduce an intron which can be spliced out, in the transposable element and test the presence or absence of the intron at a newly transposed site.
	<b>C</b>	Block transcription and then test whether transposition occurs.
	<b>D</b>	Using a suitable bioinformatics tool predict whether an mRNA intermediate can be formed.

<b>Q.79</b>	<b>With reference to lac operon which one of the following merodiploids will show a constitutive expression of <math>\beta</math>-galactosidase?</b>	
	<b>A</b>	I-O+Z+Y- / F' I+ O+Z-Y+
	<b>B</b>	I-OCZ+Y- / F' I+O+Z-Y+
	<b>C</b>	I-O+Z+Y- / F' I+OCZ-Y+
	<b>D</b>	I-OCZ-Y- / F' I+O+Z+Y+

<b>Q.80</b>	<b>In what way are the homeotic genes of flowering plants similar to those of Drosophila?</b>	
	<b>A</b>	They encode for transcription factors of the homeobox class
	<b>B</b>	They encode for transcription factors of the MADS-box type
	<b>C</b>	Mutations in the homeotic genes cause transformation of one organ to other
	<b>D</b>	The gene in flowering plants have evolved from the same lineage as those in Drosophila.



<b>Q.81</b>	<b>Integrin signaling promotes cell migration by inducing changes in the</b>	
	<b>A</b>	Lateral diffusion rate of integral membrane proteins
	<b>B</b>	Flip-Flop rate of phospholipids
	<b>C</b>	Cytoskeletal organization
	<b>D</b>	Membrane raft

<b>Q.82</b>	<b>Photon capturing prosthetic group moiety of chlorophyll molecule is known as</b>	
	<b>A</b>	Mn Porphyrin
	<b>B</b>	Mg Porphyrin
	<b>C</b>	Fe Porphyrin
	<b>D</b>	Mo Porphyrin

<b>Q.83</b>	<b>Opsonization process is involved with</b>	
	<b>A</b>	B cells
	<b>B</b>	T Cells
	<b>C</b>	Neutrophils
	<b>D</b>	Macrophages

<b>Q.84</b>	<b>Poly-L-leucine solution in dioxane is</b>	
	<b>A</b>	$\alpha$ -helical
	<b>B</b>	Random coil
	<b>C</b>	$\beta$ -sheet
	<b>D</b>	$\alpha$ -helix

<b>Q.85</b>	<b>Which one of the following is best suited for hydrolyzing peptide bonds on the carboxyl side of aromatic residues?</b>	
	<b>A</b>	Chymotrypsin
	<b>B</b>	Trypsin
	<b>C</b>	CNBr
	<b>D</b>	Performic acid

<b>Q.86</b>	<b>Which one of the following molecules has the highest diffusion coefficient in plasma membrane?</b>	
	<b>A</b>	F <sub>0</sub> -F <sub>1</sub> ATPase
	<b>B</b>	Glycophorin
	<b>C</b>	ABC transporters
	<b>D</b>	Insulin receptor

<b>Q.87</b>	<b>Cystic Fibrosis Transmembrane Regulator (CFTR) Protein is a</b>	
	<b>A</b>	Sodium transporter
	<b>B</b>	Calcium antiporter
	<b>C</b>	Chloride transporter
	<b>D</b>	Potassium transporter

<b>Q.88</b>	<b>Which one of the following modifications targets a protein for degradation?</b>	
	<b>A</b>	Fernesylation
	<b>B</b>	Ubiquitination
	<b>C</b>	Sumoylation
	<b>D</b>	Palmitoylation

<b>Q.89</b>	<b>Regulation of blood glucose level is by</b>	
	<b>A</b>	Opposing effects of insulin and glucagon
	<b>B</b>	Additive effect of insulin and glucagon
	<b>C</b>	Independent of glucagon
	<b>D</b>	Only by insulin

<b>Q.90</b>	<b>Which of the proteins or polysaccharides to which fibronectins are capable of binding is a normal plasma membrane component?</b>	
	<b>A</b>	Collagen
	<b>B</b>	Fibrin
	<b>C</b>	Heparan sulfate
	<b>D</b>	Integrin

<b>Q.91</b>	<b>The observation that plasma membrane proteins mix after cell fusion provides evidence for</b>	
	<b>A</b>	Rotational movement of plasma membrane proteins
	<b>B</b>	The bilayer structure of biomolecules
	<b>C</b>	The fluid mosaic model
	<b>D</b>	Interactions of plasma membrane proteins of two different cell types

<b>Q.92</b>	<b>The treatment of hepatocytes in in vitro culture with Ricin leads to</b>	
	<b>A</b>	Inhibition of endocytosis
	<b>B</b>	Inhibition of translation
	<b>C</b>	Inhibition of Transcription
	<b>D</b>	Inhibition of signal transduction

<b>Q.93</b>	<b>In a gel filtration chromatography</b>	
	<b>A</b>	The large protein will be eluted first
	<b>B</b>	The small protein will be eluted first
	<b>C</b>	Both large and small will elute at the same time
	<b>D</b>	The small protein with high charge will be eluted first

<b>Q.94</b>	<b>Two dimensional gel electrophoresis is a technique for separating proteins</b>	
	<b>A</b>	Based on charge
	<b>B</b>	Based on mass
	<b>C</b>	Based on both charge and mass
	<b>D</b>	Based on its pI value

<b>Q.95</b>	<b>Exact mass and sequence of proteins and peptides can be measured by</b>	
	<b>A</b>	MALDI-TOF
	<b>B</b>	Proton NMR
	<b>C</b>	X-Ray
	<b>D</b>	Mass spectroscopy

<b>Q.96</b>	<b>Fluorescence microscopy is based on the ability of certain molecules to</b>	
	<b>A</b>	Continuously emit light of a constant wavelength
	<b>B</b>	Absorb light of many different wavelengths
	<b>C</b>	Absorb light of a given wavelength and then emit light of a longer wavelength
	<b>D</b>	Absorb light of a given wavelength and then emit light of a shorter wavelength

<b>Q.97</b>	<b>An IgG and an IgM samples (against human red blood cell surface antigen) were treated with <math>\beta</math>-mercaptoethanol independently and tried for agglutinating human red blood cells with a view to checking the hemagglutination titer of the two samples. Which one of the following results is correct in this context?</b>	
	<b>A</b>	The titre of IgM was found to be drastically decreased in comparison with that of IgG remaining unaltered.
	<b>B</b>	The titre of IgG was found to be drastically decreased in comparison to that of IgM
	<b>C</b>	Both IgG and IgM exhibited the same titre
	<b>D</b>	$\beta$ -mercaptoethanol was unable to craft any chemical change on IgG and IgM

<b>Q.98</b>	<b>A lectin can bind to plasma membrane vesicles if it is</b>	
	<b>A</b>	Right side out
	<b>B</b>	Inside out
	<b>C</b>	Both right side out and inside out
	<b>D</b>	Digested with protease

<b>Q.99</b>	<b>Membrane asymmetry can be regulated by</b>	
	<b>A</b>	ABC transporters
	<b>B</b>	Flippase
	<b>C</b>	Glycosylation of integral membrane proteins
	<b>D</b>	F1-ATPase

<b>Q.100</b>	<b>What is the activated reactant in the biosynthesis of phosphatidylinositol from inositol?</b>	
	<b>A</b>	CDP-ethanolamine
	<b>B</b>	CDP-diacylglycerol
	<b>C</b>	Geranyl-pyrophosphate
	<b>D</b>	UDP-inositol

<b>Q.101</b>	<b>Best method in tracking the synthesis and maturation of a protein in a living cell is</b>	
	<b>A</b>	Making a fusion protein with an appropriate epitope
	<b>B</b>	Making a specific and high affinity monoclonal antibody
	<b>C</b>	Making a specific and high affinity polyclonal antibody
	<b>D</b>	Making a fusion protein with GFP

<b>Q.102</b>	<b>Fluorescence recovery after photobleaching (FRAP) is a powerful technique for calculating</b>	
	<b>A</b>	The diffusion coefficient of membrane lipids and proteins
	<b>B</b>	The rate of synthesis of membrane proteins
	<b>C</b>	The distance between a lipid and a membrane protein
	<b>D</b>	The extent of signal transduction in membrane upon ligand-receptor interactions

<b>Q.103</b>	<b>Treatment of the inside-out vesicles with an uncoupler like DNP that allows protons to freely move across the vesicle membrane would be expected to</b>	
	<b>A</b>	Increase ATP synthesis
	<b>B</b>	Inhibit ATP synthesis
	<b>C</b>	Increase O <sub>2</sub> consumption
	<b>D</b>	Inhibit electron transport

<b>Q.104</b>	<b>The concept of “magic bullet” proposed long back for targeted anti-cancer drug delivery is not a reality till today because</b>	
	<b>A</b>	Of multi drug resistance of cancer cells
	<b>B</b>	Efficient drug has not being designed
	<b>C</b>	Of the lack of appropriate development of anti-cancer antibody
	<b>D</b>	Of the lack of avidin-biotin type high affinity of anti-cancer antibody

<b>Q.105</b>	<b>One of the major reasons of the failure of somatic gene therapy protocol can be assigned to</b>	
	<b>A</b>	Lack of appropriate gene delivery system
	<b>B</b>	Lack of technique in site specific integration of foreign gene into the chromosome of target cells
	<b>C</b>	Low level expression of foreign genes in target cells
	<b>D</b>	High level expression of foreign genes in target cells

<b>Q.106</b>	<b>SRP selectively recognizes ER signal sequences on newly synthesized proteins. This is an outcome of</b>	
	<b>A</b>	Hydrogen bonding
	<b>B</b>	Hydrophobic interactions
	<b>C</b>	Ionic interactions
	<b>D</b>	Formation of covalent intermediate

<b>Q.107</b>	<b>In the active site of Transaldolase, which amino acid forms the Schiff base?</b>	
	<b>A</b>	Arginine
	<b>B</b>	Methionine
	<b>C</b>	Lysine
	<b>D</b>	Glutamine

<b>Q.108</b>	<b>An enzyme has an activation energy of 10,700 cal/mole. How many times faster (approximately) will the reaction proceed at 37 oC compared to 15 oC?</b>	
	<b>A</b>	5 times
	<b>B</b>	10 times
	<b>C</b>	4 times
	<b>D</b>	8 times

<b>Q.109</b>	<b>Identify the small protein (167 amino acids) that is produced in adipocytes and acts on receptors in the hypothalamus to curtail appetite</b>	
	<b>A</b>	LDL
	<b>B</b>	Lutenizing hormone
	<b>C</b>	HDL
	<b>D</b>	Leptin

<b>Q.110</b>	<b>A TLC run of rat liver phospholipids is sprayed with ninhydrin, and the colour is allowed to develop. Which phospholipids can be detected in this way?</b>	
	<b>A</b>	DP PC
	<b>B</b>	DS PC
	<b>C</b>	PS
	<b>D</b>	Lecithin

<b>Q.111</b>	<b>N-ethylmaleimide (NEM) is known to selectively inhibit bacterial lactose transporters. Which amino acid of the transporter is responsible for this inhibition?</b>	
	<b>A</b>	Cysteine
	<b>B</b>	Cystine
	<b>C</b>	Methionine
	<b>D</b>	Arginine

<b>Q.112</b>	<b>Highest turnover number of an enzymatic reaction so far known is exhibited by</b>	
	<b>A</b>	Aspartate transcarbamylase
	<b>B</b>	ATPase
	<b>C</b>	Lysozyme
	<b>D</b>	Carbonic anhydrase

<b>Q.113</b>	<b>The chemical nature of covalent linkage in a disaccharide is known as</b>	
	<b>A</b>	Ester
	<b>B</b>	Ether
	<b>C</b>	Amide
	<b>D</b>	Diester

<b>Q.114</b>	<b>Cancer cells have an unique property to exhibit uncontrolled division. This is primarily due to</b>	
	<b>A</b>	Activation of glucose transporters
	<b>B</b>	Inhibition of protein synthesis
	<b>C</b>	Inhibition of DNA replication
	<b>D</b>	Loss of contact inhibition

Q.115	<b>To evaluate cytotoxic potential of any anti-cancer drug, which is the molecule of choice?</b>	
	A	<sup>3</sup> H Thymidine
	B	<sup>3</sup> H Uridine
	C	<sup>3</sup> H Cytosine
D	<sup>3</sup> H Guanosine	

Q.116	<b>A monoclonal antibody binds to G-actin but NOT to F-actin. What does this tell you about the epitope recognized by the antibody?</b>	
	A	F-actin does not has the epitope against the antibody
	B	In F-actin enough number of epitopes are not there
	C	In F-actin the epitope is glycosylated and not able to bind
D	The epitope is likely to be a structure that is buried when G-actin polymerizes to F-actin	

Q.117	<b>Glutathione is</b>	
	A	L-Glu-Cys-Gly
	B	L--Glu-Met-Gly
	C	D-Glu-Cys-Ala
D	D-Glu-Cys-Ala	

Q.118	<b>Which one of the following amino acids is optically inactive?</b>	
	A	Glycine
	B	Methionine
	C	Phenylalanine
D	Glutamine	

Q.119	<b>Protein responsible for transport of O<sub>2</sub> from alveoli to the tissue is</b>	
	A	Leghaemoglobin
	B	Oxyhaemoglobin
	C	Haemoglobin
D	Carbaminohaemoglobin	



<b>Q.120</b>	<b>Process of formation of ATP from ADP during photosynthesis is referred to as</b>	
	<b>A</b>	Photophosphorylation
	<b>B</b>	Photorespiration
	<b>C</b>	Phosphorylation
	<b>D</b>	oxidative phosphorylation

<b>Q.121</b>	<b>Glycogen and cellulose are</b>	
	<b>A</b>	Helical and $\beta$ -sheet structure, respectively.
	<b>B</b>	Helical structures but with different degree of helicity.
	<b>C</b>	$\beta$ -sheet structures.
	<b>D</b>	Helical but glycogen is extensively branched molecule.

<b>Q.122</b>	<b>Topoisomerase I does not require ATP even though it does cleavage and ligation of DNA. This is because</b>	
	<b>A</b>	It uses GTP as energy
	<b>B</b>	It conserves the energy liberated during cleavage by binding with tryptophan of an enzyme and reused
	<b>C</b>	This reaction does not require energy
	<b>D</b>	It conserves the energy liberated during cleavage by binding with tyrosine of an enzyme and reused

<b>Q.123</b>	<b>A synthetic mRNA of repeating sequence 5'-CACACACACACACAC... is used for a cell-free protein synthesizing system like the one used by Nirenberg. If we assume that protein synthesis can begin without the need for an initiator codon, what product or products would you expect to occur after protein synthesis?</b>	
	<b>A</b>	one protein, consisting of a single amino acid
	<b>B</b>	two proteins, each with an alternating sequence of two different amino acids
	<b>C</b>	one protein, with an alternating sequence of three different amino acids
	<b>D</b>	one protein, with an alternating sequence of two different amino acids

**Q.124**

You have obtained a sample of DNA, and you transcribe mRNA from this DNA and purify it. You then separate the two strands of the DNA and analyze the base composition (%) of each strand and of the mRNA. You obtain the data shown in the table below. Which strand of the DNA is the coding strand, serving as a template for mRNA synthesis?

	A	G	C	T	U
DNA strand 1	39.1	26.0	31.0	14.9	0
DNA strand 2	14.2	30.8	25.7	38.3	0
mRNA	39.0	25.9	30.8	0	14.6

**A** Strand 1

**B** Strand 2

**C** Both strands 1 and 2

**D** Neither strand 1 nor 2

**Q.125**

**Which one of the following tools of recombinant DNA technology is INCORRECTLY paired with its applications?**

**A** restriction endonuclease - production of DNA fragments for gene cloning.

**B** DNA ligase - enzyme that cuts DNA, creating sticky ends.

**C** DNA polymerase - copies DNA sequences in the polymerase chain reaction.

**D** reverse transcriptase - production of cDNA from mRNA.

**Q.126**

**Among the six types of plant cation channels identified, the shaker channels have been most thoroughly characterized. The shaker channels are highly selective to which one of the following cations?**

**A** Na<sup>+</sup>

**B** K<sup>+</sup>

**C** Ca<sup>2+</sup>

**D** Mg<sup>2+</sup>

<b>Q.127</b>	<b>The process of oxidation of plastoquinone (PQH<sub>2</sub>) molecule during light reaction of photosynthesis takes place in which of the following major protein complexes of the thylakoid membrane?</b>	
	<b>A</b>	ATP Synthase
	<b>B</b>	Photosystem I
	<b>C</b>	Photosystem II
	<b>D</b>	Cytochrome b6f

<b>Q.128</b>	<b>In a metabolic engineering experiment the flux from primary carbon metabolism was diverted towards methylerythritol phosphate (MEP) pathway. Which one of the following secondary metabolites will be maximally synthesized?</b>	
	<b>A</b>	Alkaloids
	<b>B</b>	Phenolics
	<b>C</b>	Terpenes
	<b>D</b>	Glucosinolates

<b>Q.129</b>	<b>Which one of the following sequence of events is the first to take place during systemic production of protease inhibitors in young tomato leaves following insect feeding?</b>	
	<b>A</b>	Prosystemin is synthesized.
	<b>B</b>	Systemin is produced.
	<b>C</b>	Jasmonic acid is transported through phloem to other parts of plants.
	<b>D</b>	Systemin is released from damaged cells into apoplast.

<b>Q.130</b>	<b>Which of the following is NOT a typical feature of hypersensitive response observed in plants during the attack of invading microbes?</b>	
	<b>A</b>	Cells immediately surrounding the infection site die rapidly.
	<b>B</b>	Often preceded by rapid accumulation of reactive oxygen species.
	<b>C</b>	Results in increase in net photosynthesis rate.
	<b>D</b>	A rapid spike of nitric oxide production accompanies the oxidative burst in the infected leaves.

Q.131	<b>Plants carrying a transgene for glyphosate resistance will survive a field application of glyphosate that kills weeds. Which of the following enzyme is inhibited by glyphosate?</b>	
	A	Phosphoglycerate
	B	Phosphoglycolatephosphatase
	C	Enolpyruvate shikimate -3 – phosphate synthase
D	Glycolate dehydrogenase	

Q.132	<b>A haploid sperm from one species and a haploid egg from another species may form a diploid interspecies hybrid. Meiosis in these plants generally fails but can lead to rare duplicated gametes called</b>	
	A	Aneuploid
	B	Autopolyploid
	C	Heteropolyploid
D	Allopolyploid	

Q.133	<b>Genes essential for embryo organization have been identified by mutant analysis. Which one of the following mutants shows reduction or inhibition of cotyledons and shoot apical meristem?</b>	
	A	FACKEL
	B	GNOM
	C	MONOPTEROS
D	GURKE	

Q.134	<b>Which one of the following is true for the polymer-trapping model of sugar diffusion in plant cells?</b>	
	A	sucrose should be less concentrated in the mesophyll than in intermediary cells.
	B	Sucrose should be more concentrated in the mesophyll than in the intermediary cells.
	C	Sucrose concentration should be equal in mesophyll and intermediary cells.
D	Sucrose should be hydrolysed.	

<b>Q.135</b>	<b>The T-DNA of Agrobacterium must be excised from its circular plasmid for its transfer into plant cells. Which one of the following complexes of Vir proteins is responsible for DNA nick at the left and right border sequences?</b>	
	<b>A</b>	VirA/VirC
	<b>B</b>	VirB6/VirB7
	<b>C</b>	VirD1/VirD2
	<b>D</b>	VirE2/VirG

<b>Q.136</b>	<b>What will happen to the growth of a vertically growing root if half of the root cap is removed?</b>	
	<b>A</b>	It will bend towards the side with remaining half of the root cap.
	<b>B</b>	It will bend opposite to the side with remaining half of the root cap.
	<b>C</b>	The root growth will be inhibited.
	<b>D</b>	The root will keep growing gravitropically.

<b>Q.137</b>	<b>GA2-oxidase cDNA from bean is overexpressed in wheat plant by genetic engineering. Which one of the following phenotypes correctly describes the resultant transgenic plant?</b>	
	<b>A</b>	The plant will be taller.
	<b>B</b>	The plant will be shorter.
	<b>C</b>	There will be no change in height.
	<b>D</b>	The plant will not survive.

<b>Q.138</b>	<b>Which one of the following statements is NOT correct regarding ethylene signaling in plants?</b>	
	<b>A</b>	Ethylene binding inactivates ethylene receptors.
	<b>B</b>	In the absence of ethylene the receptors are inactive and suppress the ethylene response.
	<b>C</b>	Disrupted ethylene receptors are inactive in the presence or absence of ethylene leading to constitutive ethylene response.
	<b>D</b>	Missense mutation at binding site makes receptor insensitive to ethylene and could shut off the ethylene response.

<b>Q.139</b>	<b>Leaf abscission is a phenomenon regulated by the amount of auxin and ethylene. Which one of the following statements is correct regarding the amount of auxin and ethylene during leaf abscission?</b>	
	<b>A</b>	Reduction in ethylene and increase in auxin.
	<b>B</b>	Increase in both ethylene and auxin.
	<b>C</b>	Reduction in auxin and increase in ethylene.
	<b>D</b>	Decrease in both ethylene and auxin.

<b>Q.140</b>	<p>Transgenic plants were developed with a gene conferring kanamycin resistance. Four independent <math>T_0</math> events were selfed and <math>\sim 100</math> <math>T_1</math> seeds were germinated on kanamycin. The number of kanamycin sensitive (<math>Kan^S</math>) and kanamycin resistant (<math>Kan^R</math>) progeny obtained in each case is listed below:</p> <table border="1" data-bbox="636 764 1131 1123"> <thead> <tr> <th>Transgenic Line No.</th> <th><math>Kan^R</math></th> <th><math>Kan^S</math></th> </tr> </thead> <tbody> <tr> <td>One</td> <td>95</td> <td>7</td> </tr> <tr> <td>Two</td> <td>72</td> <td>25</td> </tr> <tr> <td>Three</td> <td>51</td> <td>47</td> </tr> <tr> <td>Four</td> <td>11</td> <td>87</td> </tr> </tbody> </table> <p>Identify the line where the transgene has integrated at a single locus.</p>		Transgenic Line No.	$Kan^R$	$Kan^S$	One	95	7	Two	72	25	Three	51	47	Four	11	87
	Transgenic Line No.	$Kan^R$	$Kan^S$														
	One	95	7														
	Two	72	25														
	Three	51	47														
Four	11	87															
<b>A</b>	Line One																
<b>B</b>	Line Two																
<b>C</b>	Line Three																
<b>D</b>	Line Four																

<b>Q.141</b>	<b>Using transgenic technology male sterile plants are developed by</b>	
	<b>A</b>	Expressing barnase gene in tapetum.
	<b>B</b>	Targeting barnase protein to tapetum.
	<b>C</b>	Expressing barnase gene in tapetum and barstar gene in the rest of the plant.
	<b>D</b>	Expressing barnase gene in tapetum and targeting barstar protein in the rest of the plant.

<b>Q.142</b>	<b>One of the concerns in commercial usage of transgenic plants is the spread of transgene through pollen flow. Which one of the following methods can be used to circumvent this problem?</b>	
	<b>A</b>	Use of terminator technology
	<b>B</b>	Chloroplast transformation
	<b>C</b>	Developing male sterile lines
	<b>D</b>	Planting of refugia

<b>Q.143</b>	<b>Which one of the following can be used as a selection marker for developing transgenic plants?</b>	
	<b>A</b>	green fluorescent protein
	<b>B</b>	$\beta$ -glucuronidase
	<b>C</b>	$\beta$ -galactosidase
	<b>D</b>	hygromycin phosphotransferase

<b>Q.144</b>	<b>Ac transposon is a /an</b>	
	<b>A</b>	Non-autonomous element
	<b>B</b>	Autonomous element
	<b>C</b>	Retrotransposon
	<b>D</b>	Intron

<b>Q.145</b>	<b>SSR is said to be a -----type of marker</b>	
	<b>A</b>	Dominant
	<b>B</b>	Co-dominant
	<b>C</b>	Recessive
	<b>D</b>	Epistatic

<b>Q.146</b>	<b>Direct DNA uptake by protoplasts can be stimulated by</b>	
	<b>A</b>	Polyethylene glycol
	<b>B</b>	Sucrose
	<b>C</b>	$\text{CaCl}_2$
	<b>D</b>	$\text{LiCl}$

<b>Q.147</b>	<b>Aroma in rice is due to</b>	
	<b>A</b>	Acetyl choline
	<b>B</b>	4-benzyl pyrroline
	<b>C</b>	2-ethyl pyrroline
	<b>D</b>	2-acetyl-1-pyrroline

<b>Q.148</b>	<b>The male sterile cytoplasm in pearl millet is</b>	
	<b>A</b>	Milo
	<b>B</b>	CK 60A
	<b>C</b>	Tift 23A
	<b>D</b>	W.A

<b>Q.149</b>	<b>The pathogen against which the crop rotation can be adopted</b>	
	<b>A</b>	Soil invader
	<b>B</b>	Soil inhabitant
	<b>C</b>	Soil-borne
	<b>D</b>	Biotrophic

<b>Q.150</b>	<b>Iodine test is used in the detection of</b>	
	<b>A</b>	Bacterial leaf blight of rice
	<b>B</b>	Tungro virus
	<b>C</b>	Rice Blast
	<b>D</b>	Bacterial leaf streak

<b>Q.151</b>	<b>When urea-denatured inclusion bodies are renatured, protein aggregates can sometimes be found due to misfolding. For small proteins with no disulphide linkages and a single domain, the probability of misfolding is the highest when</b>	
	<b>A</b>	urea is diluted stepwise
	<b>B</b>	urea is diluted in a single step
	<b>C</b>	glutathione(s) addition is not done.
	<b>D</b>	pH of urea solution is adjusted to 7.0-7.5



<b>Q.152</b>	<b>The net charge of a protein may not be sufficient to determine whether a protein will bind to an ion exchanger. This is due to</b>	
	<b>A</b>	The presence of hydrophobic patches on the protein surface
	<b>B</b>	Heterogeneous spatial distribution of charged amino acids
	<b>C</b>	The presence of repeating motifs in some proteins
	<b>D</b>	The strong hydration potential of protein

<b>Q.153</b>	<b>In a large scale high cell density fed batch reactor, which one of the following statements is true?</b>	
	<b>A</b>	Dissolved oxygen starvation occurs at the top and glucose starvation at bottom of the fermenter
	<b>B</b>	Dissolved oxygen starvation occurs at the bottom and glucose starvation at top of the fermenter
	<b>C</b>	Both dissolved oxygen and glucose starvation occurs at the top of the fermenter
	<b>D</b>	Both dissolved oxygen and glucose starvation occurs at the bottom of the fermenter

<b>Q.154</b>	<b>Optimum bead loading for cell disruption in a bead mill is</b>	
	<b>A</b>	40-50%
	<b>B</b>	80-90%
	<b>C</b>	60-70%
	<b>D</b>	50-60%

<b>Q.155</b>	<b>In which one of the following membrane separation processes, concentration difference is the driving force?</b>	
	<b>A</b>	Reverse osmosis
	<b>B</b>	Ultra filtration
	<b>C</b>	Cross flow filtration
	<b>D</b>	Dialysis

<b>Q.156</b>	<b>Expanded bed chromatography runs on the principle of</b>	
	<b>A</b>	Fick's law of diffusion
	<b>B</b>	Stroke's law of sedimentation
	<b>C</b>	Darcy's equation
	<b>D</b>	Karman and Kozney Equation

<b>Q.157</b>	<b>Which one of the following statements pertaining to ultrafiltration is INCORRECT?</b>	
	<b>A</b>	In symmetric membranes entire membrane thickness acts as selective barrier
	<b>B</b>	In asymmetric membrane only a thin top layer determines the selective barrier
	<b>C</b>	All molecules below the Molecular Weight Cut Off (MWCO) – value will be retained on the membrane while all the other molecules will be permeated
	<b>D</b>	Membrane processes can be distinguished according to the type of driving force

<b>Q.158</b>	<b>Which one of the following factors affects the morphology of fungal biomass the least?</b>	
	<b>A</b>	Inoculum size
	<b>B</b>	Media composition
	<b>C</b>	Incubation pH
	<b>D</b>	Agitation rate

<b>Q.159</b>	<b>In order to fractionate particles based on size; which of the following centrifuges is best suited?</b>	
	<b>A</b>	Tubular centrifuge
	<b>B</b>	Multichamber centrifuge
	<b>C</b>	Disk stack centrifuge
	<b>D</b>	Decanter centrifuge

<b>Q.160</b>	<b>Which one of the following purification steps always requires a high initial ionic strength in the sample?</b>	
	<b>A</b>	Ion exchange chromatography
	<b>B</b>	Hydrophobic interaction chromatography
	<b>C</b>	Chromatofocusing
	<b>D</b>	Gel filtration chromatography

<b>Q.161</b>	<b>In Sephadex G series (gel filtration) as the G number increases from 10, 15, 25....200, the pore size of the beads</b>	
	<b>A</b>	Decreases
	<b>B</b>	Increases
	<b>C</b>	remains constant
	<b>D</b>	varies from manufacturer to manufacturer

<b>Q.162</b>	<b>In a large scale bioreactor with fungal fermentation, the dissolved oxygen concentration gradient is primarily due to the</b>	
	<b>A</b>	large volume of the reactor
	<b>B</b>	small size of agitator
	<b>C</b>	Low air flow rate per unit reactor volume
	<b>D</b>	Pseudoplastic nature of the broth

<b>Q.163</b>	<b>When in a plug flow reactor with low levels of axial mixing, is the maximum product concentration obtained?</b>	
	<b>A</b>	At the exit of reactor
	<b>B</b>	At the inlet of reactor
	<b>C</b>	It's the same throughout the reactor
	<b>D</b>	It depends upon the product formation kinetics

<b>Q.164</b>	<b>The reasons for existence of lag phase in a batch cultivation process in a bioreactor could be due to the following reasons. Identify the best combination from the following. P: low inoculum size Q:low preinoculum size R:stationary phase inoculum S:inoculum not having the same medium as in batch reactor</b>	
	<b>A</b>	P, Q, R and S
	<b>B</b>	P, R and S
	<b>C</b>	P, Q and S
	<b>D</b>	Q only

<b>Q.165</b>	<b>Increasing aeration at a particular rpm does not always lead to increase in oxygen mass transfer in a bioreactor. This is because</b>	
	<b>A</b>	As aeration increases, the bubble size increases.
	<b>B</b>	As aeration increases, the bubble size decreases
	<b>C</b>	Agitator can get flooded leading to inconsistencies in bubble size
	<b>D</b>	Residence time of the bubble does not change

<b>Q.166</b>	<p>If in a fed batch cultivation of recombinant <i>E. coli</i>, feeding of the substrate is based on the following equation <math>F(t) = [\mu V X(t)] / S_F \cdot Y_{XS}</math>. Where <math>\mu</math> is specific growth rate and is maintained constant, <math>F(t)</math> is feed rate, <math>X(t)</math> biomass cell concentration, <math>Y_{XS}</math> is biomass yield coefficient and <math>S_F</math> is the substrate feed concentration. The feed pattern indicates that with increasing time, every cell is receiving the</p>	
	<b>A</b>	same amount of substrate/time
	<b>B</b>	increasing amounts of substrate /time
	<b>C</b>	decreasing amounts of substrate /time
	<b>D</b>	initially increases and then decreases/time

<b>Q.167</b>	<p>Match the <math>K_{La}</math> determination method in Group I with the characteristics of the method in Group II.</p>			
	P.	oxygen balance method	1.	aeration of an actively respiring culture is stopped and switched on again
	Q.	static gassing out technique	2.	yields greater OTR and $K_{La}$ than other methods
	R.	dynamic gassing method	3.	It can be done precisely only at steady state
	S.	sodium sulphite oxidation method	4.	Non respiring biological system is required
<b>A</b>	P-1, Q-2, R-3 and S-4			
<b>B</b>	P-3, Q-4, R-1 and S-2			
<b>C</b>	P-2, Q-4, R-1 and S-3			
<b>D</b>	P-4, Q-2, R-1 and S-3			

Q.168	<b>Under unaerated condition in a fermentor, the power consumed by a single impeller was 10,000 W. The diameter of the impeller D is 1m and the density of the medium is 1000 kg/m<sup>3</sup> and the stirrer speed is 1s<sup>-1</sup>. If one more impeller is added to the fermentor, power consumption would be approximately</b>	
	<b>A</b>	10,000 W
	<b>B</b>	12,000 W
	<b>C</b>	20,000 W
	<b>D</b>	25,000 W

Q.169	<b>For mixing solid contents in a media mixing tank, inclined blade turbine is used because it</b>	
	<b>A</b>	acts like an axial flow impeller with downward movement of liquid
	<b>B</b>	is more powerful as compared to flat blade turbine and hence better mixing
	<b>C</b>	prevents vortex formation
	<b>D</b>	is a radial flow impeller with sideward movement of liquid

Q.170	<b>In microbial cultivation experiment with cells having significant maintenance requirements, the measured growth yield Y' XS (G) and the true growth yield Y XS</b>	
	<b>A</b>	are equal
	<b>B</b>	Y' XS (G) is greater than Y XS
	<b>C</b>	Y' XS (G) is lesser than Y XS
	<b>D</b>	Y' XS (G) is not related to Y XS

Q.171	The logistic equation for growth of a bacterial culture is given by	
	$X = \frac{X_0 e^{kt}}{1 + \frac{X_0}{\beta} (e^{kt} - 1)}$	
	Where X and X <sub>0</sub> are biomass concentration, k and β are constants. The model depicts that initially when x is small, the growth pattern of the culture would be	
	<b>A</b>	Linear
	<b>B</b>	Cubical
<b>C</b>	Exponential	
<b>D</b>	Inhibited by the theoretical maximum biomass value	

<b>Q.172</b>	<b>In an anaerobic fermentor, broth is agitated intensely at 100rpm in a 3.0 m<sup>3</sup> baffled tank using a Rushton turbine with diameter of 0.5m. If the diameter of the impeller is decreased to 0.25m the mixing time in (seconds) would approximately increase .....fold</b>	
	<b>A</b>	2
	<b>B</b>	4
	<b>C</b>	8
	<b>D</b>	32

<b>Q.173</b>	<b>Culture comprising a B. subtilis strain by inoculating 1g of cells into 1 liter bioreactor. Fermentor containing 10g/l of glucose. The maximum specific growth rate of the culture is 1.0 /h. The biomass yield from glucose is 0.5 g/g. If the residual glucose concentration left out is 1g/l, the final cell concentration in g/l achieved would be around</b>	
	<b>A</b>	4.5
	<b>B</b>	5
	<b>C</b>	5.5
	<b>D</b>	6

<b>Q.174</b>	<b>Continuous stirred tank fermenter is characterized by (biomass concentration X kg/m<sup>3</sup>, residual substrate is S kg/m<sup>3</sup>, S<sub>f</sub>=substrate concentration in feed kg/m<sup>3</sup>, Dilution rate = D and <math>\mu_m \gg D</math> and <math>K_m &lt; S_f</math>, X<sub>D</sub>= the biomass productivity kg/m<sup>3</sup>h. If the dilution rate is doubled to 2D then the new steady state values in comparison with earlier steady state is characterized by</b>	
	<b>A</b>	decreased X, increased S, increased X <sub>D</sub>
	<b>B</b>	X doubles, S unchanged, X <sub>D</sub> unchanged
	<b>C</b>	X unchanged, S=doubles, X <sub>D</sub> unchanged
	<b>D</b>	X unchanged, S=doubles, decreased X <sub>D</sub>

<b>Q.175</b>	Fourier's law of heat conduction $\frac{q}{A} = - \frac{k}{\rho C_p} \frac{d(\rho C_p T)}{dz}$ This equation is very similar to	
	<b>A</b>	Fick's law for mass diffusion
	<b>B</b>	Henderson Hasselbach equation
	<b>C</b>	Stefan Boltzman Law
	<b>D</b>	Monod kinetics

<b>Q.176</b>	<b>A fluidized bed is formed when</b>	
	<b>A</b>	friction is zero
	<b>B</b>	Gravity force is less than fluid friction
	<b>C</b>	Pressure force is equal but acts in opposite direction to the gravity force
	<b>D</b>	Sum of fluid friction and pressure force is equal but opposite to gravity force

<b>Q.177</b>	<b>Batch filtration often characterized by continuous increase of the inlet pressure of slurry, is called the .....filtration</b>	
	<b>A</b>	constant rate
	<b>B</b>	varying pressure
	<b>C</b>	varying rate
	<b>D</b>	constant pressure

<b>Q.178</b>	<b>The most precise method of estimating the metabolic heat produced in an aerobic fermentation process is by</b>	
	<b>A</b>	Measuring oxygen uptake
	<b>B</b>	Measuring CO2 production
	<b>C</b>	Measuring biomass production
	<b>D</b>	Measuring both biomass and product

<b>Q.179</b>	<b>The ethanol yield per unit mass of substrate consumed (Y<sub>P/S</sub>) in an anaerobic fermentation process can be improved by</b>	
	<b>A</b>	Increasing specific growth rate and increasing maintenance coefficient
	<b>B</b>	Decreasing specific growth rate and increasing maintenance coefficient
	<b>C</b>	Decreasing specific growth rate and decreasing maintenance coefficient
	<b>D</b>	Increasing specific growth rate and decreasing maintenance coefficient

<b>Q.180</b>	<b>Exponentially growing cells increase 10 fold in 10 hours, the time required to increase 5 fold will be .....hours</b>	
	<b>A</b>	$5 \log 10$
	<b>B</b>	5
	<b>C</b>	$\log_{10}/\log 5$
	<b>D</b>	$10 \log 5$

<b>Q.181</b>	<b>There are five classes of immunoglobulins [Ig]: IgM, IgG, IgD, IgA and IgE. Upon stimulation of B cells through B cell receptor and a switch factor, which one of the following Ig classes does NOT switch?</b>	
	<b>A</b>	IgM
	<b>B</b>	IgG
	<b>C</b>	IgD
	<b>D</b>	IgE



<b>Q.182</b>	<b>For quantitation of an antigen, researchers A, B, C and D used the following set-up. Which one of the following set up is the most sensitive?</b>	
	<b>A</b>	Antigen-coated plates were directly probed with HRP-labelled antigen-specific antibody
	<b>B</b>	Antigen-specific antibody coated plates were trapped with the antigen, followed by direct probing with HRP-labelled antigen-specific antibody
	<b>C</b>	Antigen-specific antibody captured antigen was probed with biotin-labelled antibody that is specific to the antigen, followed by streptavidin-HRP
<b>D</b>	Antigen-specific antibody coated plates were trapped with the antigen, sequentially followed by antigen-specific antibody, a secondary antibody specific to this antibody, an HRP-labelled tertiary antibody specific to the secondary antibody	

<b>Q.183</b>	<b>A mouse deficient in ROR-gammaT will be deficient in</b>	
	<b>A</b>	T-reg cells
	<b>B</b>	Th1 cells
	<b>C</b>	Th2 cells
<b>D</b>	Th17 cells	

<b>Q.184</b>	<b>The specificity in IFN-<math>\alpha/\beta</math> induced response comes from</b>	
	<b>A</b>	Phosphorylated homodimer of STAT-1/STAT-1
	<b>B</b>	A complex of IRF9, STAT-1 and STAT2 binding to ISRE sequence
	<b>C</b>	Phosphorylated homodimer of STAT-1/STAT-2
<b>D</b>	A complex of IRF9, STAT-1 and STAT2 binding to GAS sequence	

<b>Q.185</b>	<b>CD152-deficient mice have lymphoproliferative disorder. The disorder is characterized by</b>	
	<b>A</b>	Exaggerated B cell proliferation
	<b>B</b>	Very high T cell proliferation
	<b>C</b>	Very high NK T cell proliferation
<b>D</b>	No proliferation of B cells and T cells in response to antigenic stimulation	

<b>Q.186</b>	<b>MHC class-II molecule can signal because it</b>	
	<b>A</b>	has a long cytoplasmic domain where signaling molecules can bind
	<b>B</b>	has a transmembrane domain that interacts with membrane signaling molecules
	<b>C</b>	interacts with membrane receptors to make a supramolecular complex that signals
	<b>D</b>	is internalized immediately after ligand binding and results in signaling

<b>Q.187</b>	<b>The T cells in CD28-deficient mice do not proliferate in response to re-exposure to the same antigen. This is because</b>	
	<b>A</b>	the T cells cannot memorize the antigenic specificity
	<b>B</b>	the T cells do not secrete interleukin-2 at all
	<b>C</b>	the T cells are rendered Anergic
	<b>D</b>	the T cells die immediately after antigen re-exposure

<b>Q.188</b>	<b>CD1 molecules are unique antigen-presenting molecules because they</b>	
	<b>A</b>	are non-MHC Class-I molecules
	<b>B</b>	structurally mimic MHC Class-II molecules
	<b>C</b>	are MHC Class-I-like molecules presenting lipid and glycolipid antigens
	<b>D</b>	are non-MHC Class-II molecules

<b>Q.189</b>	<b>Mutations in common gamma chain of receptors for IL-2 cytokine family cause</b>	
	<b>A</b>	Leukocyte adhesion deficiency
	<b>B</b>	Hyper-IgM syndrome
	<b>C</b>	Goodpasture syndrome
	<b>D</b>	X-L SCID syndrome

<b>Q.190</b>	<b>Which one of the following conditions generally favours tumour development?</b>	
	<b>A</b>	Hyper gammaglobulinemia
	<b>B</b>	Impaired innate immunity
	<b>C</b>	Impaired cell mediated immunity
	<b>D</b>	Impaired humoral immunity

<b>Q.191</b>	<b>Which one of the following is NOT a single gene disease?</b>	
	<b>A</b>	Duchenne Muscular Dystrophy
	<b>B</b>	Hemophilia A
	<b>C</b>	Spinal muscular atrophy
	<b>D</b>	Turner syndrome

<b>Q.192</b>	<b>Dental plaque is an example of the formation of</b>	
	<b>A</b>	Calcium deposition
	<b>B</b>	Endotoxin
	<b>C</b>	Biofilm
	<b>D</b>	Exotoxin

<b>Q.193</b>	<b>Rheumatic fever is a complication of</b>	
	<b>A</b>	Streptococcal pharyngitis
	<b>B</b>	Tuberculous meningitis
	<b>C</b>	Pneumonia
	<b>D</b>	Whooping cough

<b>Q.194</b>	<b>Undulant fever is a characteristic of</b>	
	<b>A</b>	Tuberculosis
	<b>B</b>	Brucellosis
	<b>C</b>	Botulism
	<b>D</b>	Listeriosis

<b>Q.195</b>	<b>Bubonic plague is the infection of</b>	
	<b>A</b>	Spleen
	<b>B</b>	Liver
	<b>C</b>	Lungs
	<b>D</b>	Lymph nodes

<b>Q.196</b>	<b>Leptospirosis is transmitted by exposure to animal</b>	
	<b>A</b>	Urine and meat products
	<b>B</b>	Fecal matter and milk products
	<b>C</b>	Vectors and water
	<b>D</b>	Urine and milk products

<b>Q.197</b>	<b>Which one of the following is correct when Na ion concentration in the bathing fluid of a squid giant axon is less than that present in sea water, but the osmotic pressure is maintained by substituting it with choline chloride?</b>	
	<b>A</b>	Hyperpolarization in membrane potential
	<b>B</b>	The amplitude of the action generated in the nerve fibre will be higher than normal action potential in sea water
	<b>C</b>	Depolarization in membrane potential
	<b>D</b>	The amplitude of the action potential generated in the nerve fibre will be lower than normal action potential in sea water

<b>Q.198</b>	<b>When Tetrodotoxin is administered in bathing medium of a nerve fibre during voltage clamp experiments the membrane current may show which one of the following changes?</b>	
	<b>A</b>	(A) Absence of outward membrane current
	<b>B</b>	Absence of inward membrane current
	<b>C</b>	Higher amplitude of outward membrane current
	<b>D</b>	Higher amplitude of inward membrane current

<b>Q.199</b>	<b>The arrival of the action potential in a presynaptic knob initiates quantal release of neurotransmitter by influx of Ca ions, which may act by</b>	
	<b>A</b>	Changing the viscosity of cytoplasm and thereby increasing the Brownian movements of synaptic vesicles
	<b>B</b>	Activating calcium-calmodulin protein kinase
	<b>C</b>	Dephosphorylating clathrin
	<b>D</b>	Phosphorylation of dynamin

<b>Q.200</b>	<b>Which one of the following changes will occur when the external K<sup>+</sup> ion concentration in the neuromuscular junction of skeletal muscles is increased?</b>	
	<b>A</b>	The rate of occurrence of MEPP is increased
	<b>B</b>	The amplitude of MEPP is increased
	<b>C</b>	The rate of occurrence of MEPP is decreased
	<b>D</b>	The amplitude of MEPP is decreased

<b>Q.201</b>	<b>The black widow spider venom, alpha-latrotoxin produces its neurotoxicity by</b>	
	<b>A</b>	Blocking calcium ion channels in the active zone
	<b>B</b>	Binding with neurexin resulting in a massive discharge of synaptic vesicles
	<b>C</b>	Binding with SNAP-25 causes blocking of exocytosis
	<b>D</b>	Destructing syntaxin causes inhibition of the docking of vesicles

<b>Q.202</b>	<b>The generalized seizure is due to the activity of</b>	
	<b>A</b>	Voltage dependent K ion channels
	<b>B</b>	GABAA channels
	<b>C</b>	T-type Ca ion channels
	<b>D</b>	AMPA receptor channels

<b>Q.203</b>	<b>Which one of the following genes is related with the late-onset of Alzheimer's disease?</b>	
	<b>A</b>	Amyloid precursor protein (APP)
	<b>B</b>	Presenilin 1
	<b>C</b>	Apolipoprotein E4
	<b>D</b>	Presenilin 2

<b>Q.204</b>	<b>The first genetic maps that were developed used genes as markers because</b>	
	<b>A</b>	the phenotype governed by the gene could be visually identified and its inheritance pattern followed.
	<b>B</b>	the location of the gene on the chromosome could be easily observed by the banding patterns like in the polytene chromosomes.
	<b>C</b>	the genes specifying a given phenotype could be easily cloned.
	<b>D</b>	genes spanned larger regions than the current day DNA markers like SNPs.

<b>Q.205</b>	<p>In <i>E. coli</i> four Hfr strains donate the following genetic markers, shown in the order donated</p> <p style="margin-left: 40px;">Strain 1: A D C E Q</p> <p style="margin-left: 40px;">Strain 2: A K M T Y</p> <p style="margin-left: 40px;">Strain 3: C E Q W X</p> <p style="margin-left: 40px;">Strain 4: M T Y X W</p> <p>All these HFr strains are derived from the same F<sup>+</sup> strain. What is the order of these markers on the circular chromosome of the original F<sup>+</sup>?</p>	
	<b>A</b>	A D C E Q W X Y T M K A
	<b>B</b>	Y T M K A D C E Q W X Y
	<b>C</b>	D C E Q A K M T Y X W D
	<b>D</b>	C E Q W X Y T M A K D C

<b>Q.206</b>	<b>Which of the following statements is true?</b>	
	<b>A</b>	There is a lesser probability for a crossover to occur between 2 genes farther apart from the genes nearer to each other.
	<b>B</b>	There is a greater probability for a crossover to occur between 2 genes farther apart from the genes nearer to each other.
	<b>C</b>	Probability of crossover between 2 genes is not related to the distance between them.
	<b>D</b>	Maximum frequency of recombination that can result from crossing over between linked genes is 100%.

<b>Q.207</b>	<b>In which one of the following evolutionary processes, random changes in allele frequency can lead to a loss of genetic diversity?</b>	
	<b>A</b>	Recombinational event
	<b>B</b>	Frequency –dependent selection
	<b>C</b>	Genetic drift
	<b>D</b>	Spontaneous selection

<b>Q.208</b>	<b>In human pointed eyebrows are dominant to smooth eyebrows and widow's peak (downward pointed frontal hairline) is dominant to continuous hairline. What phenotypic ratio would you expect in the offspring from a cross between an individual heterozygous for both genes and an individual homozygous recessive for both genes?</b>	
	<b>A</b>	9:3:3:1
	<b>B</b>	1:01
	<b>C</b>	1:1:1:1
	<b>D</b>	9:03:04

<b>Q.209</b>	<b>The character regulated by a holandric gene</b>	
	<b>A</b>	passes from the father through the son to the grandson.
	<b>B</b>	passes from the father through the daughter to the grandsons.
	<b>C</b>	passes from the mother through the daughter to the granddaughter.
	<b>D</b>	passes from the mother through the daughter to the grandson.

<b>Q.210</b>	<b>Necrosis that develops in tissues subsequent to denaturation of structural and enzymatic proteins soon after death is appropriately referred to as</b>	
	<b>A</b>	Fat necrosis
	<b>B</b>	Liquefactive necrosis
	<b>C</b>	Coagulative necrosis
	<b>D</b>	Caseous necrosis

<b>Q.211</b>	<b>The demyelination of the central nervous system white matter produced by the canine distemper virus is an example of</b>	
	<b>A</b>	Fat necrosis
	<b>B</b>	Coagulation necrosis
	<b>C</b>	Zenker's necrosis
	<b>D</b>	Liquefactive necrosis

<b>Q.212</b>	<b>Catarrhal exudate is observed in</b>	
	<b>A</b>	Stomach of a dog
	<b>B</b>	Brain of a cow
	<b>C</b>	Small intestine of a cat
	<b>D</b>	Trachea of a horse

<b>Q.213</b>	<b>Sudden onset of heavy mortality in chicken with cyanotic comb and wattles, closed eyes and a semicomatose state are characteristic features of</b>	
	<b>A</b>	Fowl plague
	<b>B</b>	Newcastle disease
	<b>C</b>	Blue comb
	<b>D</b>	Infectious bronchitis.

<b>Q.214</b>	<b>Most prominent initial symptom of Vitamin A deficiency in cows and horses is</b>	
	<b>A</b>	Copius lacrymation
	<b>B</b>	Copius salivation
	<b>C</b>	Xerophthalmia
	<b>D</b>	Night blindness

<b>Q.215</b>	<b>Hydropericardium syndrome is otherwise known as</b>	
	<b>A</b>	Leechi heart disease
	<b>B</b>	Chicken flu
	<b>C</b>	EDS 76
	<b>D</b>	Chicken heart attack

<b>Q.216</b>	<b>Scombroid Fish Poisoning is due to the high levels of free ----- in fish tissue</b>	
	<b>A</b>	Histidine
	<b>B</b>	Proline
	<b>C</b>	Glutamate
	<b>D</b>	Aspartate



<b>Q.217</b>	<b>The synthetic equivalent of neuropharmacologically active peptides obtained from the marine snail <i>Conus magus</i> is</b>	
	<b>A</b>	Zinconotide
	<b>B</b>	Discodermin
	<b>C</b>	Didemnins
	<b>D</b>	Dolastatins

<b>Q.218</b>	<b>Prophenol Oxidase-mediated immune system is found in</b>	
	<b>A</b>	Crustaceans
	<b>B</b>	Coelenterates
	<b>C</b>	Tunicates
	<b>D</b>	Protozoans

<b>Q.219</b>	<b>Bryostatin is a marine derived anticancer agent obtained from</b>	
	<b>A</b>	<i>Tethya crypta</i>
	<b>B</b>	<i>Salinospora tropica</i>
	<b>C</b>	<i>Bugula neritina</i>
	<b>D</b>	<i>Trididemnum solidum</i>

<b>Q.220</b>	<b>Viral encephalopathy and retinopathy in fishes are caused by</b>	
	<b>A</b>	Betanodavirus
	<b>B</b>	Rhabdovirus
	<b>C</b>	Baculovirus
	<b>D</b>	Rotavirus

<b>Q.221</b>	<b>Environmental gene tags are</b>	
	<b>A</b>	16S rRNA gene signatures from the environment
	<b>B</b>	Habitat-specific functional genes from microbial communities
	<b>C</b>	Non-essential genes from microbial communities
	<b>D</b>	Fluorescently tagged metagenome

<b>Q.222</b>	<b>Which one of the following is NOT true of biophotolysis?</b>	
	<b>A</b>	It is a photoheterotrophic process
	<b>B</b>	It is a photoautotrophic process
	<b>C</b>	H <sub>2</sub> O is the electron donor in the process
	<b>D</b>	[FeFe]-hydrogenase catalyses the reaction

<b>Q.223</b>	<b>Which is NOT a characteristic of a plasmid used for production of DNA vaccines in fish?</b>	
	<b>A</b>	Promoter- and enhancer sequences
	<b>B</b>	Poly-adenylation sequence
	<b>C</b>	Transcriptional termination sequence
	<b>D</b>	Poly-T- tail

<b>Q.224</b>	<b>White spot syndrome virus has</b>	
	<b>A</b>	vertical transmission
	<b>B</b>	horizontal transmission
	<b>C</b>	both vertical and horizontal transmission
	<b>D</b>	an intermediate host

<b>Q.225</b>	<b>Haemorrhagic septicemia in carp is caused by</b>	
	<b>A</b>	Vibrio parahaemolyticus
	<b>B</b>	Staphylococcus aureus
	<b>C</b>	Aeromonas hydrophila
	<b>D</b>	Streptococcus sp

<b>Q.226</b>	<b>Primary aetiology of Epizootic Ulcerative Syndrome is</b>	
	<b>A</b>	IHHNV
	<b>B</b>	Gregarines
	<b>C</b>	Aphanomyces invadans
	<b>D</b>	Baculovirus

<b>Q.227</b>	<b>Net Primary production (NPP) =</b>	
	<b>A</b>	GPP – respiration
	<b>B</b>	GPP - (R <sub>p</sub> + R <sub>h</sub> + R <sub>d</sub> )
	<b>C</b>	Respiration- GPP
	<b>D</b>	GPP – R <sub>p</sub>

<b>Q.228</b>	<b>The lower, dense region of the atmosphere is known as</b>	
	<b>A</b>	Hydrosphere
	<b>B</b>	Ionosphere
	<b>C</b>	Stratosphere
	<b>D</b>	Troposphere

<b>Q.229</b>	<b>The two most important climatic factors affecting the distribution of world biomes are</b>	
	<b>A</b>	Temperature and precipitation
	<b>B</b>	Latitude and temperature
	<b>C</b>	Altitude and temperature
	<b>D</b>	Humidity and precipitation

<b>Q.230</b>	<b>A high BOD value in aquatic environment is indicative of</b>	
	<b>A</b>	A pollution free system
	<b>B</b>	A highly polluted system due to excess of nutrients
	<b>C</b>	A highly polluted system due to abundant heterotrophs
	<b>D</b>	A highly pure water with abundance of autotrophs

<b>Q.231</b>	<b>Benthic organisms of lakes or sea are usually</b>	
	<b>A</b>	Producer
	<b>B</b>	Herbivores
	<b>C</b>	Carnivores
	<b>D</b>	Decomposers

<b>Q.232</b>	<b>Which of these biomes would you expect to find a coyote living in?</b>	
	<b>A</b>	Desert
	<b>B</b>	Taiga
	<b>C</b>	tropical rain forest
	<b>D</b>	Tundra

<b>Q.233</b>	<b>The Ozone layer saves from lethal UV. It mainly absorbs</b>	
	<b>A</b>	UV-A
	<b>B</b>	UV-B
	<b>C</b>	UV-A & B
	<b>D</b>	UV-B & C

<b>Q.234</b>	<b>The maximum biodiversity in India occurs at</b>	
	<b>A</b>	Western Himalayas
	<b>B</b>	North East Himalayas
	<b>C</b>	Western Ghats
	<b>D</b>	Eastern Ghats

<b>Q.235</b>	<b>Extinction rate is high at</b>	
	<b>A</b>	Main lands
	<b>B</b>	Large islands
	<b>C</b>	Small islands near mainlands
	<b>D</b>	Small island far from mainlands

<b>Q.236</b>	<b>Bootstrapping technique in molecular phylogeny analysis is used to derive additional datasets by</b>	
	<b>A</b>	Swapping the columns in Multiple sequence alignment
	<b>B</b>	Randomising individual sequences
	<b>C</b>	Inserting deletions and insertions
	<b>D</b>	Shuffling the order of sequences

<b>Q.237</b>	<b>Which of the following statements regarding scoring matrices of proteins is incorrect?</b>	
	<b>A</b>	Most scoring matrices are symmetrical.
	<b>B</b>	The scores are log odd ratios of observed vs expected probabilities.
	<b>C</b>	Gap is considered as 21st amino acid in deriving some of the scoring matrices.
	<b>D</b>	Most of the matrices assign highest score to substitution of an amino acid with itself.

<b>Q.238</b>	<b>Trade off between sensitivity and specificity can be represented by</b>	
	<b>A</b>	Receiving Operating Character curve
	<b>B</b>	Positive Predictive value
	<b>C</b>	Principle Component analysis
	<b>D</b>	Regression analysis

<b>Q.239</b>	<b>Which of the following interactions are NOT characteristics of epitope-paratope interactions?</b>	
	<b>A</b>	Hydrogen bond
	<b>B</b>	Disulfide bond
	<b>C</b>	Salt bridges
	<b>D</b>	Van der Waal's

<b>Q.240</b>	<b>While building a model of a protein using homology modeling approach, special care needs to be exercised while assigning conformation of</b>	
	<b>A</b>	Gly from non-Gly residue
	<b>B</b>	Non-Gly from Gly
	<b>C</b>	Arg from Lys
	<b>D</b>	Non-Pro from Pro

<b>Q.241</b>	<b>Which of the following complementarity determining regions (CDRs) of antibodies is sequentially and conformationally the most variable?</b>	
	<b>A</b>	CDR1 of Light chain
	<b>B</b>	CDR3 of Light chain
	<b>C</b>	CDR1 of Heavy chain
	<b>D</b>	CDR3 of Heavy chain

<b>Q.242</b>	<b>The LIS technique is used in the MUMmer algorithm for</b>	
	<b>A</b>	Identification of MUMs
	<b>B</b>	Sorting of MUMs
	<b>C</b>	Alignment of MUMs
	<b>D</b>	Tabulating MUMs

<b>Q.243</b>	<b>The numbers at the internal nodes of a phylogenetic tree indicate</b>	
	<b>A</b>	Number of times the OTUs were clustered together
	<b>B</b>	Number of parsimony sites shared by OTUs
	<b>C</b>	Number of mismatches shared by OTUs
	<b>D</b>	Similarity score of OTUs that cluster together

<b>Q.244</b>	<b>Which one of the following statements is FALSE?</b>	
	<b>A</b>	Needleman & Wunsch algorithm is used for global alignment of pair of sequences.
	<b>B</b>	There could be several possible local alignments as part of a global alignment.
	<b>C</b>	In Needleman & Wunsch algorithm sequences are randomised by keeping length and composition same.
	<b>D</b>	The terms identity, similarity and homology are expressed as %.

<b>Q.245</b>	<b>Structure determination of myoglobin in 1958 revealed that the protein consists mostly of</b>	
	<b>A</b>	Right-handed $\alpha$ -helices
	<b>B</b>	Left-handed $\alpha$ -helices
	<b>C</b>	$\beta$ -sheets
	<b>D</b>	Random coils

<b>Q.246</b>	<b>One side of a 30-residue <math>\alpha</math>-helix faces the hydrophobic interior of a protein. If the helical wheel of this helix were to be drawn, which of the following residues are likely to be hydrophobic?</b>	
	<b>A</b>	10 <sup>th</sup> , 20 <sup>th</sup> and 30 <sup>th</sup>
	<b>B</b>	1 <sup>st</sup> , 6 <sup>th</sup> , 11 <sup>th</sup> , 16 <sup>th</sup> , 21 <sup>st</sup> and 26 <sup>th</sup>
	<b>C</b>	1 <sup>st</sup> , 4 <sup>th</sup> , 7 <sup>th</sup> , 10 <sup>th</sup> , 13 <sup>th</sup> , 16 <sup>th</sup> , 19 <sup>th</sup> , 22 <sup>nd</sup> , 25 <sup>th</sup> and 28 <sup>th</sup>
	<b>D</b>	1 <sup>st</sup> , 5 <sup>th</sup> , 8 <sup>th</sup> , 12 <sup>th</sup> , 15 <sup>th</sup> , 19 <sup>th</sup> , 22 <sup>nd</sup> , 26 <sup>th</sup> and 30 <sup>th</sup>

<b>Q.247</b>	<b>The dielectric constant of protein interiors is likely to be</b>	
	<b>A</b>	Similar to that of water's, i.e. close to 80
	<b>B</b>	Much smaller than that of water
	<b>C</b>	Much more than that of water
	<b>D</b>	At some places in the interior more and at some other places less than that of water

<b>Q.248</b>	<b>In a helix-turn-helix motif in proteins, which one of the following is true for binding to nucleic acids?</b>	
	<b>A</b>	Both the helices bind
	<b>B</b>	Neither of the two helices bind
	<b>C</b>	Only the 1st helix is important in binding
	<b>D</b>	The 2nd helix is important in binding

<b>Q.249</b>	<b>In the prokaryotic ribosome structure, the peptidyl transferase activity of the ribosomes is found</b>	
	<b>A</b>	Entirely in the ribosomal RNA
	<b>B</b>	Entirely in the ribosomal proteins
	<b>C</b>	Partially embedded in the RNA and partially in the proteins
	<b>D</b>	Ribosomal RNA binds the m-RNA but proteins catalyze peptidyl transferase activity

<b>Q.250</b>	<b>Maximum parsimony analysis in the context of molecular phylogeny implies</b>	
	<b>A</b>	Complex hypotheses are preferred over simpler hypotheses
	<b>B</b>	Complex and simple hypothesis need not be considered
	<b>C</b>	Simpler hypotheses are preferred over complex hypotheses
	<b>D</b>	Both complex and simple hypotheses are considered, and the one, which is more suitable to observations is applied

# ANSWER KEY TO BET-2013 EXAMINATION

Held on 5<sup>th</sup> May 2013

Question No.	Answer
1	C
2	A
3	C
4	C
5	B
6	B
7	D
8	A
9	A
10	A
11	D
12	C
13	D
14	D
15	A
16	A
17	A
18	D
19	B
20	A
21	C
22	A
23	D
24	D
25	D
26	C
27	A
28	B
29	A
30	C
31	B
32	B
33	B
34	A
35	C
36	C
37	D



38	C
39	A
40	C
41	C
42	B
43	A
44	A
45	B
46	A
47	D
48	C
49	C
50	A
51	B
52	C
53	C
54	A
55	A
56	B
57	D
58	C
59	C
60	C
61	A
62	C
63	B
64	A
65	D
66	C
67	C
68	C
69	B
70	A
71	A
72	A
73	D
74	A
75	C
76	A
77	A
78	B
79	B
80	C
81	C

82	B
83	D
84	A
85	A
86	B
87	C
88	B
89	A
90	D
91	C
92	B
93	A
94	C
95	A
96	C
97	A
98	A
99	B
100	B
101	D
102	A
103	D
104	D
105	B
106	D
107	C
108	C
109	D
110	C
111	A
112	D
113	B
114	D
115	A
116	D
117	A
118	A
119	B
120	A
121	A
122	D
123	D
124	A
125	B

126	B
127	D
128	C
129	A
130	C
131	C
132	D
133	D
134	B
135	C
136	A
137	B
138	B
139	C
140	B
141	A
142	B
143	D
144	B
145	B
146	A
147	D
148	C
149	A
150	B
151	A
152	B
153	A
154	B
155	D
156	B
157	C
158	C
159	B
160	B
161	B
162	D
163	A
164	B
165	C
166	A
167	B
168	C
169	A

170	C
171	C
172	C
173	C
174	A
175	A
176	D
177	A
178	A
179	B
180	D
181	C
182	C
183	D
184	B
185	B
186	C
187	C
188	C
189	D
190	C
191	D
192	C
193	A
194	B
195	D
196	A
197	D
198	B
199	B
200	A
201	B
202	C
203	C
204	A
205	B
206	B
207	C
208	C
209	A
210	C
211	D
212	B
213	A

214	A
215	A
216	A
217	A
218	A
219	C
220	A
221	B
222	A
223	D
224	C
225	C
226	C
227	B
228	D
229	A
230	B
231	D
232	D
233	D
234	C
235	D
236	A
237	C
238	A
239	B
240	B
241	D
242	B
243	A
244	D
245	A
246	D
247	B
248	D
249	A
250	C

# Biotechnology Eligibility Test-2014

## (BET-2014) for DBT-JRF Fellowship

Government of India, Ministry of Science & Technology,

Department of Biotechnology, New Delhi

(Coordinated by NCCS, Pune)

April 20, 2014

Total Marks - 375

Duration 10.00 a.m. - 1.00 p.m.

1. The Question Paper consists of multiple choice objective type questions with 4 options out of which only one is correct.
2. **All 75 question in Section A are compulsory.**
3. **Answer any 50 questions from Section B.**
4. In case more than 50 are attempted in Section B, only first 50 will be considered.
5. Each question carries 3 marks; for every wrong answer, one mark will be deducted (-1 negative marking).
6. The examination duration is **180 minutes**. Questions can be answered in any order you like to.

### About Question Paper:

1. Only one question will be displayed on the computer screen at a time. To attempt next question the candidates should click on "**Next**" or to go back click on "**Previous**" button provided at the bottom of the screen
2. The candidates will be given "Sample Test Questions" for practice purpose before they start answering the actual "Examination Questions".
3. The candidate should click with the mouse on the correct choice, from given 4 options for the right Answer. In case, the candidate does not wish to attempt the question it can be left blank.
4. The candidate can choose to change the option of a question later by selecting a new option in case he/she wishes to. In case student does not want to answer the question,

he/she can deselect the answer by clicking the “Erase Answer” link provided against the question.

5. The questions can be answered in any order within the given time frame.

6. **The list of attempted and un-attempted questions is shown in the right side of the screen. You can click on any of the attempted ones to revise the answers in case you wish so.**

7. To move back and forth between questions, candidates should use the “Next”/ “Previous” button/ or should click on the question number displayed at the right side of the screen.

8. The answers will be saved whenever the candidate goes for next question, by clicking on “Next”/ “Previous” button

9. After the expiry of 180 minutes, if the candidates is not able to attempt any question or click the answers a nil result will be saved automatically by the computer system even if he/ she does not click the “Preview Submit” button.

10. If a student finishes the paper within the stipulated time, he/she can end the examination by clicking the PREVIEW SUBMIT button. **Once the submission is done, the examination cannot be restarted.** So please be careful before pressing **PREVIEW SUBMIT** button. However, students will not be allowed to leave the examination hall till the end of the stipulated time.

## SECTION - A

Q1	Question/ Options	Mr. X, Mr. Y and Mr. Z went to a fruit shop to purchase apples and oranges at a fixed price for each orange and apple. The transaction amount for each purchase was noted. (I) Mr. X purchased 8 oranges and 4 apples (II) Mr. Y purchased 16 oranges and 8 apples (III) Mr. Z purchased 6 oranges and 5 apples. The individual prices of oranges and apples can be obtained by which one of the following?
	Option 1	(I) and (II)
	Option 2	(I) and (III) or (II) and (III)
	Option 3	(I), (II) and(III)
	Option 4	Insufficient data.

Q2	Question/ Options	A watch repair man noticed that the clock under repair showed 12 minutes slow at 10:00 PM. He made an adjustment and went home. Next day at 10:00 AM, the clock showed 10:12 AM. At what time the clock would have shown the correct time?
	Option 1	3:48 AM
	Option 2	4:00 AM
	Option 3	4:12 AM
	Option 4	5.00 AM
Q3	Question/ Options	In a class of 15, the mean marks for a unit examination was 25 with a standard deviation 0. The correct interpretation is:
	Option 1	Half the class had scores less than 25
	Option 2	There was a high correlation between ability and grade
	Option 3	Everyone had a score of exactly 25.
	Option 4	Half the class had 0's and half had 25s
Q4	Question/ Options	A person travelled 3 km towards west and continued walking 4 km towards north. The shortest distance from the point of starting to current position is
	Option 1	7 km
	Option 2	5 km
	Option 3	1 km
	Option 4	2 km
Q5	Question/ Options	Mohan is 18th from either end of a row of boys? How many boys are there in that row ?
	Option 1	26
	Option 2	32
	Option 3	37
	Option 4	35
Q6	Question/ Options	'Soldier' is related to 'Army' in the same way as 'Pupil' is related to _____
	Option 1	Education
	Option 2	Teacher
	Option 3	Student
	Option 4	Class
Q7	Question/ Options	What should come in the place of 'X' in the following series: 3, 8, 6, 14, X, 20 ?
	Option 1	11
	Option 2	10
	Option 3	8
	Option 4	9





Q12	Question/ Options	A 300 bp long B- form of plasmid DNA has 20 complete turns. This DNA molecule is:
	Option 1	Positively supercoiled
	Option 2	Negatively supercoiled
	Option 3	Relaxed
	Option 4	Cannot be predicted
Q13	Question/ Options	Which one of the following sequences is a palindrome?
	Option 1	5' ACGGATTCGC 3'
	Option 2	5' ATGCCG 3'
	Option 3	5' CCATT 3'
	Option 4	5'AGGCCT3'
Q14	Question/ Options	The nucleotide sequence in an mRNA is 5' UAA AUG ACC CAU UGG UCU CGU UAG AAA AAA 3'. Assuming that ribosomes could translate this mRNA, how many amino acids long would you expect the resulting polypeptide chain to be?
	Option 1	6
	Option 2	7
	Option 3	10
	Option 4	5
Q15	Question/ Options	The difference between two numbers is 4 and the difference of their squares is 152. The sum of these two numbers is
	Option 1	44
	Option 2	38
	Option 3	30
	Option 4	40
Q16	Question/ Options	One ml of NADH solution gave absorbance of 0.31 O.D. at 340 nm wavelength with 1 cm cuvette path length. Calculate the molarity of NADH in this solution. ( $\epsilon_{340}=6220 \text{ M}^{-1} \text{ cm}^{-1}$ , mol wt. of NADH = 663 Da)
	Option 1	50 $\mu\text{M}$
	Option 2	50 nM
	Option 3	5 $\mu\text{M}$
	Option 4	500 nM

Q17	Question/ Options	Number of molecules present in 1 ml of 250 $\mu\text{g}$ per ml solution of 10 kDa protein will be - (Avogadro's number is $6.022 \times 10^{23}$ molecules per mole)
	Option 1	$1.50 \times 10^{16}$
	Option 2	$15.0 \times 10^{16}$
	Option 3	$0.15 \times 10^{16}$
	Option 4	$150 \times 10^{16}$
Q18	Question/ Options	A producer must select a pair consisting of one lead actor and one supporting actor from 6 candidates. The number of possible pairs that could be selected are:
	Option 1	15
	Option 2	30
	Option 3	12
	Option 4	36
Q19	Question/ Options	<p>Read the following passage and answer questions given at the end of the passage:</p> <p>Although the schooling of fish is a familiar form of animal social behavior, how the school is formed and maintained is only beginning to be understood in detail. It had been thought that each fish maintains its position chiefly by means of vision. Our work has shown that, as each fish maintains its position, the lateral line, an organ sensitive to transitory changes in water displacement, is as important as vision. In each species a fish has a "preferred" distance and angle from its nearest neighbor. The ideal separation and bearing, however, are not maintained rigidly. The result is a probabilistic arrangement that appears like a random aggregation. The tendency of the fish to remain at the preferred distance and angle, however, serves to maintain the structure. Each fish having established its position uses its eyes and its lateral lines simultaneously to measure the speed of all the other fish in the school. It then adjusts its own speed to match a weighted average that emphasizes the contribution of nearby fish.</p> <p>According to the above passage, the structure of a fish school is dependent on which of the following?</p>
	Option 1	Rigidly formed random aggregations
	Option 2	Measurements of a weighted average by individual fish.
	Option 3	Instructions from a "leader fish" usually found to be swimming at the head of the school.
	Option 4	The answer is not clear at present.

Q20	Question/ Options	<p>Read the following passage and answer questions given at the end of the passage:</p> <p>Although the schooling of fish is a familiar form of animal social behavior, how the school is formed and maintained is only beginning to be understood in detail. It had been thought that each fish maintains its position chiefly by means of vision. Our work has shown that, as each fish maintains its position, the lateral line, an organ sensitive to transitory changes in water displacement, is as important as vision. In each species a fish has a "preferred" distance and angle from its nearest neighbor. The ideal separation and bearing, however, are not maintained rigidly. The result is a probabilistic arrangement that appears like a random aggregation. The tendency of the fish to remain at the preferred distance and angle, however, serves to maintain the structure. Each fish having established its position uses its eyes and its lateral lines simultaneously to measure the speed of all the other fish in the school. It then adjusts its own speed to match a weighted average that emphasizes the contribution of nearby fish.</p> <p>The passage suggests that, after establishing its position in the school formation, an individual fish will subsequently</p>
	Option 1	Maintain its preferred position primarily by visual and auditory means.
	Option 2	Rigorously avoid changes that would interfere with the overall structure of the school.
	Option 3	Make continuous sensory readjustments to its position within the school.
	Option 4	Surrender its ability to make quick instinctive judgements.
Q21	Question/ Options	The Budh International circuit length is 5.1 km. One Formula 1 driver made 61.5 rounds and stopped the race. What is the net displacement from start light?
	Option 1	313.65
	Option 2	311.1
	Option 3	2.55
	Option 4	0
Q22	Question/ Options	On a bright sunny day, a healthy person (with perfect eyesight) walking on a tar road saw the legs of a deer were "blurred or wavy" on the surface, far ahead of him. This unusual image formation is because of:
	Option 1	Total internal reflection of the light.
	Option 2	Total external reflection of the light into the medium
	Option 3	Total absorption of the light into the surface because of black surface.
	Option 4	Total emission of light from the surface

Q23	Question/ Options	In which one of the following situations, the entropy may be maximum?
	Option 1	A class full of students without the teacher being present
	Option 2	A class full of students with teacher being present
	Option 3	A class full of students answering an annual examination monitored by video camera
	Option 4	An empty class room
Q24	Question/ Options	What is the pH of $10^{-8}$ M solution of HCl?
	Option 1	6.959
	Option 2	8.121
	Option 3	5.876
	Option 4	6.367
Q25	Question/ Options	You have induced a rare mutation in a microbe which in special media has 50% higher specific growth rate (2/3rd the doubling time) of the normal cells. If the mutation frequency is $1 \times 10^{-6}$ , how many generations of the normal culture are needed for the populations of mutant and normal cells to be equal?
	Option 1	20
	Option 2	40
	Option 3	60
	Option 4	80
Q26	Question/ Options	The two most common processes that lead to production of multiple functional proteins from same DNA sequences are:
	Option 1	RNA editing and alternative splicing
	Option 2	Differential protein folding and protein splicing
	Option 3	Differential poly adenylation of 3' UTR and capping
	Option 4	Differential usage of enhancers and suppressors
Q27	Question/ Options	Which of the following statements is false?
	Option 1	The potassium channel allows potassium ions through the plasma membrane.
	Option 2	Porin allows chloride ions to pass through the plasma membrane
	Option 3	Thermogenin allows $H^+$ to pass from the inner mitochondrial membrane to the matrix
	Option 4	The gap junction channel allows ions to pass from the cytosol of one cell to that of the other

Q28	Question/ Options	Which of the following statements about the glycolysis pathway in the cytosol is incorrect?
	Option 1	It makes ATP
	Option 2	It makes acetyl-CoA
	Option 3	It interacts with the pentose phosphate pathway
	Option 4	It can feed to gluconeogenesis.
Q29	Question/ Options	The trp operon is transcribed when
	Option 1	tryptophan concentration in the cell is high
	Option 2	the trp repressor is bound to tryptophan or a similar shaped molecule
	Option 3	tryptophan is bound to its aporepressor
	Option 4	the appropriate corepressor is absent
Q30	Question/ Options	Glycosylation of protein occurs in the
	Option 1	peroxisome
	Option 2	mitochondrion.
	Option 3	Lysosome
	Option 4	endoplasmic reticulum.
Q31	Question/ Options	PMSF (a serine protease inhibitor) inhibits which of the following:
	Option 1	Chymotrypsin
	Option 2	Pepsins
	Option 3	Papain
	Option 4	Renins
Q32	Question/ Options	Innate immunity is mediated by:
	Option 1	Toll like receptors
	Option 2	G protein coupled receptors
	Option 3	Integrins
	Option 4	FGF receptor

Q33	Question/ Options	Humans have 23 pairs of chromosomes, while our closest relatives, chimpanzees, have 24. Chromosome studies indicate that at some point early in human evolution, two chromosomes simultaneously broke into a large portion and a small portion. The large parts combined to form a large chromosome, and the small parts combined to form a much smaller chromosome (which was subsequently lost). This important chromosomal change could best be described as
	Option 1	nondisjunction followed by deletion
	Option 2	translocation followed by deletion
	Option 3	duplication followed by deletion
	Option 4	translocation followed by inversion
Q34	Question/ Options	Transgenic organisms carry the transgene in:
	Option 1	Gametes only
	Option 2	Somatic cells only
	Option 3	Both gametes and somatic cells
	Option 4	The recipient cell only
Q35	Question/ Options	What is a pseudogene?
	Option 1	An unidentified gene located within a gene family
	Option 2	Mobile genetic elements that act like real genes.
	Option 3	A gene with the same sequence as another gene in the same organism.
	Option 4	A coding region that cannot be translated into a functional protein
Q36	Question/ Options	An operon is a
	Option 1	regulatory molecule that turns genes on and off
	Option 2	cluster of regulatory sequences controlling transcription of protein-coding genes.
	Option 3	cluster of genes that are coordinately regulated
	Option 4	promoter, an operator, and a group of linked structural genes
Q37	Question/ Options	Pyrosequencing uses which of the following:
	Option 1	emulsion PCR
	Option 2	ligation based PCR
	Option 3	Nick translation
	Option 4	Inverse PCR

Q38	Question/ Options	Necrotrophic plant pathogens
	Option 1	Are Pathogens which kill cells of the host plants
	Option 2	Cause minimum cellular damage
	Option 3	Keep the cells alive
	Option 4	cause mildews and rusts
Q39	Question/ Options	Transgenic crops occupying the largest cultivated area in the world are tolerant to
	Option 1	Herbicide
	Option 2	Insect
	Option 3	Viral disease
	Option 4	Drought
Q40	Question/ Options	Which one of the following techniques is used to detect SNPs?
	Option 1	SSCP
	Option 2	SSR
	Option 3	RT-PCR
	Option 4	DAF
Q41	Question/ Options	Which one of the following phytochrome genes in <i>Arabidopsis thaliana</i> is responsible for hypocotyl elongation, flowering and seed germination?
	Option 1	PHYB
	Option 2	PHYC
	Option 3	PHYD
	Option 4	PHYE
Q42	Question/ Options	Bread wheat <i>Triticum aestivium</i> is
	Option 1	An Autohexaploid
	Option 2	An Allohexaploid
	Option 3	An Allotetraploid
	Option 4	A Diploid
Q43	Question/ Options	The Cytokinin receptor is
	Option 1	A G-protein coupled receptor
	Option 2	A tyrosine kinase
	Option 3	An acidic cytosolic protein
	Option 4	A two component histidine kinase



Q44	Question/ Options	The br2 (Brachytic 2 ) gene encodes a P-glycoprotein required for normal auxin transport in corn. Which one of the following describes the phenotype of br2 mutants?
	Option 1	Long internodes
	Option 2	Short internodes
	Option 3	Broad leaves
	Option 4	Tapering leaves

Q45	Question/ Options	A pipe having an outside diameter $d_o$ and an inside diameter $d_I$ is used to transport a hot fluid. Heat transfer occurs radially outwards. The area for heat transfer per unit length of the pipe is given by
	Option 1	$\pi (d_I + d_o)/2$
	Option 2	$2\pi\sqrt{(d_o d_I)}$
	Option 3	$\pi (d_o - d_I) / \ln(d_o/ d_I)$
	Option 4	$d_o/d_I$

Q46	Question/ Options	What is the generation time of a bacterial population that increases from 100 cells to 100,000 cells in 3 hours of growth?
	Option 1	22 min
	Option 2	18 min
	Option 3	60 min
	Option 4	40 min


Q47	Question/ Options	<p>Based on the flow behavior of fluids depicted in the following figure, choose the correct option.</p>
	Option 1	1- Bingham , 2- Newtonian , 4- Dilatant
	Option 2	1- Bingham, 2- Pseudoplastic, 4- Dilatant
	Option 3	1- Newtonian , 2- Pseudoplastic, 4- Newtonian
	Option 4	1- Newtonian, 2- Bingham, 4- Pseudoplastic

Q48	Question/ Options	<p>Cells are grown in a CSTR at Steady state at two dilution rates <math>0.1\text{h}^{-1}</math> and <math>0.5\text{h}^{-1}</math> and the steady state concentrations are as follows:</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Dilution rate (<math>\text{h}^{-1}</math>)</th> <th>Cell mass conc. X (g/l)</th> <th>Substrate conc. S (g/l)</th> <th>Product conc. P (g/l)</th> </tr> </thead> <tbody> <tr> <td>0.1</td> <td>5</td> <td>0.22</td> <td>1</td> </tr> <tr> <td>0.5</td> <td>5</td> <td>2.0</td> <td>0.2</td> </tr> </tbody> </table> <p>If the inlet substrate concentration is 20 g/l, the cells follow Monod growth kinetics and product formation kinetics is modeled as both growth associated and non-growth associated kinetics given by the equation; <math>q_p = \alpha\mu + \beta</math> then answer the following questions:</p> <p>The best estimate of maximum specific growth rate is:</p>	Dilution rate ( $\text{h}^{-1}$ )	Cell mass conc. X (g/l)	Substrate conc. S (g/l)	Product conc. P (g/l)	0.1	5	0.22	1	0.5	5	2.0	0.2
	Dilution rate ( $\text{h}^{-1}$ )	Cell mass conc. X (g/l)	Substrate conc. S (g/l)	Product conc. P (g/l)										
	0.1	5	0.22	1										
	0.5	5	2.0	0.2										
	Option 1	0.6												
Option 2	1													
Option 3	1.4													
Option 4	2													
Q49	Question/ Options	Which transparent bioplastic is produced by fermentation?												
	Option 1	Polyhydroxybutyrate												
	Option 2	Starch												
	Option 3	Polylactate												
	Option 4	Polyvinyl chloride												
Q50	Question/ Options	In any centrifugal separator, the separation efficiency is a function of												
	Option 1	Radius of the rotor												
	Option 2	Rotational speed of rotor												
	Option 3	Both the radius and speed of the rotor												
	Option 4	Both the load and radius of the rotor												
Q51	Question/ Options	A green process of solvent extraction of biomolecules is												
	Option 1	Solvent-solvent extraction												
	Option 2	Reactive extraction												
	Option 3	Supercritical fluid extraction												
	Option 4	Solid-liquid extraction												

Q52	Question/ Options	For a given fluid, as the pipe diameter increases, the pumping cost
	Option 1	Decreases
	Option 2	Increases
	Option 3	Remains the same
	Option 4	May increase or decrease, depending upon whether the fluid is Newtonian or non-Newtonian
Q53	Question/ Options	The critical regulatory site in the circuit of emotions is:
	Option 1	Hippocampus
	Option 2	Cingulate gyrus
	Option 3	Amygdala
	Option 4	Fornix
Q54	Question/ Options	Which one of the following is the most populous in the CNS?
	Option 1	Pyramidal neurons
	Option 2	Motor neurons
	Option 3	Granule cells
	Option 4	Purkinje neurons
Q55	Question/ Options	Huntington's disease (HD) is caused by degeneration of neurons in the _____, leading clinically to involuntary movements (chorea), psychiatric symptoms and dementia.
	Option 1	basal ganglia followed by cortical regions
	Option 2	cortical regions followed by basal ganglia
	Option 3	cortical regions alone
	Option 4	basal ganglia alone
Q56	Question/ Options	The function of the pyloric sphincter is to prevent the backflow of material from the
	Option 1	Esophagus to the mouth
	Option 2	Duodenum to the stomach
	Option 3	Stomach to the esophagus
	Option 4	Colon to the small intestine
Q57	Question/ Options	Which of the following types of stem cells have a highest risk of teratoma formation?
	Option 1	Hematopoietic stem cells
	Option 2	Embryonic stem cells
	Option 3	Spermatogonial stem cells
	Option 4	Mesenchymal stem cells

Q58	Question/ Options	Which one of the following cell types is the most characteristic component of the early stages of acute inflammatory reaction?
	Option 1	Eosinophils
	Option 2	Neutrophils
	Option 3	Basophils
	Option 4	Monocytes
Q59	Question/ Options	Severe combined immunodeficiency mice and nude mice differ in which of the following cellular components?
	Option 1	B lymphocytes
	Option 2	T lymphocytes
	Option 3	Macrophages
	Option 4	Natural killer cells
Q60	Question/ Options	Smallest lipid containing enveloped animal virus belongs to
	Option 1	Coronaviridae
	Option 2	Togaviridae
	Option 3	Flaviviridae
	Option 4	Bunyaviridae
Q61	Question/ Options	Which one of the following characteristic cells is found in granulomatous inflammation?
	Option 1	Myofibroblast
	Option 2	Plasma cell
	Option 3	Histocyte
	Option 4	Epithelioid cell
Q62	Question/ Options	Role of diatoms in the oceans is
	Option 1	Primary production
	Option 2	Secondary production
	Option 3	Tertiary production
	Option 4	Nitrification
Q63	Question/ Options	One of the free living aerobic nitrogen fixing bacterium in the Oceans is
	Option 1	Rhizobium
	Option 2	Azotobacter
	Option 3	Clostridium
	Option 4	Bacillus

Q64	Question/ Options	The prominent group of microorganism involved in marine bio-corrosion is
	Option 1	Sulphate reducing bacteria
	Option 2	Sulphur oxidizing bacteria
	Option 3	Iron oxidizing bacteria
	Option 4	Sulphide oxidizing bacteria
Q65	Question/ Options	"Green house effect" with respect to global warming refers to
	Option 1	Cooling and moist condition
	Option 2	Warming effect
	Option 3	Increased rainfall and greenery
	Option 4	Desertification
Q66	Question/ Options	A high BOD value in aquatic environment is indicative of
	Option 1	A pollution free system
	Option 2	A highly polluted system due to excess of nutrients
	Option 3	A highly polluted system due to abundant heterotrophs
	Option 4	A highly pure water with abundance of autotrophs
Q67	Question/ Options	Primary productivity at the climax stage of a succession is
	Option 1	Higher than consumption
	Option 2	Lower than the consumption
	Option 3	Equal to consumption
	Option 4	Not related to consumption
Q68	Question/ Options	You have isolated an Indian strain of a phage $\Phi_{x174}$ . You measure the nucleotide base content of the phage and find the following result: A-40%, G- 10%. What are the likely percentage contents of T and C?
	Option 1	It cannot be predicted from the given data
	Option 2	T-40% and C-10%
	Option 3	C-40% and T-10%
	Option 4	Both 25% each
Q69	Question/ Options	Cluster analysis in DNA microarray experiments refers to
	Option 1	Genes that are clustered together in the genome
	Option 2	Cluster of probes that are used to monitor gene expression
	Option 3	Genes that are likely to work in concert in the cell
	Option 4	Clusters of cDNAs printed on microarray chip

Q70	Question/ Options	A sample of a homo-multimeric protein containing one atom of iron per polypeptide which amounts to 0.56% by weight. Gel filtration indicates that the molecular weight of the multimer is 20 kDa. The maximum number of subunits that the protein may have is (Assume that the atomic weight of Fe is 56)
	Option 1	2 
	Option 2	3
	Option 3	4
	Option 4	5
Q71	Question/ Options	A tri-peptide has an amino acid composition (Lys, Phe, Pro). Dansyl chloride treatment produces Dns-Phe. The peptide is not cleaved by trypsin. The primary structure of the peptide is:
	Option 1	Phe-Pro-Lys
	Option 2	Lys-Pro-Phe
	Option 3	Pro-Lys-Phe
	Option 4	Pro-Phe-Lys
Q72	Question/ Options	You have been given two unlabelled samples of PTH-Lysine which has been derivatized either in the $\alpha$ -NH <sub>2</sub> or in the $\epsilon$ -NH <sub>2</sub> group. Which one of the following techniques may be used to distinguish between these two?
	Option 1	pH titrations
	Option 2	UV absorption spectroscopy
	Option 3	Fluorescence spectroscopy
	Option 4	Osmotic pressure measurements
Q73	Question/ Options	Polytene chromosome is generated due to
	Option 1	Extensive transcription
	Option 2	Pairing of homologous chromosome
	Option 3	Repeated DNA replication in DNA without segregation
	Option 4	Failure of DNA replication
Q74	Question/ Options	If a man of blood group AB marries a woman of blood group A whose father was of blood group O, to what different blood groups can this man and woman expect their children to belong?
	Option 1	A, AB, B
	Option 2	A, AB
	Option 3	AB, O
	Option 4	A, O, B

Q75	Question/ Options	A human male (XY) carrying an allele for a trait on the X chromosome is
	Option 1	hemizygous
	Option 2	homozygous
	Option 3	heterozygous
	Option 4	monozygous

## SECTION - B

Q76	Question/ Options	Positive feedback is operating
	Option 1	When adenosine monophosphate activates phosphofructokinase
	Option 2	When cAMP activates transcription of the <i>lac</i> operon
	Option 3	When tryptophan inhibits transcription of the <i>trp</i> operon
	Option 4	When N-acyl-HSL promotes transcription of the <i>lux</i> operon

Q77	Question/ Options	Consider a typical hepatocyte, the major cell type in the liver. It is roughly a cube of 15 $\mu\text{m}$ on a side. Assume the density of cell is 1.03gm/ml and 20% of total weight of which is occupied by protein which is having 400 amino acids (mol wt=50,000g/mol). The total no. of molecules of that protein present in the hepatocyte will be
	Option 1	$8.3 \times 10^9$
	Option 2	$7.3 \times 10^9$
	Option 3	$6.3 \times 10^9$
	Option 4	$5.3 \times 10^9$

Q78	Question/ Options	Process of formation of ATP from ADP while harvesting the photon is referred as
	Option 1	Photophosphorylation
	Option 2	Photorespiration
	Option 3	Phosphorylation
	Option 4	Respiration

Q79	Question/ Options	<p>Match the Enzyme from Group A with the respective Class in Group B</p> <table border="0"> <thead> <tr> <th>Group A</th> <th>Group B</th> </tr> </thead> <tbody> <tr> <td>1. Cytochrome P-450</td> <td>a. Hydrolase</td> </tr> <tr> <td>2. Alkaline phosphatase</td> <td>b. Oxido-reductase</td> </tr> <tr> <td>3. Phosphoglucomutase</td> <td>c. Transferase</td> </tr> <tr> <td>4. Hexokinase</td> <td>d. Isomerases</td> </tr> </tbody> </table>	Group A	Group B	1. Cytochrome P-450	a. Hydrolase	2. Alkaline phosphatase	b. Oxido-reductase	3. Phosphoglucomutase	c. Transferase	4. Hexokinase	d. Isomerases
	Group A	Group B										
	1. Cytochrome P-450	a. Hydrolase										
	2. Alkaline phosphatase	b. Oxido-reductase										
	3. Phosphoglucomutase	c. Transferase										
4. Hexokinase	d. Isomerases											
Option 1	1a, 2c, 3d, 4b											
Option 2	1c, 2a, 3d, 4b											
Option 3	1b, 2a, 3d, 4c											
Option 4	1b, 2c, 3a, 4d											
Q80	Question/ Options	<p>Match the Cofactor in Group A with appropriate 'group carried in activated form' in Group B</p> <table border="0"> <thead> <tr> <th>Group A</th> <th>Group B</th> </tr> </thead> <tbody> <tr> <td>1. FMNH<sub>2</sub></td> <td>a. Acyl</td> </tr> <tr> <td>2. Lipoamide</td> <td>b. Methyl</td> </tr> <tr> <td>3. Thiamine pyrophosphate</td> <td>c. Aldehyde</td> </tr> <tr> <td>4. S-Adenosylmethionine</td> <td>d. Electron</td> </tr> </tbody> </table>	Group A	Group B	1. FMNH <sub>2</sub>	a. Acyl	2. Lipoamide	b. Methyl	3. Thiamine pyrophosphate	c. Aldehyde	4. S-Adenosylmethionine	d. Electron
	Group A	Group B										
	1. FMNH <sub>2</sub>	a. Acyl										
	2. Lipoamide	b. Methyl										
	3. Thiamine pyrophosphate	c. Aldehyde										
4. S-Adenosylmethionine	d. Electron											
Option 1	1d, 2a, 3c, 4b											
Option 2	1c, 2a, 3d, 4b											
Option 3	1d, 2b, 3a, 4c											
Option 4	1b, 2c, 3d, 4a											



Q81	Question/ Options	There are four conserved homologous motifs within the Bcl-2 family: BH1, BH2, BH3, and BH4; which among these is critical for Bcl-2 family heterodimerization?
	Option 1	BH-1
	Option 2	BH-2
	Option 3	BH-3
	Option 4	BH-4
Q82	Question/ Options	What will be the charge of the protein having pH less than its pI value,?
	Option 1	Positive
	Option 2	Negative
	Option 3	One
	Option 4	Zero
Q83	Question/ Options	Ammonium sulfate is the most suitable salt for protein precipitation, because
	Option 1	It is kosmotropic and falls on the left side of Hofmeister series
	Option 2	It is chaotropic and falls on the right side of Hofmeister series
	Option 3	It is kosmotropic and falls on right side of Hofmeister series
	Option 4	It is chaotropic and falls on left side of Hofmeister series
Q84	Question/ Options	There are two protein molecules S and M. They have the same molecular weight, same charge and are structurally very similar but vary in certain domains. How will you separate S and M?
	Option 1	Affinity Chromatography
	Option 2	Ion-exchange Chromatography
	Option 3	Thin Layer Chromatography
	Option 4	Poly-acrylamide Gel Electrophoresis
Q85	Question/ Options	What provides the information necessary to specify the three-dimensional shape of a protein?
	Option 1	The protein's peptide bonds
	Option 2	The protein's interactions with other polypeptides
	Option 3	The protein's amino acid sequence
	Option 4	The protein's interaction with molecular chaperones

Q86	Question/ Options	Those portions of a transmembrane protein that cross the lipid bilayer usually consist of which secondary structures?
	Option 1	A beta sheet with mostly polar side chains
	Option 2	A beta sheet with mostly nonpolar side chains
	Option 3	A helix with mostly polar side chains
	Option 4	A helix with mostly nonpolar side chains
Q87	Question/ Options	Which one among the following suits to protein families?
	Option 1	Proteins found in organisms of the same taxonomic family.
	Option 2	Groups of proteins with the same functions.
	Option 3	Evolutionarily related proteins that are similar in amino acid sequence and three-dimensional conformation.
	Option 4	The amino acid sequence is highly homologous but must perform different functions.
Q88	Question/ Options	Which of the following determines the specificity of an antibody towards an antigen?
	Option 1	The amino acid loops in its variable domain
	Option 2	The amino acid loops in its constant domain
	Option 3	Its Y-shaped structure
	Option 4	The concentration of antibodies and antigens
Q89	Question/ Options	An allosteric inhibitor affects the active site of an enzyme by which of the following?
	Option 1	It binds to the active site, preventing substrate molecules from binding there.
	Option 2	It binds to a second site, resulting in a conformational change which makes the active site of the enzyme less accommodating to the substrate.
	Option 3	It modifies the substrate in such a way that it cannot bind to the enzyme.
	Option 4	It carries a chemical modification to the enzyme, which prevents the progress of further reaction.
Q90	Question/ Options	Phosphorylation controls the protein activity by which one of the following reasons?
	Option 1	It adds energy to a protein.
	Option 2	It can induce conformational changes in target protein.
	Option 3	Two negative charges of phosphate group prevents other negatively charged molecules from interacting with the protein.
	Option 4	Phosphate group degrades the target proteins.

Q91	Question/ Options	Which of the following classes of enzymes add a phosphate group to another protein?
	Option 1	Oxido-reductase
	Option 2	Isomerase
	Option 3	Transferase
	Option 4	Ligase
Q92	Question/ Options	The reaction between dihydroxyacetone phosphate and glyceraldehyde 3-phosphate to form fructose 1,6-bisphosphate is best described as
	Option 1	An aldol condensation reaction
	Option 2	Grignard reaction
	Option 3	Free radical reaction
	Option 4	Hydrolytic reaction
Q93	Question/ Options	In the following options which has the most reduced form of carbon atom
	Option 1	R-CH <sub>3</sub>
	Option 2	R-COOH
	Option 3	R-CHO
	Option 4	R-CH <sub>2</sub> OH
Q94	Question/ Options	The similarities between mitogenic stimulation by EGF and depolarization of the membrane of skeletal muscle cell by acetylcholine are
	Option 1	Essential early step, an ion flux across the plasma membrane receptor
	Option 2	Ligand mediated conformational change in the receptor of responding cell
	Option 3	Occurs independently without ligand or stimulation.
	Option 4	Mainly dependent on regulatory RNA binding sequences.
Q95	Question/ Options	The KDEL sequence of the ER luminal proteins is responsible for
	Option 1	Translocation of the proteins into the ER lumen
	Option 2	Insertion of proteins into the membrane of the ER
	Option 3	Quality control in the ER
	Option 4	Retrieval of ER luminal proteins from the golgi
Q96	Question/ Options	The direction of a chemical reaction is best predicted by
	Option 1	Entropy change
	Option 2	Enthalpy Change
	Option 3	Energy of activation change
	Option 4	Free energy change

Q97	Question/ Options	1g of rice flour from 1kg pack is mixed in 100 ml of sterile water. Aliquot from this solution was dispensed in test tube in order to make dilution of 5X to make final volume of 10 ml. 1 ml of this solution was then poured on sterile nutrient agar plate. 5 colonies were observed after 24 hours of incubation. What is the viable count of bacterial cell in the rice flour sample?
	Option 1	2,500 cells per kg
	Option 2	25, 00, 000 cells per kg
	Option 3	250 cells per kg
	Option 4	25,000 cells per kg
Q98	Question/ Options	Which of the following is false about the <i>E. Coli</i> Lac operon?
	Option 1	It is polycistronic
	Option 2	It is an example of negative control
	Option 3	The presence of lactose acts as an inducer
	Option 4	The repressor binds to the promoter
Q99	Question/ Options	A substance exists in protonated form with a pKa 4.7. The percentage of the protonated form at pH 5.7 will be close to
	Option 1	10
	Option 2	9
	Option 3	99
	Option 4	50
Q100	Question/ Options	Most of the dry mass in a tree trunk is originally derived from
	Option 1	The soil
	Option 2	CO <sub>2</sub>
	Option 3	Light energy
	Option 4	Glucose
Q101	Question/ Options	You have examined 10000 cells in a culture and found that only 2 cells were in mitosis. Therefore the mitotic index is
	Option 1	20000
	Option 2	0.0002
	Option 3	0.0001
	Option 4	10000

Q102	Question/ Options	In vitro coupled transcription and translation systems have been developed that use reticulocyte or wheat germ lysates to specifically translate a defined cDNA. Using this technique, you have translated a gene of your interest. However, when you run SDS-PAGE to check for the translated product, you see many bands from the top to the bottom of the gel. This could be due to the following reasons
	Option 1	The translated protein got degraded
	Option 2	Since it is an in vitro system, it could read the cDNA in all the frames
	Option 3	There are a number of endogenous proteins present in the wheat germ and reticulocyte lysates
	Option 4	Reticulocyte lysates and wheat germ lysates have lysosomes that have taken up many proteins by endocytosis that show up on the gel
Q103	Question/ Options	Cell cycle controller is robust and adaptable. Additionally, it functions like a switch to ensure unidirectional cell cycle. This switch like behavior can be achieved by which one of the following mechanisms
	Option 1	Gradual increase in cyclin-dependent kinase activities in different phases of the cell cycle
	Option 2	Gradual increase in cyclin-dependent kinase synthesis in different phases of the cell cycle
	Option 3	Negative feedback loops to regulate the activity of cyclin-dependent kinases
	Option 4	Positive feedback loops to regulate the activity of cyclin-dependent kinases
Q104	Question/ Options	Colchicine treatment blocks the polymerization of microtubules whereas Taxol blocks the depolymerization of microtubules. Treatment with either colchicine or taxol ultimately results in cell death. It is possible to achieve the same result even though the actions of both agents are opposite because they
	Option 1	block signaling from microtubules
	Option 2	block transcription of microtubules
	Option 3	block translation of microtubules
	Option 4	block mitosis

Q105	Question/ Options	In mammals, average lengths of transcription factor binding sequences are quite short i.e., ~7 base pairs. Hence, the frequency of occurrence of such sites in the entire genome is very high vis-a-vis the total number of genes present therein. However, the specificity of transcription is still achieved
	Option 1	as specificity of those target sequences are further defined by their adjoining sequences.
	Option 2	because of pair wise occurrence of those target sites in the promoters.
	Option 3	as mammalian transcription factors are highly evolved with built in capability of recognizing only the promoter associated target sites.
	Option 4	as the recognition of target sequences in mammals is guided by auxiliary factors that ensures their target specificity.
Q106	Question/ Options	Cell division cycle is divided into 4 phases G1, S, G2 and M. Standard eukaryotic cell cycles are of 12 hr or longer duration. Early embryonic cell cycles are extremely rapid having time duration of less than an hour. Which of the following phases are drastically reduced in embryonic cell cycles?
	Option 1	G1 & G2
	Option 2	G1 & S
	Option 3	M & S
	Option 4	G2 & M
Q107	Question/ Options	Recognition of intracellular pathogens in innate immune cells involves
	Option 1	Toll-like receptors
	Option 2	Antibody
	Option 3	NOD-like receptors (NLRs)
	Option 4	Natural killer T cells
Q108	Question/ Options	In complementation tests, Benzer simultaneously infected <i>E.coli</i> cells with two phages, each of which carried a different mutation. What conclusion did he make when the progeny phage produced normal plaques?
	Option 1	The mutations occurred at the same locus
	Option 2	The mutations occurred at different loci
	Option 3	The mutations occurred close together on the chromosome
	Option 4	The genes were in the cis configuration

Q109	Question/ Options	Discontinuous replication is a result of which property of DNA?
	Option 1	Complementary bases
	Option 2	Charged phosphate group
	Option 3	Antiparallel nucleotide strands
	Option 4	Five- carbon sugar
Q110	Question/ Options	Primers are synthesized where on the lagging strand?
	Option 1	at the 5' end of the newly synthesized strand
	Option 2	at the 3' end of the newly synthesized strand
	Option 3	at the beginning of every Okazaki fragment
	Option 4	at multiple places within an Okazaki fragment
Q111	Question/ Options	Which one of the following is the difference between the core promoter and the regulatory promoter?
	Option 1	Only the core promoter has consensus sequences
	Option 2	The regulatory promoter is farther upstream of the gene
	Option 3	Transcription factors bind to the core promoter; transcriptional activator proteins bind to the regulatory promoter
	Option 4	Both 2 and 3
Q112	Question/ Options	In the <i>trp</i> operon, what happens to the <i>trp</i> repressor in the absence of tryptophan?
	Option 1	It binds to the operator and represses transcription
	Option 2	It cannot bind to the operator and transcription takes place
	Option 3	It binds to the regulator gene and represses transcription
	Option 4	It cannot bind to the regulator gene and transcription takes place
Q113	Question/ Options	Which one of the following is the correct order of mutagenesis screen?
	Option 1	Positional cloning, mutagenesis, identify mutants, verify genetic basis
	Option 2	Mutagenesis, positional cloning, identify mutants, verify genetic basis
	Option 3	Mutagenesis, identify mutants, verify genetic basis, positional cloning
	Option 4	Identify mutants, positional cloning, mutagenesis, verify genetic basis
Q114	Question/ Options	In area of high GC content of the human genome
	Option 1	Gene density tends to be low
	Option 2	Gene density tends to be high
	Option 3	Gene density is variable
	Option 4	Genes tends to have fewer introns

Q115	Question/ Options	The bases A,G,U,C,I (inosine) all occur at 5' position of anticodons in tRNAs. What is the minimum number of tRNAs required to recognize all codons of amino acids specified by codons with complete degeneracy?
	Option 1	one
	Option 2	two
	Option 3	three
	Option 4	four
Q116	Question/ Options	Which of the following cell surface markers is used to identify the B cells from blood samples?
	Option 1	CD3
	Option 2	CD4
	Option 3	CD25
	Option 4	CD19
Q117	Question/ Options	Administration of the DPT vaccine (diphtheria toxoid, pertussis products, and tetanus toxoid) would stimulate which of the following types of immunity?
	Option 1	Artificial active
	Option 2	Artificial passive
	Option 3	Natural active
	Option 4	Natural passive
Q118	Question/ Options	Loss of which of the following classes of molecules on the surface of a tumor cell target would result in reduced susceptibility to killing by host immune cells?
	Option 1	CD3
	Option 2	CD4
	Option 3	MHC class I
	Option 4	MHC class II
Q119	Question/ Options	Genes for 16S and 28S rRNA are transcribed by
	Option 1	DNA polymerase
	Option 2	RNA polymerase II
	Option 3	RNA polymerase I
	Option 4	RNA polymerase III



Q120	Question/ Options	In cancer condition, genes can be either repressed or over-expressed. Repression of genes by DNA methylation depends on
	Option 1	High CpG density
	Option 2	Promoter strength
	Option 3	High CpG density and Promoter strength
	Option 4	Low CpG density
Q121	Question/ Options	Which type of inhibition requires binding of one or more substrates to enzyme before the inhibitor can bind:
	Option 1	Uncompetitive inhibition
	Option 2	Noncompetitive inhibition
	Option 3	Mixed inhibition
	Option 4	competitive inhibition
Q122	Question/ Options	The genes, which remain confined to differential region of Y-chromosome, are
	Option 1	Autosomal genes
	Option 2	Holandric genes
	Option 3	Completely sex-linked genes
	Option 4	Mutant genes.
Q123	Question/ Options	Blastopore is
	Option 1	Opening of neural tube
	Option 2	Opening of gastrocoel
	Option 3	Future anterior end of embryo
	Option 4	Found in blastula
Q124	Question/ Options	Arp, profilin, and villin are all
	Option 1	Cell adhesion molecules.
	Option 2	Molecular motors.
	Option 3	Actin-binding proteins.
	Option 4	Intermediate filament proteins.
Q125	Question/ Options	Cdk1 can only be fully active when
	Option 1	It is phosphorylated on threonine 14.
	Option 2	It is phosphorylated on tyrosine 15.
	Option 3	It is bound to cyclin A.
	Option 4	It is dephosphorylated by Cdc25.

Q126	Question/ Options	Which one of following statements about Bt cotton cultivation in India is NOT TRUE?
	Option 1	Farmers cultivating Bt cotton are benefitted from higher return
	Option 2	Pesticide consumption on cotton is significantly reduced
	Option 3	India became an exporter of cotton
	Option 4	The cotton cultivation in India is free from bollworm menace
Q127	Question/ Options	The latest version of Golden rice contains the following transgenes
	Option 1	Three genes, one from Erwinia and two from daffodil
	Option 2	Two genes, one each from Erwinia and daffodil
	Option 3	Two genes, one each from maize and Erwinia
	Option 4	Three genes one each from maize, rice and Erwinia
Q128	Question/ Options	Which one of the following studies is NOT needed for the biosafety assessment of GM crops?
	Option 1	human and animal safety studies
	Option 2	gene flow analysis
	Option 3	soil microflora, natural enemies of the pest
	Option 4	micronutrient uptake by plants
Q129	Question/ Options	Which one of the following steps is NOT true for production of artificial seeds by desiccated system?
	Option 1	Somatic embryos are first hardened to withstand desiccation
	Option 2	Hardened somatic embryos are encapsulated in a suitable coating material
	Option 3	Somatic embryos may be hardened by either coating/treating mature somatic embryos with a suitable polymer, followed by drying during their maturation phase
	Option 4	Somatic embryos can be planted directly in the field
Q130	Question/ Options	Absorption of which one of the following nutrients in human intestine is interfered by phytate present in seeds?
	Option 1	Nitrate
	Option 2	Sulphur
	Option 3	Iron
	Option 4	Phosphate

Q131	Question/ Options	The following are the key resources needed for efficient marker-assisted germplasm enhancement: i) Suitable characterised genetic markers and the necessary information for multiplexing ii) High-density molecular maps and densely spread markers iii) Established marker–trait associations for traits of agronomic importance iv) High-throughput genotyping systems. Now rank the key resources in the right order of requirement
	Option 1	iii, i, ii, iv
	Option 2	i, ii, iii, iv
	Option 3	iv, iii, ii, i
	Option 4	iv, i, ii, iii
Q132	Question/ Options	Which one of the following methods is highly amenable for automation in most of the genotyping studies?
	Option 1	RFLP
	Option 2	AFLP
	Option 3	ISSR
	Option 4	SNPs
Q133	Question/ Options	A patch clamp device is used to
	Option 1	measure the strength of an electrochemical gradient
	Option 2	study the properties of individual neurotransmitters
	Option 3	infuse different kinds of ions into exons
	Option 4	study the properties of individual membrane channels
Q134	Question/ Options	Which one of the following is a component in the signaling pathway stimulated by receptor tyrosine kinases?
	Option 1	Adenylate cyclase
	Option 2	Janus kinase
	Option 3	Autophosphorylating receptor
	Option 4	Ras activating protein
Q135	Question/ Options	A mutation that inactivates the cytochrome b/f complex would
	Option 1	inhibit movement of electrons from PSII to PSI
	Option 2	inhibit movement of electrons from PSI to PSII
	Option 3	inhibit reduction of quinone
	Option 4	promote formation of NADPH

Q136	Question/ Options	How many ATP molecules are required for the conversion of one $N_2$ to $2NH_4^+$ during biological nitrogen fixation?
	Option 1	8
	Option 2	10
	Option 3	12
	Option 4	16
Q137	Question/ Options	Which of the following bacterial gene can be used for increasing starch content in potato?
	Option 1	Sucrose phosphate synthase
	Option 2	ADP Glucose pyrophosphorylase
	Option 3	Polygalactouranase
	Option 4	Aspartate kinase
Q138	Question/ Options	Which one of the following options describe the term "Transplastomics" correctly?
	Option 1	Targeting genes into the chloroplast.
	Option 2	Providing exceptionally low yield of protein products.
	Option 3	Targeting genes expressed in pollens.
	Option 4	Generating transgenic plants resistant to viral infections.
Q139	Question/ Options	The electrons from excited chlorophyll molecule of photosystem II are accepted first by
	Option 1	Ferredoxin
	Option 2	Cytochrome-b
	Option 3	Cytochrome- f
	Option 4	Quinone
Q140	Question/ Options	Which one of the following agents stimulates direct DNA uptake by protoplasts?
	Option 1	Polyethylene glycol
	Option 2	Lipofectamine
	Option 3	Calcium chloride
	Option 4	Mannitol
Q141	Question/ Options	Transgenic plants expressing barnase or barstar genes are used for
	Option 1	Insect resistance
	Option 2	Hybrid seed production
	Option 3	Stress tolerance
	Option 4	Inhibit pollen flow

Q142	Question/ Options	The presence of polyadenylation signals in the wild type <i>CRY1Ac</i> gene from <i>Bacillus thuringiensis</i> prevented expression of appropriate amount of CRY1Ac protein in transgenic plants. What was done to overcome this problem?
	Option 1	The <i>CRY1Ac</i> gene was expressed under a strong promoter like CaMV 35S
	Option 2	The CRY1Ac protein was targeted to the chloroplast
	Option 3	The <i>CRY1Ac</i> gene sequence was modified taking help of codon degeneracy
	Option 4	The <i>CRY1Ac</i> gene was fused to <i>CRY1Ac</i> gene
Q143	Question/ Options	The following are some of the genes and DNA sequences important for Agrobacterium-mediated transformation of plants: i. gene conferring resistance to an antibiotic under a promoter expressed in plants ii. T-DNA border sequences iii. vir genes iv. a reporter gene like $\beta$ -glucuronidase under CaMV 35S promoter. Which of the above features in combination given below are present on a binary vector and minimally required for transfer of T-DNA from Agrobacterium to plant cell and positive selection of the transformants?
	Option 1	(i) and (ii)
	Option 2	(i), (ii) and (iii)
	Option 3	(ii) and (iv)
	Option 4	(ii), (iii) and (iv)
Q144	Question/ Options	Which one of the following hormone ratios usually promote shoot formation from callus?
	Option 1	High abscisic acid to auxin
	Option 2	Low auxin to cytokinin
	Option 3	High auxin to cytokinin
	Option 4	Low abscisic acid to auxin
Q145	Question/ Options	Which one of the following dyes can be used to test the viability of cultured plant cells?
	Option 1	Fluorescein diacetate
	Option 2	Acetocarmine
	Option 3	Aceto-orcein
	Option 4	Giemsa stain

Q146	Question/ Options	The two Vir proteins with nuclear localization signals which help in movement of T-DNA to plant nucleus are
	Option 1	VirA and VirG
	Option 2	VirD1 and VirE1
	Option 3	VirD2 and VirE2
	Option 4	VirD1 and VirD2
Q147	Question/ Options	Which one of the following statements is NOT TRUE for <i>Agrobacterium</i> mediated plant transformation?
	Option 1	<i>vir</i> genes are essential for gene transfer
	Option 2	T-DNA border are essential for gene transfer
	Option 3	Genes for hormone and opine synthesis are essential for gene transfer
	Option 4	Plant exudates from wounded region acts as positive chemotaxis during gene transfer
Q148	Question/ Options	The breeding method for conventionally transferring cytoplasm from one genotype to the other is
	Option 1	Pedigree
	Option 2	Recurrent selection
	Option 3	Back cross
	Option 4	Bulk selection
Q149	Question/ Options	Detaselling is a method of emasculation followed in _____
	Option 1	Cotton
	Option 2	Sorghum
	Option 3	Bajra
	Option 4	Maize
Q150	Question/ Options	A mechanism where stamens and pistils of hermaphrodite flowers may mature at different times leading to cross pollination is _____
	Option 1	Diclony
	Option 2	Dichogamy
	Option 3	Protogamy
	Option 4	Heterogamy

Q151	Question/ Options	Which one of the following amino acids is an example of a compatible osmolyte in response to a range of environmental stresses?
	Option 1	Lysine
	Option 2	Glycine
	Option 3	Proline
	Option 4	Leucine
Q152	Question/ Options	The principal signal molecule involved in induced systemic resistance in plants is
	Option 1	Malic acid
	Option 2	Salicylic acid
	Option 3	Jasmonic acid
	Option 4	Benzoic acid
Q153	Question/ Options	International treaty in the field of the protection of the new variety of plants and rights of the breeders is
	Option 1	PPV & FR act
	Option 2	UPOV
	Option 3	Cartagena protocol
	Option 4	Suigeneris system
Q154	Question/ Options	The revised Genebank Standards for Plant Genetic Resources for Food and Agriculture were endorsed at the 14th Regular Session of the CGRFA, at
	Option 1	Rome, in 2013
	Option 2	Geneva, in 2010
	Option 3	Indonesia, 2004
	Option 4	Brazil, 2002
Q155	Question/ Options	Gluconoacetobacter diazotrophicus is predominantly found in
	Option 1	Rhizosphere
	Option 2	Phyllosphere
	Option 3	Endorhizosphere
	Option 4	Spermosphere
Q156	Question/ Options	A system in which there is exchange of energy but not of mass, is called a/an _____ system.
	Option 1	Open
	Option 2	Isolated
	Option 3	Insulated
	Option 4	Closed

Q157	Question/ Options	The second law of thermodynamics is concerned with
	Option 1	non-cyclic processes only.
	Option 2	amount of energy transferred.
	Option 3	irreversible processes only.
	Option 4	direction of energy transfer.
Q158	Question/ Options	The oxygen transfer rate in an aerobic fermentation process does not depend on the
	Option 1	Driving force [difference of DO concentration ( $C^* - C_L$ )] in the system
	Option 2	Interfacial transfer area of bubbles
	Option 3	Temperature of the fermentation broth
	Option 4	Volume of the fermentation broth
Q159	Question/ Options	A culture is grown in a flask and after 120 h there were $1.0 \times 10^6$ cells/ml. After 270 h there were $1.0 \times 10^9$ cells/ml, the specific growth rate of the organisms is
	Option 1	$2.0 \text{ h}^{-1}$
	Option 2	$0.69 \text{ h}^{-1}$
	Option 3	$0.14 \text{ h}^{-1}$
	Option 4	$3.0 \text{ h}^{-1}$
Q160	Question/ Options	In a CSTR at steady state of volume 1L, the feed rate of a compound A is 1L/h. The exit concentration of A is 50% of the inlet concentration and the rate of conversion of A to products is a first order reaction given by $dCA/dt = k CA$ . The value of k is
	Option 1	$0.5 \text{ h}^{-1}$
	Option 2	$1.0 \text{ h}^{-1}$
	Option 3	$1.5 \text{ h}^{-1}$
	Option 4	$2.0 \text{ h}^{-1}$
Q161	Question/ Options	Which of the following processes provides the best effluent quality for water reuse?
	Option 1	Conventional activated sludge process with media filters.
	Option 2	Trickling filters.
	Option 3	Membrane bioreactor.
	Option 4	Aerated lagoons.



Q162	Question/ Options	In any centrifugal separator the separation efficiency is a.....
	Option 1	Linear function of agitation
	Option 2	Square function of radius
	Option 3	Linear function of radius and square function of the rotor speed.
	Option 4	Square function of radius and linear function of the rotor speed
Q163	Question/ Options	In aqueous two phase separation systems, a phase diagram is prepared at constant :
	Option 1	pressure and volumes
	Option 2	pH and temperature
	Option 3	viscosity and mass
	Option 4	volumes and density
Q164	Question/ Options	For preparative chromatography, a simple scale up principle which can be used without significantly affecting resolution by
	Option 1	increasing length of the column
	Option 2	decreasing length of the column
	Option 3	increasing diameter of the column
	Option 4	decreasing diameter of the column
Q165	Question/ Options	Penicillin is extracted using isoamylacetate in a counter current extractor. Before the extraction, pH of the aqueous solution is adjusted to pH 2.5. This is done as penicillin
	Option 1	is more soluble at pH 2.5 in its ionic form
	Option 2	is more soluble at pH 2.5 in its non-ionic form
	Option 3	is more stable at pH 2.5
	Option 4	isoamylacetate is stable at pH 2.5
Q166	Question/ Options	In an adsorption column for the separation of antibiotics, a sharp break through curve indicates
	Option 1	more unused bed capacity
	Option 2	less unused bed capacity
	Option 3	unused bed capacity does not change at all with sharpness of the peak
	Option 4	a high affinity of the antibiotic to the column matrix

Q167	Question/ Options	Which of the following is not a desired property of the membranes used for separation
	Option 1	Selectivity
	Option 2	Mechanical Strength
	Option 3	High porosity
	Option 4	Resistance to fouling
Q168	Question/ Options	Identify which of the following is NOT considered as a criterion for scale up of fermentation processes
	Option 1	power input/unit volume
	Option 2	$K_L a$
	Option 3	Impeller tip velocity
	Option 4	Aeration rate
Q169	Question/ Options	If agitator energy input per unit volume of the fermentor is kept constant during scale up, the factor that would always decrease upon increasing size of the fermenter is
	Option 1	rpm
	Option 2	aeration rate
	Option 3	tip velocity
	Option 4	$K_L a$
Q170	Question/ Options	For a given thickness of the head closing the end of cylindrical vessel, which of the following can withstand the highest pressure ?
	Option 1	Hemispherical
	Option 2	Torispherical
	Option 3	Ellipsoidal
	Option 4	Flat plate
Q171	Question/ Options	A mechanical seal is used for
	Option 1	pipelines handling large pressure drops.
	Option 2	prevention of fluid leakage around moving parts.
	Option 3	used in machinery to prevent leakage of current
	Option 4	used in joints of pipe lines to prevent leakage of fluids

Q172	Question/ Options	Which of the following elements is not included in the scope of market analysis ?
	Option 1	Competition from other manufactures.
	Option 2	Product distribution.
	Option 3	Opportunities
	Option 4	Economics
Q173	Question/ Options	"Break-even point" is the point of intersection of
	Option 1	fixed cost and total cost.
	Option 2	total cost and sales revenue.
	Option 3	fixed cost and sales revenue.
	Option 4	fixed cost and variable cost
Q174	Question/ Options	Fumaric acid is produced from Malic acid using Fumarase. Calculate standard heat of reaction for the following transformation: $C_4H_6O_5 \rightarrow C_4H_4O_4 + H_2O$ Given: $(\Delta h_c^\circ)$ malic acid= -1328.8 kJ/gmol $(\Delta h_c^\circ)$ Fumaric acid= -1334.0 kJ/gmol
	Option 1	-8.2kJ /gmol
	Option 2	8.2 kJ/gmol
	Option 3	5.2 kJ /gmol
	Option 4	-5.2 kJ/gmol
Q175	Question/ Options	Air at 104.2 kPa at 37°C with a relative humidity of 60% is cooled at the same pressure to 29°C. The cooled air has a higher _____
	Option 1	dew point.
	Option 2	absolute humidity.
	Option 3	relative humidity
	Option 4	wet bulb temperature.
Q176	Question/ Options	An enzyme having $K_m$ values of $2.5 \times 10^{-5} M$ and $2.5 \times 10^{-7} M$ for the substrates S1 and S2, respectively, is added to a solution consisting of 100 nano moles of both S1 and S2. Which of the following statement is correct?
	Option 1	Most of the active sites of the enzyme will be occupied by S1
	Option 2	Most of the active sites of the enzyme will be occupied by S2
	Option 3	The active sites of the enzyme will be occupied equally by S1 & S2
	Option 4	Occupation of active sites has no relation to the value of $K_m$

Q177	Question/ Options	Which of the following only permits uni-directional fluid flow?
	Option 1	Gate valve
	Option 2	Butterfly valve
	Option 3	Globe valve
	Option 4	Ball valve
Q178	Question/ Options	The internal temperature in the refrigerator is 280 K and the external temperature is 300K. The theoretical maximum value of coefficient of performance is
	Option 1	0.933
	Option 2	1.071
	Option 3	14
	Option 4	25
Q179	Question/ Options	Concentrated feeding in a Fed batch system is used to get
	Option 1	Higher product concentration in the reactor
	Option 2	Higher product yield/unit substrate
	Option 3	Higher product yield/unit cell mass
	Option 4	Reduced by product formation
Q180	Question/ Options	A digestible linear polysaccharide abundantly found in cereals having $\alpha$ -1,4 linkages in its structure is
	Option 1	Pectin
	Option 2	Amylopectin
	Option 3	Amylose
	Option 4	Inulin
Q181	Question/ Options	A prominent prebiotic substance is:
	Option 1	Starch
	Option 2	Pectin
	Option 3	Fructo oligosaccharide
	Option 4	Cellulose

Q182	Question/ Options	Considering the importance of moisture content of food in promoting microbial growth, which one of the following statements is true
	Option 1	Gram negative bacteria are more sensitive to low $a_w$ values than Gram positive bacteria
	Option 2	Gram positive bacteria are more sensitive to low $a_w$ values than Gram negative bacteria
	Option 3	Both are equally sensitive to low $a_w$ values
	Option 4	Both are unaffected by $a_w$ values
Q183	Question/ Options	The rate of cell disintegration in high pressure homogenizer primarily depends on the
	Option 1	Number of cycles
	Option 2	Pressure drop across the homogenizer
	Option 3	Both on the number of cycles and pressure drop
	Option 4	Temperature
Q184	Question/ Options	Which one of the following statements is FALSE?
	Option 1	For incompressible cakes, resistance in the cake is assumed to be directly proportional to the amount of cake deposited
	Option 2	For constant pressure filtration with compressible cake, the specific cake resistance is constant
	Option 3	Compared to the cake resistance, the filter membrane resistance is usually negligible for broth filtration.
	Option 4	The mass of cake deposited per unit area is a function of time in batch operation and concentration of solids in the broth
Q185	Question/ Options	In a counter current single pass heat exchanger, cooling water enter at $0^\circ\text{C}$ and leaves at $20^\circ\text{C}$ . Hot water enters from the other side at $60^\circ\text{C}$ at a flow rate which is half of the cooling water flow rate. Assuming there is no heat loss, what is the Log Mean Temperature Difference?
	Option 1	20.7
	Option 2	30.2
	Option 3	34.8
	Option 4	40.4
Q186	Question/ Options	The Pyramidal neurons in the cerebral cortex are found in
	Option 1	Layer V & VI
	Option 2	Layer II & IV
	Option 3	Layer III & V
	Option 4	Layer III & VI

Q187	Question/ Options	Which one of the following types of glial cells participate in the re-uptake mechanism of neurotransmitter from the synaptic cleft?
	Option 1	Microglia
	Option 2	Oligodendroglia
	Option 3	Radial Glia
	Option 4	Astroglia
Q188	Question/ Options	Cerebrospinal fluid is produced by
	Option 1	Astrocytes and ependymal cells
	Option 2	Chroid plexus and ependymal cells
	Option 3	Radial glial cells
	Option 4	Spinal cord
Q189	Question/ Options	Saccadic eye movement
	Option 1	Shifts fovea rapidly to a new visual target
	Option 2	Keeps the image of the moving target on the foves
	Option 3	Moves the eyes in opposite direction to position the image on both fovea
	Option 4	Holds image stationary during head rotation or transfer
Q190	Question/ Options	Which part of the brain integrates autonomic, endocrine and behavioral responses?
	Option 1	cerebellum
	Option 2	brain stem
	Option 3	hypothalamus
	Option 4	cerebrum
Q191	Question/ Options	The patterning of the nervous system along the anterior-posterior axis in embryo is controlled by
	Option 1	Pax genes
	Option 2	Hox genes
	Option 3	Segment polarity genes
	Option 4	Pair rule genes
Q192	Question/ Options	All the neurons in the basal ganglionic nuclei are inhibitory except in
	Option 1	Globus pallidus external segment
	Option 2	Globus pallidus internal segment
	Option 3	Sub-thalamic nucleus
	Option 4	Lentiform nucleus

Q193	Question/ Options	Tay-Sachs disease is due to a defect in the enzyme _____ and _____ as its substrate:
	Option 1	GM2-ganglioside (and) Hexosaminidase A
	Option 2	GM2-ganglioside, asialo-GM2-ganglioside, globoside (and) Hexosaminidases A and B
	Option 3	Glucosylceramidase (and) Glucosylceramide
	Option 4	GM2-ganglioside (and) Hexosaminidase A and B
Q194	Question/ Options	Which one of the following causes stunted growth and severe fasting hypoglycemia with ketonuria?
	Option 1	Glycogen synthetase deficiency
	Option 2	Phosphoglycerate kinase deficiency
	Option 3	pyruvate-carboxylase deficiency
	Option 4	protein malnutrition
Q195	Question/ Options	Which one of the following techniques is of highest resolution for detection of chromosomal alterations?
	Option 1	PCR
	Option 2	CGH
	Option 3	G-banding
	Option 4	C-banding
Q196	Question/ Options	<i>E. coli</i> bacteria are beneficial to humans because they
	Option 1	Convert pepsinogen to pepsin
	Option 2	Produce vitamins and amino acids
	Option 3	Absorb water from the large intestine
	Option 4	Synthesize urea from the breakdown of amino acids
Q197	Question/ Options	Which of the following reporters can be used for magnetic resonance imaging?
	Option 1	Luciferase
	Option 2	Herpes Simplex Virus-1 thymidine kinase
	Option 3	Green fluorescence protein (GFP)
	Option 4	Transferrin receptor.

Q198	Question/ Options	Which one of the following statements forms the basis for the increased circulatory life time for a sialylated recombinant therapeutic protein?
	Option 1	Increased molecular size due to post translational modification reduces the movement of the glycoproteins
	Option 2	Sialic acid terminated glycans are not recognized by asialoglycoprotein receptors of hepatocytes
	Option 3	Sialylation increases the structural stability of the glycoprotein
	Option 4	Sialylation blocks the enzyme cleavage sites of the glycoprotein
Q199	Question/ Options	Which one of the following plays a role in changing the antigen binding site of a B cell after antigenic stimulation?
	Option 1	Junctional diversity
	Option 2	Combinatorial diversity
	Option 3	Germline diversity
	Option 4	Somatic hypermutation
Q200	Question/ Options	Rostral is an anatomical term meaning towards the
	Option 1	Nose
	Option 2	Forehead
	Option 3	Chest
	Option 4	Foot
Q201	Question/ Options	Phlebitis is the inflammation of
	Option 1	Lung
	Option 2	Vein
	Option 3	Liver
	Option 4	Lip
Q202	Question/ Options	Mucosal immunity is preferentially stimulated if an immunogen is administered
	Option 1	Intravenously
	Option 2	Intramuscularly
	Option 3	Intradermally
	Option 4	Orally



Q203	Question/ Options	An example of lysogeny in animals could be
	Option 1	Slow viral infections
	Option 2	Latent viral infections
	Option 3	T-even bacteriophages
	Option 4	Infections resulting in cell death
Q204	Question/ Options	Which one of the following is the earliest site of hematopoiesis in the embryo?
	Option 1	Bone Marrow
	Option 2	Liver
	Option 3	Yolk Sac
	Option 4	Thymus
Q205	Question/ Options	Which one of the following viruses contains single stranded DNA as the genome?
	Option 1	Parvo virus
	Option 2	Herpes virus
	Option 3	Adeno virus
	Option 4	Pox virus
Q206	Question/ Options	Which of the following is TRUE regarding the drugs that affect the stability of microtubules used in cancer chemotherapy
	Option 1	Immune system is detached from functioning
	Option 2	They prevent chromatin condensation
	Option 3	They interfere with mitosis.
	Option 4	They stop the movement of cancer cells into other tissues
Q207	Question/ Options	Therapies of lysosomal and peroxisomal disorders that have shown success in clinical trials with enzyme replacement therapy exclude:
	Option 1	Gaucher's disease type I
	Option 2	Fabry's disease
	Option 3	Pompe's disease
	Option 4	Refsum's disease

Q208	Question/ Options	Lysosomes are thought to play an important role in which of the following processes?
	Option 1	Class I MHC-restricted antigen presentation,
	Option 2	Class II MHC-restricted antigen presentation,
	Option 3	T cell receptor alpha chain rearrangement,
	Option 4	T cell receptor beta chain rearrangement
Q209	Question/ Options	COFAL test is used for the diagnosis of
	Option 1	equine infectious anemia
	Option 2	human immunodeficiency virus
	Option 3	avian leukosis
	Option 4	bovine leukosis
Q210	Question/ Options	Which one of the following animals has a cheek pouch in their mouth and used as an animal model for studying oral cancer?
	Option 1	Guinea pig
	Option 2	Hamster
	Option 3	Swiss mice
	Option 4	Wistar rat
Q211	Question/ Options	Which one of the following protozoan is transmitted by ingestion of ticks?
	Option 1	<i>Haemoproteus columbae</i>
	Option 2	<i>Ehrlichia canis</i>
	Option 3	<i>Hepatozoon canis</i>
	Option 4	<i>Histomonas meleagridis</i>
Q212	Question/ Options	The demyelination of the central nervous system white matter produced by the canine distemper virus is an example of:
	Option 1	Fat necrosis
	Option 2	Coagulation necrosis
	Option 3	Zenker's necrosis
	Option 4	Liquefactive necrosis
Q213	Question/ Options	Which one of the following clinical conditions does not have exudates?
	Option 1	Pus
	Option 2	Catarrhal inflammation
	Option 3	Serous inflammation
	Option 4	Granulomatous inflammation

Q214	Question/ Options	BioSteel is a trademark name for a high-strength based fiber material which was made from the recombinant spider silk-like protein extracted from the milk of transgenic
	Option 1	Goats
	Option 2	Sheep
	Option 3	Cow
	Option 4	Buffalo
Q215	Question/ Options	Which of the following protozoan parasites replicates inside a non nucleated human cell
	Option 1	Entamoeba
	Option 2	Leishmania
	Option 3	Trypanosoma
	Option 4	Plasmodium
Q216	Question/ Options	Hypophysation refers to
	Option 1	Injection of growth hormone
	Option 2	Injection of gonadotropins
	Option 3	Injection of pituitary gland extract
	Option 4	Injection of leutinizing hormone
Q217	Question/ Options	The term "Mitotic gynogen" refers to
	Option 1	A fish that has only a female parent whose diploidy status is restored by preventing the first mitosis of oocytes.
	Option 2	A fish that has only a male parent whose diploidy status is restored by preventing the first mitosis of oocytes.
	Option 3	A fish that has only a female parent whose diploidy status is restored by preventing the first meiosis of oocytes.
	Option 4	A fish that has only a male parent whose diploidy status is restored by preventing the first meiosis of oocytes.
Q218	Question/ Options	In animal cell culture, CO <sub>2</sub> incubator is used for maintaining open culture system. What is the function of CO <sub>2</sub> ?
	Option 1	It serves as a Carbon source to the cells.
	Option 2	It maintains the temperature via green house effect
	Option 3	It dissolves in the medium and generates carbonic acid and regulates the pH to neutrality
	Option 4	It dissolves in the medium and generates carbonic acid and regulates the pH to alkaline side.

Q219	Question/ Options	Which one of the following is a fish cell line?
	Option 1	VERO
	Option 2	HeLa
	Option 3	RTG -2
	Option 4	HepG2
Q220	Question/ Options	Photosynthetic sulphur bacteria get hydrogen ions for CO <sub>2</sub> reduction from
	Option 1	Water
	Option 2	Hydrogen sulphide
	Option 3	Molecular hydrogen
	Option 4	Hydrogen peroxide
Q221	Question/ Options	White spot syndrome virus is transmitted
	Option 1	Vertically
	Option 2	Horizontally
	Option 3	Both vertically and horizontally
	Option 4	Through a vector
Q222	Question/ Options	Ziconotide, a synthetic bioactive peptide originally isolated from the marine snail <i>Conus magus</i> is used as an
	Option 1	Analgesic agent
	Option 2	Anticancer agent
	Option 3	Antiviral agent
	Option 4	Anti inflammatory agent
Q223	Question/ Options	Which of the following is a bioluminescent bacterium?
	Option 1	<i>Vibrio harveyi</i>
	Option 2	<i>Vibrio parahaemolyticus</i>
	Option 3	<i>Vibrio cholerae</i>
	Option 4	<i>Vibrio splendidus</i>
Q224	Question/ Options	The site of production of Gonad Inhibiting Hormone (GIH) in crustaceans is
	Option 1	Thoracic ganglion
	Option 2	X-organ
	Option 3	Hepatopancreas
	Option 4	Y-organ

Q225	Question/ Options	In bony fishes, Immunoglobulin IgM is secreted as a
	Option 1	Monomer
	Option 2	Dimer
	Option 3	Tetramer
	Option 4	Pentamer
Q226	Question/ Options	Which one of the following electron acceptors used by the bacteria is mainly responsible for microbial induction of marine corrosion?
	Option 1	O <sub>2</sub>
	Option 2	NO <sub>3</sub> <sup>-</sup>
	Option 3	SO <sub>4</sub> <sup>2-</sup>
	Option 4	CO <sub>2</sub>
Q227	Question/ Options	Which one of the following methods is used to identify the sites in a genome that are occupied <i>in vivo</i> by a gene regulatory protein?
	Option 1	Chromatin immunoprecipitation (ChIP)
	Option 2	Gel mobility shift assay
	Option 3	Methylation interference assay
	Option 4	Phage display library
Q228	Question/ Options	The class of immunoglobulin found in fish is
	Option 1	IgD
	Option 2	IgA
	Option 3	IgM
	Option 4	IgG
Q229	Question/ Options	Besides nitrogen fixation the heterocysts of cyanobacteria also contribute to
	Option 1	Photosynthesis and ATP production
	Option 2	The functioning of photosystem II
	Option 3	ATP production
	Option 4	Generation of oxygen
Q230	Question/ Options	The enzyme involved in hydrogen production from biophotolysis in green algae is
	Option 1	Nitrogenase
	Option 2	Fe-Fe hydrogenase
	Option 3	Ni-Fe hydrogenase
	Option 4	Both Ni-Fe and Fe-Fe hydrogenases

Q231	Question/ Options	The compound used for the preferential removal of diatoms from microalgal cultures is
	Option 1	Penicillin
	Option 2	Copper sulfate
	Option 3	Germanium dioxide
	Option 4	Potassium tellurite

Q232	Question/ Options	<p>The overall reaction for microbial conversion of glucose to L-glutamic acid is:</p> $\text{C}_6\text{H}_{12}\text{O}_6 + \text{NH}_3 + 3/2\text{O}_2 \rightarrow \text{C}_5\text{H}_9\text{NO}_4 + \text{CO}_2 + 3\text{H}_2\text{O}.$ <p>(glucose) (glutamic acid)</p> <p>What mass of oxygen is required to produce 49 g glutamic acid?</p> <p>Molecular weight of glutamic acid=147</p>
	Option 1	16 g
	Option 2	8.15 g
	Option 3	10.45g
	Option 4	20 g

Q233	Question/ Options	Which one of the following databases allows users to search marine species datasets from all of the world's oceans?
	Option 1	KEGG
	Option 2	OBIS
	Option 3	PDB
	Option 4	Uniprot

Q234	Question/ Options	N <sub>2</sub> fixation requires large amounts of energy, since there is high activation energy for breaking the triple bond of the N <sub>2</sub> . If so, how many molecules of ATP are required for reducing one molecule of nitrogen?
	Option 1	12
	Option 2	18
	Option 3	16
	Option 4	24

Q235	Question/ Options	Marine environment has abundance of osmotrophs. Osmotrophs are defined as organisms which obtains nutrients and energy via passive or active transport of
	Option 1	Low molecular weight substrates across cell membrane
	Option 2	High molecular weight substrates across cell membrane
	Option 3	Dissolved organic matter across cell membrane
	Option 4	Particulate organic matter across cell membrane
Q236	Question/ Options	Most endangered species are victims of
	Option 1	greenhouse warming.
	Option 2	habitat destruction.
	Option 3	overhunting.
	Option 4	competition with introduced species
Q237	Question/ Options	The Ozone layer saves from lethal UV. It mainly absorbs-
	Option 1	UV-A
	Option 2	UV-B
	Option 3	UV-A & B
	Option 4	UV-A & C
Q238	Question/ Options	Total energy available for work at equilibrium is termed as
	Option 1	Free energy
	Option 2	Entropy
	Option 3	Activation energy
	Option 4	Enthalpy
Q239	Question/ Options	Global warming is due to:
	Option 1	Absorption of UV by Ozone
	Option 2	Absorption of IR by CO <sub>2</sub>
	Option 3	Absorption of IR by ozone
	Option 4	Absorption of UV by CO <sub>2</sub>
Q240	Question/ Options	In a pond ecosystem, net productivity by zooplankton is 'p' and biomass consumed by small fishes is 'c', then the ratio of c/p is termed as
	Option 1	Assimilation efficiency
	Option 2	Net secondary productivity
	Option 3	Consumption efficiency
	Option 4	Conversion efficiency

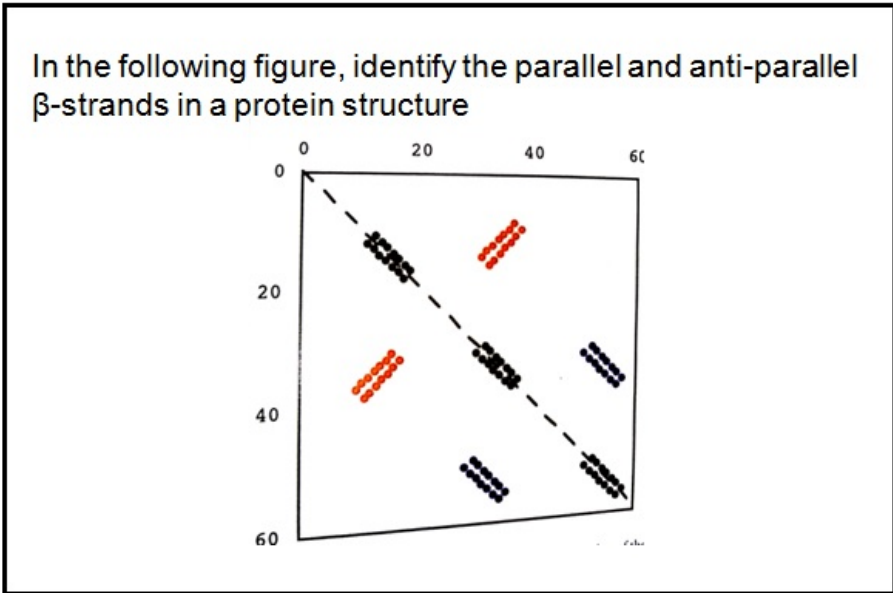
Q241	Question/ Options	Two species or populations are competing for the exact same resources, and one will eventually exclude the other. What is the technical term for this?
	Option 1	Predation
	Option 2	Competitive exclusion
	Option 3	Coevolution
	Option 4	Mutualism
Q242	Question/ Options	Which of the following processes is most capable of slowing global warming?
	Option 1	Decomposition
	Option 2	Respiration
	Option 3	Photosynthesis
	Option 4	Chemosynthesis
Q243	Question/ Options	Ecosystem is mainly concerned with
	Option 1	energy flow and nutrient recycling
	Option 2	Population
	Option 3	Community
	Option 4	Species
Q244	Question/ Options	An organism with the ability to withstand changes to biotic and abiotic environmental factors is said to have _____
	Option 1	Tolerance
	Option 2	a pioneer community
	Option 3	limiting factors
	Option 4	secondary succession
Q245	Question/ Options	An undersea volcano in the Hawaiian Islands chain erupts, forming a new island in the Pacific Ocean. Over the course of time, which of these would most likely be the first species to survive on the new island?
	Option 1	Lichens
	Option 2	Grasses
	Option 3	Mammals
	Option 4	Birds



Q246	Question/ Options	A certain membrane protein is known to contain a single membrane spanning $\alpha$ -helix of length 72 amino acids. A scientist makes deletion mutants of this protein by reducing the length of this $\alpha$ -helix. What would be the minimum length of the $\alpha$ -helix that will still keep the membrane protein active?
	Option 1	18
	Option 2	36
	Option 3	72
	Option 4	64
Q247	Question/ Options	A compound X inhibits an enzyme A competitively. A small concentration of X increases the enzyme's activity while higher concentration inhibits the activity significantly. This indicates that the enzyme
	Option 1	Is allosteric
	Option 2	Is made up of more than one subunit
	Option 3	Contains disulfide bonds
	Option 4	Is a hetero-oligomer
Q248	Question/ Options	It is observed that in a multiple sequence alignment of homologous proteins, there is an absolutely conserved Glycine residue at a particular position. Crystal structure analysis of a representative protein shows that the $\Phi$ and $\Psi$ angles of this residue occurs in the bottom right quadrant of the Ramachandran map. What is the evolutionary basis of conservation of this Glycine residue?
	Option 1	No other amino acid can occupy this position in the Ramachandran map and hence mutation at this position can be structurally destabilizing
	Option 2	Change of Gly into any other amino acid, changes the chirality of the enzyme, which can functionally deleterious
	Option 3	Gly does not prefer any particular secondary structure, and change into any other amino acid will change the overall secondary structure of the enzyme
	Option 4	Replacement of Gly by any other amino acid changes the overall charge of the protein
Q249	Question/ Options	Which of the following terms will have to be taken into consideration for developing a potential function for docking simulation?
	Option 1	hydrogen bonding, van der Waal's and electrostatic interaction terms
	Option 2	Bond, angle and dihedral terms
	Option 3	Dihedral and hydrogen bonding terms
	Option 4	Bond, angle and hydrogen bonding terms

Q250	Question/ Options	You are interested in a particular enzyme that is expressed in various human tissues. You have isolated the protein from the brain, liver and kidneys. After a lot of experimentation you determine that the liver protein has three domains A, B and C occurring in sequential order. Domain B is the catalytic domain and the other two have regulatory function. The kidney protein has only domains A and B in that order and the brain protein has domains B and C. You then proceed to determine the primary structure of the proteins using chemical methods and find that the amino acid sequence of the three domains are completely identical regardless of the source from which they were isolated. You then ask the question whether the three different proteins have all originated from the same gene by means of alternative splicing, or they could be products of different genes. Having the experimentally determined protein sequences and knowing the sequence of the human genome, which one of the following bioinformatic method you will use to answer the question above.
	Option 1	TBLASTN using the protein sequence as query and the human genome sequence as database.
	Option 2	TBLASTX using the protein sequence as query and the human genome sequence as database.
	Option 3	BLASTN using the protein sequence as query and the human genome sequence as reference.
	Option 4	BLASTP using the protein sequence as query and the human genome sequence as reference.
Q251	Question/ Options	When $p$ and $q$ are lengths of sequences, the computational complexity of the Needleman and Wunsch algorithm is
	Option 1	$O(pq)$
	Option 2	$O(p+q)$
	Option 3	$O(q \log p)$
	Option 4	$O(p^q)$

Q252	Question/ Options	<p>Given the following Table of joint and marginal probabilities:</p> <table style="margin-left: auto; margin-right: auto;"> <tr> <td></td> <td>A1</td> <td>A2</td> </tr> <tr> <td>B1</td> <td>0.24</td> <td>0.06</td> </tr> <tr> <td>B2</td> <td>0.21</td> <td>0.49</td> </tr> </table> <p>What is the value of <math>P(B2 A1)</math>?</p>		A1	A2	B1	0.24	0.06	B2	0.21	0.49
	A1	A2									
B1	0.24	0.06									
B2	0.21	0.49									
	Option 1	0.467									
	Option 2	0.533									
	Option 3	0									
	Option 4	1									

Q253	Question/ Options	<p>In the following figure, identify the parallel and anti-parallel <math>\beta</math>-strands in a protein structure</p> 
	Option 1	Residues 30-40 in anti-parallel beta strands and residues 50-60 in parallel beta strands
	Option 2	Residues 30-40 in parallel beta strands and residues 50-60 in anti-parallel beta strands
	Option 3	Residues 10-20 in parallel beta strands and residues 30-40 in anti-parallel beta strands
	Option 4	Residues 10-20 in anti-parallel beta strands and residues 30-40 in parallel beta strands

Q254	Question/ Options	The E. coli ribosomal release factor gene has an in-frame stop codon in the middle of the protein coding sequence. Mutating the stop codon in this gene makes the protein non-functional. Which one of the following is an adequate explanation for this observation?
	Option 1	When the intracellular concentration of this protein is low, ribosomes jump over the stop codon and synthesize the full length protein. When it is high, the protein itself facilitates release of its mRNA from the ribosomes at the stop codon
	Option 2	The gene is a pseudo gene
	Option 3	In this case, the stop codon is not a real stop codon, but codes for an unnatural amino acid essential for the function of the protein
	Option 4	The stop codon is involved in secondary structure of the mRNA
Q255	Question/ Options	A protein has three domains P, Q, and R, whereas another protein has three domains R, S and Q in that order. The preferred alignment algorithm for these two proteins will be
	Option 1	Local alignment
	Option 2	Global alignment
	Option 3	Both algorithms will give the same results
	Option 4	None of the methods are suitable in this case
Q256	Question/ Options	PAM120, PAM80 and PAM60 scoring matrices are most suitable for aligning sequences with
	Option 1	40%, 50% and 60% similarity respectively
	Option 2	60%, 50% and 40% similarity respectively
	Option 3	60%, 40% and 50% similarity respectively
	Option 4	The usefulness of PAM matrices have no relationship with similarities of sequences to be aligned
Q257	Question/ Options	Which of the following descriptors would be a suitable set for QSAR analysis?
	Option 1	logP, molecular volume, Hammett $\sigma$ and $\pi$ constants, molar refractivity, polar surface area
	Option 2	logP, number of synthetic steps, polar surface area, molar refractivity
	Option 3	logP, number of nitrogen atoms, Hammett $\sigma$ and $\pi$ constants, molar refractivity, polar surface area
	Option 4	molecular weight, molecular volume, molecular surface area.

Q258	Question/ Options	A closed circular plasmid of length 5000 base pairs is completely relaxed in aqueous buffer. If the plasmid is put in 80% ethanol so that it transforms to A-form DNA, what will be the status of its superhelicity?
	Option 1	It will become positively supercoiled
	Option 2	It will become negatively supercoiled
	Option 3	It will remain relaxed without any change in supercoiling.
	Option 4	Exactly half the molecules will become positively supercoiled and the other half will become negatively supercoiled, so that there is no net change in supercoiling.

Q259	Question/ Options	How many edges meet at every branch node in a phylogenetic tree?
	Option 1	1
	Option 2	2
	Option 3	3
	Option 4	4

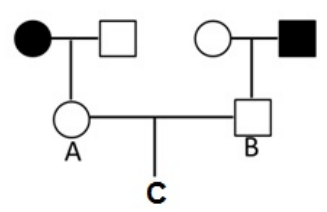
Q260	Question/ Options	Which one of the following proteins can be used as a template for structure prediction by homology modelling?
	Option 1	pdb 1TLH B: Identities = 39/66 (59%), Positives = 51/66 (77%), Expect = 3e-16
	Option 2	pdb 1DQL H: Identities = 9/15 (60%), Positives = 12/15 (80%), Expect = 9.9
	Option 3	pdb 1L9U H: Identities = 173/333(51%), Positives = 233/333(69%), Expect = 2e-89
	Option 4	pdb 1RP3 A: Identities = 56/206 (27%), Positives = 98/206 (47%), Expect = 2e-05

Q261	Question/ Options	In a pairwise alignment, an optimal alignment is the one that
	Option 1	either minimizes the implied number of evolutionary changes or minimizes a particular scoring function.
	Option 2	either maximizes the implied number of evolutionary changes or minimizes a particular scoring function.
	Option 3	either minimizes the implied number of evolutionary changes or maximizes a particular scoring function.
	Option 4	either maximizes the implied number of evolutionary changes or maximizes a particular scoring function.

Q262	Question/ Options	Which one of the following correctly specifies the order of helices according to their radius?
	Option 1	pi helix>alpha helix>3 <sub>10</sub> helix
	Option 2	3 <sub>10</sub> helix>alpha helix>pi helix
	Option 3	3 <sub>10</sub> helix>pihelix>alpha helix
	Option 4	alpha helix> 3 <sub>10</sub> helix> pi helix
Q263	Question/ Options	In protein sequence analysis, Twilight zone refers to the evolutionary distance corresponding to about
	Option 1	60% identity between two proteins
	Option 2	90% identity between two proteins
	Option 3	30% identity between two proteins
	Option 4	85% identity between two proteins
Q264	Question/ Options	The double-helical structure of DNA was first obtained using
	Option 1	Fiber diffraction only
	Option 2	Fiber diffraction and molecular modeling
	Option 3	X-ray diffraction from single crystals
	Option 4	Diffraction from single crystals and molecular modeling
Q265	Question/ Options	Molecular dynamics differs from molecular mechanics by taking account of the
	Option 1	velocities of the constituent particles
	Option 2	effect of the solvent medium
	Option 3	non-bonded interactions
	Option 4	periodic boundary condition
Q266	Question/ Options	An organism has 10 pairs of chromosomes. If all the genes in this organism were mapped how many linkage groups would be observed?
	Option 1	10
	Option 2	20
	Option 3	40
	Option 4	Cannot be predicted
Q267	Question/ Options	In a genetic map two genes A and B are 60 cM apart. If an individual heterozygous for the two genes (AaBb) is test-crossed, what percentage of the progeny will have the genotype aabb?
	Option 1	60
	Option 2	30
	Option 3	25
	Option 4	12.5

Q268	Question/ Options	The following can be used as DNA markers: a. Restriction Fragment Length Polymorphism b. Amplified Fragment Length Polymorphism c. Randomly Amplified Polymorphic DNA d. Microsatellites. Which of the above can be used to distinguish a heterozygote from a homozygote.
	Option 1	(a) and (c)
	Option 2	(b) and (c)
	Option 3	(b) and (d)
	Option 4	(a) and (d)
Q269	Question/ Options	The following events lead to changes in the DNA: a. Inversion b. Recombination c. Translocation d. Transition. Which of the above can lead to changes in the linkage map of an organism?
	Option 1	Only (b)
	Option 2	(a) and (c)
	Option 3	(b) and (d)
	Option 4	(a), (b) and (c)
Q270	Question/ Options	The following are terms which are used to describe sequence identities a. Homologs b. Paralogs c. Orthologs d. Analogs. Which of the above can be used to describe the relationship between a myoglobin gene from human and that from a mouse?
	Option 1	Only (b)
	Option 2	Only (c)
	Option 3	(a) and (b)
	Option 4	(a) and (c)
Q271	Question/ Options	To make a linkage map in <i>Drosophila</i> , a three-point test cross was carried out. The parental cross was between homozygous flies of genotype $a+c$ and $+b+$ . The double crossovers obtained after the test cross had the genotype $a++$ and $+cb$ . What is the order of the three genes?
	Option 1	c a b
	Option 2	a b c
	Option 3	a c b
	Option 4	a b c or a c b

Q272	Question/ Options	<p>Mouse-human somatic cell hybridization led to a number of cell clones in which all mouse chromosomes are present, but only certain human chromosomes are retained. The results are summarized below. The table indicates three such clones. '+' indicates presence of human chromosomes and '-' for those that are absent. All other human chromosomes are absent.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th rowspan="2">Hybrid clone</th> <th colspan="8">Human chromosomes</th> </tr> <tr> <th>1</th> <th>2</th> <th>3</th> <th>4</th> <th>5</th> <th>6</th> <th>7</th> <th>8</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>+</td> <td>+</td> <td>+</td> <td>+</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> </tr> <tr> <td>B</td> <td>+</td> <td>+</td> <td>-</td> <td>-</td> <td>+</td> <td>+</td> <td>-</td> <td>-</td> </tr> <tr> <td>C</td> <td>+</td> <td>-</td> <td>+</td> <td>-</td> <td>+</td> <td>-</td> <td>+</td> <td>-</td> </tr> </tbody> </table> <p>If an enzyme activity was present only in clone C, the allele encoding the enzyme is present on chromosome</p>	Hybrid clone	Human chromosomes								1	2	3	4	5	6	7	8	A	+	+	+	+	-	-	-	-	B	+	+	-	-	+	+	-	-	C	+	-	+	-	+	-	+	-
	Hybrid clone	Human chromosomes																																												
		1	2	3	4	5	6	7	8																																					
	A	+	+	+	+	-	-	-	-																																					
	B	+	+	-	-	+	+	-	-																																					
C	+	-	+	-	+	-	+	-																																						
Option 1	2																																													
Option 2	3																																													
Option 3	6																																													
Option 4	7																																													

Q273	Question/ Options	<p>The following pedigree shows the inheritance of an autosomal recessive trait</p> <p>What is the probability that a child (C) born to individuals A and B will show the trait?</p> 
	Option 1	1/2
	Option 2	1/4
	Option 3	1/9
	Option 4	1/16



Q274	Question/ Options	Assume a population in Hardy-Weinberg equilibrium for alleles at an autosomal recessive disease locus. The frequency of mutant allele 'q' is 1/50. The fraction of the population representing carriers of the disease is closest to
	Option 1	$(1/50)^2$
	Option 2	1/25
	Option 3	$(1/25)^2$
	Option 4	1/50

Q275	Question/ Options	<p>A subset of informative SNPs that may be used as good representative of the rest of the SNPs is called as tag-SNPs.</p> <p>The following is a set of SNPs representing four haplotypes. Of the four shaded SNPs (a to d) which of the following combinations can be used as a tag-SNP for the four haplotypes?</p> <p>1.   CTC<b>A</b>AAGTACGGTTCAGGC          2.   TTG<b>A</b>TTG<b>C</b>GCAACAGTAAT          3.   CCCGATCTGTGATACTGGT          4.   TCG<b>A</b>TT<b>C</b>GCGGGTTCAGAC</p> <p style="text-align: center;">(a)      (b)      (c)      (d)</p>
	Option 1	(a) and (b)
	Option 2	(c) and (d)
	Option 3	(a), (b) and (c)
	Option 4	(b), (c) and (d)

# Biotechnology Eligibility Test-2014 for DBT-JRF

(BET-2014) held on 20<sup>th</sup> April 2014

## Answer Key

SECTION - A				
Q1 : 2	Q2 : 2	Q3 : 3	Q4 : 2	Q5 : 4
Q6 : 4	Q7 : 4	Q8 : 3	Q9 : 2	Q10 : 1
Q11 : 4	Q12 : 2	Q13 : 4	Q14 : 1	Q15 : 2
Q16 : 1	Q17 : 1	Q18 : 2	Q19 : 2	Q20 : 3
Q21 : 3	Q22 : 1	Q23 : 1	Q24 : 1	Q25 : 2
Q26 : 1	Q27 : 2	Q28 : 2	Q29 : 4	Q30 : 4
Q31 : 1	Q32 : 1	Q33 : 2	Q34 : 3	Q35 : 4
Q36 : 4	Q37 : 1	Q38 : 1	Q39 : 1	Q40 : 1
Q41 : 1	Q42 : 2	Q43 : 4	Q44 : 2	Q45 : 3
Q46 : 2	Q47 : 2	Q48 : 2	Q49 : 3	Q50 : 3
Q51 : 3	Q52 : 1	Q53 : 3	Q54 : 3	Q55 : 1
Q56 : 2	Q57 : 2	Q58 : 2	Q59 : 1	Q60 : 3
Q61 : 2	Q62 : 1	Q63 : 2	Q64 : 1	Q65 : 2
Q66 : 2	Q67 : 3	Q68 : 1	Q69 : 3	Q70 : 1
Q71 : 1	Q72 : 1	Q73 : 3	Q74 : 1	Q75 : 1
SECTION - B				
Q76 : 4	Q77 : 1	Q78 : 1	Q79 : 3	Q80 : 1
Q81 : 3	Q82 : 1	Q83 : 1	Q84 : 1	Q85 : 3
Q86 : 4	Q87 : 3	Q88 : 1	Q89 : 2	Q90 : 2
Q91 : 3	Q92 : 1	Q93 : 1	Q94 : 2	Q95 : 4
Q96 : 4	Q97 : 2	Q98 : 4	Q99 : 3	Q100 : 2
Q101 : 2	Q102 : 3	Q103 : 4	Q104 : 2	Q105 : 2
Q106 : 1	Q107 : 3	Q108 : 2	Q109 : 3	Q110 : 3
Q111 : 4	Q112 : 2	Q113 : 3	Q114 : 2	Q115 : 2
Q116 : 4	Q117 : 1	Q118 : 3	Q119 : 3	Q120 : 3
Q121 : 1	Q122 : 2	Q123 : 2	Q124 : 3	Q125 : 4
Q126 : 4	Q127 : 3	Q128 : 4	Q129 : 4	Q130 : 3
Q131 : 1	Q132 : 4	Q133 : 4	Q134 : 4	Q135 : 1
Q136 : 4	Q137 : 2	Q138 : 1	Q139 : 4	Q140 : 1
Q141 : 2	Q142 : 3	Q143 : 1	Q144 : 2	Q145 : 1
Q146 : 3	Q147 : 3	Q148 : 3	Q149 : 4	Q150 : 2
Q151 : 3	Q152 : 3	Q153 : 2	Q154 : 1	Q155 : 3

**BET-2014 Answer Key****SECTION-B (Continued from Page-1)**

Q156 : 4	Q157 : 4	Q158 : 4	Q159 : 3	Q160 : 2
Q161 : 3	Q162 : 3	Q163 : 2	Q164 : 3	Q165 : 2
Q166 : 2	Q167 : 3	Q168 : 4	Q169 : 3	Q170 : 3
Q171 : 2	Q172 : 4	Q173 : 2	Q174 : 3	Q175 : 3
Q176 : 2	Q177 : 2	Q178 : 3	Q179 : 1	Q180 : 3
Q181 : 3	Q182 : 1	Q183 : 3	Q184 : 2	Q185 : 3
Q186 : 3	Q187 : 4	Q188 : 2	Q189 : 1	Q190 : 3
Q191 : 2	Q192 : 3	Q193 : 1	Q194 : 1	Q195 : 2
Q196 : 2	Q197 : 4	Q198 : 2	Q199 : 4	Q200 : 1

Q201 : 2	Q202 : 4	Q203 : 2	Q204 : 3	Q205 : 1
Q206 : 3	Q207 : 4	Q208 : 2	Q209 : 3	Q210 : 2
Q211 : 3	Q212 : 4	Q213 : 4	Q214 : 1	Q215 : 4
Q216 : 3	Q217 : 1	Q218 : 3	Q219 : 3	Q220 : 2
Q221 : 3	Q222 : 1	Q223 : 1	Q224 : 2	Q225 : 3
Q226 : 3	Q227 : 1	Q228 : 3	Q229 : 3	Q230 : 2
Q231 : 3	Q232 : 1	Q233 : 2	Q234 : 3	Q235 : 1
Q236 : 2	Q237 : 2	Q238 : 1	Q239 : 2	Q240 : 3
Q241 : 2	Q242 : 3	Q243 : 1	Q244 : 1	Q245 : 1
Q246 : 1	Q247 : 1	Q248 : 1	Q249 : 1	Q250 : 1
Q251 : 1	Q252 : 1	Q253 : 1	Q254 : 1	Q255 : 1
Q256 : 2	Q257 : 1	Q258 : 1	Q259 : 3	Q260 : 3
Q261 : 3	Q262 : 1	Q263 : 3	Q264 : 2	Q265 : 1
Q266 : 1	Q267 : 3	Q268 : 4	Q269 : 2	Q270 : 4
Q271 : 3	Q272 : 4	Q273 : 3	Q274 : 2	Q275 : 4

# **BET-2015 (DBT-JRF) Examination**

## **INSTRUCTIONS FOR CANDIDATES**

**April 26, 2015**

**Total Marks - 375**

**Duration 2.30 p.m. - 5.30 p.m.**

- 1) The Question Paper consists of multiple choice objective type questions with **4 options** out of which only one is correct.
- 2) The questions will be displayed on the screen one at a time. Candidate can use the **View QP** feature to view the complete question paper at a time.
- 3) The test will be made available only in **English**.
- 4) Question paper will have two sections: **Section A and Section B**.
- 5) **All 75 question in Section A are compulsory. However, candidates can attempt less number of questions if they wish.**
- 6) **Answer any 50 questions out of 200 questions from Section B. In case you want to attempt any new question i.e. 51<sup>st</sup> question then you will have to clear response of any of the previous questions and so on.**
- 7) Each question carries **3 marks**; for every wrong answer, one mark will be deducted **(-1 negative marking)**.
- 8) The examination duration is **180 minutes**. Questions can be answered in any order you like to.
- 9) **Submit button will be enabled after the completion of exam i.e. the candidate has to sit for the entire duration of the exam.**
- 10) The candidates are requested to follow the instructions of the "Test Administrator" carefully. If any candidate does not follow the instructions / rules, it would be treated as a case of misconduct / adoption of unfair means.
- 11) The candidates may ask the Test Administrator about their doubts or questions only before the commencement of the test. No query shall be entertained after the commencement of the examination.
- 12) After the expiry of 180 minutes, the candidates will not be able to attempt any question or check their answers. The answers of the candidate would be saved automatically by the computer system even if he/ she have not clicked the "Submit" button.
- 13) Please note that under no circumstances should a candidate click on any of the 'keyboard keys' once the exam starts.

## SECTION-A

Q 1	From a group of 7 women and 6 men, 5 persons are required to form a selection committee in which at least 3 women should be there. How many are the possibilities?
Option 1	765
Option 2	657
Option 3	567
Option 4	756

Q 2	Two trains, one from Delhi to Pune and the other from Pune to Delhi, start at the same time from their respective stations. After they meet, the trains reach their appropriate destinations after 4 hours and 9 hours respectively. The ratio of their speeds is:
Option 1	9:4
Option 2	3:2
Option 3	4:3
Option 4	5:4

Q 3	A container has a mixture of kerosene and water in a ratio of 7 : 5. When 9 litres of mixture are taken off and the container is filled with 9 litres of water, the ratio between kerosene and water becomes 7 : 9. How many litres of kerosene were initially in the container?
Option 1	11
Option 2	16
Option 3	21
Option 4	26

Q 4	The missing number in the series 40, 120, 60, 180, 90, ____, 135 is
Option 1	110
Option 2	270
Option 3	105
Option 4	210

Q 5	If a rectangle was called a circle, a circle a point, a point a triangle and a triangle a square, the shape of a wheel would be a
Option 1	rectangle
Option 2	circle
Option 3	point
Option 4	triangle

Q 6	Six persons A, B, C, D, E and F are standing in a circle facing the centre of the circle. B is between F and C, A is between E and D, F is to the left of D. Who is between A and F?
Option 1	B
Option 2	C
Option 3	D
Option 4	E

Q 7	The molecular weight of a protein is 30 kDa. The minimal length of mRNA encoding this polypeptide will be close to
Option 1	800
Option 2	900
Option 3	1000
Option 4	300

Q 8	What is the amount of protein required to prepare 5 ml of $1\mu\text{M}$ solution (Mol. Wt. of protein is 25 kDa)?
Option 1	125 $\mu\text{g}$
Option 2	125 ng
Option 3	250 $\mu\text{g}$
Option 4	12.5 $\mu\text{g}$

Q 9	Calculate the concentration of NADH solution, whose $A_{340\text{nm}} = 0.8$ O.D. (optical path length is 10 mm, NADH molar extinction coefficient is $\epsilon_{340} = 6220$ )
Option 1	128.6 $\mu\text{M}$
Option 2	12.86 nM
Option 3	1.286 $\mu\text{M}$
Option 4	1.28 nM

Q 10	Identify the pair that best expresses the relationship similar to that expressed in: MENTOR:GUIDANCE
Option 1	Philanthropist : Arguments
Option 2	Philosopher : Donation
Option 3	Physician : Treatment
Option 4	Physicist : Succour

Q 11	If counting was done in base 5 (instead of 10) so that 5 (in base 10) would be written as 10 (in base 5), 6 (in base 10) would be written as 11 (in base 5), then 89 (in base 10) will be written as which of the following numbers in base 5?
Option 1	234
Option 2	324
Option 3	423
Option 4	432

Q 12	If there are 3 children in a family, then the probability that there is only one girl child in the family is
Option 1	2/3
Option 2	1/3
Option 3	3/25
Option 4	3/8

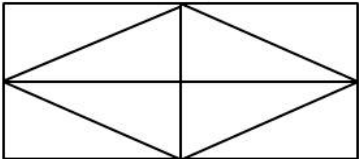
Q 13	A student's average marks (arithmetic mean) on three tests is 80. Which of the following CANNOT be the number of tests on which (s)he earned exactly 80 marks?
Option 1	0
Option 2	1
Option 3	2
Option 4	3

Q 14	If $0 < a < b < 1$ , which of the following is INCORRECT?
Option 1	$a - b < 0$
Option 2	$\frac{1}{ab} > 1$
Option 3	$\frac{1}{b} - \frac{1}{a} > 0$
Option 4	$ab < \frac{a^2 + b^2}{2}$

Q 15	If 25% of 260 equals 6.5% of $10^a$ , what is a?
Option 1	0
Option 2	1
Option 3	2
Option 4	3

Q 16	Complete the following sentence from the options provided. Few other plants can grow beneath the canopy of a tree, whose leaves and pods produce a natural herbicide that leaches into the surrounding soil, _____ other plants that might compete for water and nutrients.
Option 1	inhibiting
Option 2	distinguishing
Option 3	nourishing
Option 4	refreshing

Q 17	<p>The data below are from a Meselson-Stahl type of experiment. Which model of DNA replication is supported by the results shown in the table below?</p> <table border="1"> <thead> <tr> <th>Generation</th> <th>% Heavy DNA</th> <th>% Hybrid DNA</th> <th>% light DNA</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>100</td> <td>0</td> <td>0</td> </tr> <tr> <td>2</td> <td>50</td> <td>0</td> <td>50</td> </tr> <tr> <td>3</td> <td>25</td> <td>0</td> <td>75</td> </tr> <tr> <td>4</td> <td>12.5</td> <td>0</td> <td>87.5</td> </tr> </tbody> </table>	Generation	% Heavy DNA	% Hybrid DNA	% light DNA	1	100	0	0	2	50	0	50	3	25	0	75	4	12.5	0	87.5
Generation	% Heavy DNA	% Hybrid DNA	% light DNA																		
1	100	0	0																		
2	50	0	50																		
3	25	0	75																		
4	12.5	0	87.5																		
Option 1	DNA replication is semi-conservative																				
Option 2	DNA replication is conservative																				
Option 3	DNA replication is dispersive																				
Option 4	DNA replication is random																				

Q 18	<p>How many triangles are present in this figure?</p> 
Option 1	8
Option 2	10
Option 3	12
Option 4	14

Q 19	<p>A man goes to the house of Sita, who is the neighbor of Geeta, who has a daughter named Meera. Ashu is Aman's father and is married to Anjali, who is sister of Geeta. How is Meera related to Anjali?</p>
Option 1	Niece
Option 2	Cousin
Option 3	Sister
Option 4	Aunt



Q 20	What will come in place of (*) in the following number series? 19, 26, 40, 68, 124 (*)
Option 1	256
Option 2	238
Option 3	246
Option 4	236

Q 21	Fifty-three percent of a number is 358 less than the square of 26. What is the value of three-fourth of 23 per cent of that number?
Option 1	109.5
Option 2	113.5
Option 3	101.5
Option 4	103.5

Q 22	A cube is painted on all sides using yellow and black color such that opposite faces are painted in different color. This cube is cut into 27 smaller cubes of equal sizes. How many smaller cubes will have only one face colored?
Option 1	3
Option 2	6
Option 3	8
Option 4	12

Q 23	A man fills a basket with eggs in such a way that the number of eggs added on each successive day is the same as the number already present in the basket. This way the basket gets completely filled in 24 days. After how many days the basket was 1 / 4th full?
Option 1	6
Option 2	12
Option 3	17
Option 4	22

Q 24	Seema goes 30 km towards North from a fixed point, then after turning to her right she goes 15 km. After this she turns right again and goes another 30 km. How far and in what direction is she from her starting point?
Option 1	45 km East
Option 2	15 km East
Option 3	45 km West
Option 4	15 km West

Q 25	Find the odd one out:
Option 1	77
Option 2	36
Option 3	65
Option 4	3

Q 26	Th1 response is characterized by the secretion of which of the following combinations of cytokines?
Option 1	IL4 and IL17
Option 2	IFN $\gamma$ and IL12
Option 3	IL1 $\beta$ and IL12
Option 4	IFN $\gamma$ and IL4

Q 27	In hybridoma production, aminopterin is added after fusion to
Option 1	ensure monoclonality of the cultures that survive .
Option 2	cause the death of non -antibody secreting hybrids.
Option 3	cause the death of unfused myeloma cells.
Option 4	cause the death of unfused splenic cells.

Q 28	An alpha-helical conformation of a globular protein can be determined by
Option 1	Atomic force microscopy
Option 2	Electron microscopy
Option 3	Ultraviolet-visible absorbance spectroscopy
Option 4	Circular dichroism

Q 29	The athymic nude (nu/nu) mice are difficult to breed and maintain because the homozygous (nu/nu) females are sterile. How will you propagate it to get maximum nude (nu/nu) mice progeny.
Option 1	by mating of normal males to heterozygous (nu/+) females.
Option 2	by mating homozygous (nu/nu) males to heterozygous (nu/+) females.
Option 3	by mating of heterozygous (nu/+) males to heterozygous (nu/+) females.
Option 4	by mating of heterozygous (nu/+) males to normal females.

Q 30	The base sequence of a short piece of DNA is AGCTTACG. During replication, a transition mutation occurs in the complementary strand synthesized on this piece of DNA. Which of the following is mutated complementary strand?
Option 1	T C G A A T C G
Option 2	T C G A A T G C
Option 3	C G C G A G C T
Option 4	U C G A A G U C

Q 31	Uncoupling of LDL receptors with their ligands occur at which of the following compartments?
Option 1	Late endosome
Option 2	Recycling endosome
Option 3	Early endosome
Option 4	Lysosome

Q 32	Transport of cargo from nucleus to cytoplasm through nuclear pore is regulated by
Option 1	Ras GTPase
Option 2	Rab GTPase
Option 3	Rho GTPase
Option 4	Ran GTPase

Q 33	Which one of the following is a cobalt containing vitamin?
Option 1	Vitamin B <sub>2</sub>
Option 2	Vitamin B <sub>4</sub>
Option 3	Vitamin B <sub>6</sub>
Option 4	Vitamin B <sub>12</sub>

Q 34	Brefeldin A inhibits protein transport from
Option 1	ER to Golgi apparatus
Option 2	Golgi apparatus to ER
Option 3	Golgi apparatus to nucleus
Option 4	Golgi apparatus to mitochondria

Q 35	Which one of the following diseases is caused by a bacteria ?
Option 1	Measles
Option 2	Tetanus
Option 3	Marek's disease
Option 4	Mumps

Q 36	Which one of the following antibiotics is used to demonstrate the new/fresh protein synthesis in response to an inducer/ upon induction in a microbial system?
Option 1	Chloramphenicol
Option 2	Carbenicillin
Option 3	Ampicillin
Option 4	Tetracyclin

Q 37	Both somatic hypermutation and isotype switching depend upon a highly specific enzyme of adaptive immunity that is made only by B cells proliferating in response to antigen. The name of the enzyme is
Option 1	Rag1 recombinase
Option 2	Activation induced cytidine deaminase
Option 3	Terminal deoxynucleotidyl transferase
Option 4	Cre recombinase

Q 38	AGO proteins are associated with
Option 1	Histone complex
Option 2	RNAi effector complex
Option 3	SOS mechanisms
Option 4	Tryptophan operon

Q 39	The fusion between protoplasts can be enhanced by subjecting them to
Option 1	High temperature
Option 2	Low temperature
Option 3	High electric current
Option 4	High light intensity

Q 40	If a nucleotide sequence encoding a protein is known and a homologous protein to be identified, which of the following will be the best analysis tool?
Option 1	BLASTp
Option 2	BLASTn
Option 3	BLASTx
Option 4	tBLASTn

Q 41	The concentration of which of the following plays an important role in somatic embryogenesis?
Option 1	$\text{NH}_4^+$
Option 2	$\text{NO}_3^-$
Option 3	$\text{K}^+$
Option 4	$\text{PO}_4^{3-}$

Q 42	Simple sequence repeats (SSRs) markers are derived from
Option 1	Non-coding sequences only
Option 2	Coding sequences only
Option 3	Both coding and non-coding sequences
Option 4	Only from promoter sequences

Q 43	Which of the following enzymes are required for making plant protoplasts?
Option 1	Cellulase and proteinase
Option 2	Cellulase and pectinase
Option 3	Cellulase and amylase
Option 4	Amylase and pectinase

Q 44	The floral dip method is commonly used for
Option 1	Proteomics
Option 2	Genetic transformation
Option 3	Crossing
Option 4	DNA isolation

Q 45	Impeller Reynolds number is given by
Option 1	$DV\rho/\mu$
Option 2	$D^2N\rho/\mu$
Option 3	$D^2V\rho/\mu$
Option 4	$DN\rho/\mu$

Q 46	Continuous cultivation is carried out in 10 L working volume. If $0.2 \text{ h}^{-1}$ dilution rate has to be maintained, then the feed rate will be
Option 1	2L/h
Option 2	400 mL/h
Option 3	400 mL/min
Option 4	5 L/h

Q 47	If the doubling time of an organism is 0.693 h, the specific growth rate will be
Option 1	$1 \text{ h}^{-1}$
Option 2	$1 \text{ min}^{-1}$
Option 3	$0.1 \text{ h}^{-1}$
Option 4	$10 \text{ min}^{-1}$

Q 48	Aeration in a fermentor is expressed as VVM. What will be the VVM if air is sparged at 2000 L/min with a working volume 10 m <sup>3</sup> ?
Option 1	0.2
Option 2	0.5
Option 3	1
Option 4	1.2

Q 49	Rate of centrifugation of a particle in a centrifuge is increased by
Option 1	Decreasing the particle diameter
Option 2	Increasing the centrifuge speed
Option 3	Decreasing the density difference between the particle and liquid
Option 4	Increasing the viscosity of suspended fluid

Q 50	In a batch process of solvent-solvent extraction, higher percentage of extraction is ensured when the whole solvent for extraction is added
Option 1	Once at a time
Option 2	Twice in equal volume
Option 3	Thrice in equal volume
Option 4	Four times in equal volume

Q 51	Which one of the following is true during the separation of biomolecules by reversed phase chromatography ?
Option 1	Stationary phase is less polar than the mobile phase
Option 2	Stationary phase is more polar than the mobile phase
Option 3	Both the stationary and the mobile phase are having the same polarity
Option 4	Polarity of the mobile phase does not play any role

Q 52	In ultrafiltration, identify which one of the following relationships between transmembrane pressure (TMP) and flux (F) is CORRECT
Option 1	For water, initially F increases with TMP and remains constant
Option 2	For water, F always increases with TMP
Option 3	For water, F always decreases with TMP
Option 4	For water, initially F decreases with TMP and remains constant

Q 53	Identify the INCORRECT match
Option 1	Koch-Germ theory
Option 2	Pasteur-blood clotting theory
Option 3	Halsted-modern surgical principles
Option 4	Lavoisier-oxygen theory of combustion

Q 54	The first smallpox vaccine is an example of
Option 1	Heat killed vaccine
Option 2	Chemically attenuated vaccine
Option 3	Live vaccine
Option 4	Vaccine with adjuvant

Q 55	ELISPOT assay is traditionally used for measuring
Option 1	Frequency of T cell responses
Option 2	Frequency of B cell responses
Option 3	Cytokine concentration in serum
Option 4	Antibody titre in serum

Q 56	Fertility factor' is related to 'conjugation' in the same way as 'bacteriophage P1' to
Option 1	Transformation
Option 2	Transduction
Option 3	Efflux
Option 4	Transposition

Q 57	Hemorrhage in the brain tissue with loss of consciousness is known as
Option 1	Hematoma
Option 2	Hemoptysis
Option 3	Hematemesis
Option 4	Apoplexy

Q 58	Which one of the following methods is frequently used to create transgenic animals?
Option 1	Particle bombardment
Option 2	Nuclear micro-injection
Option 3	Nuclear fusion
Option 4	Nucleo-cytoplasmic transplantation

Q 59	Which of the following is an atypical signaling receptor?
Option 1	Cytokine receptor
Option 2	Chemokine receptor
Option 3	T-cell receptor
Option 4	Mannose receptor

Q 60	The critical regulatory site in the circuit of emotions is
Option 1	Hippocampus
Option 2	Cingulate gyrus
Option 3	Amygdala
Option 4	Fornix

Q 61	Which glial cells participate in the re-uptake mechanism of neurotransmitter from the synaptic cleft?
Option 1	Microglia
Option 2	Oligodendroglia
Option 3	Radial Glia
Option 4	Astroglia

Q 62	Red data book contains data of ....
Option 1	all plant species
Option 2	all animal species
Option 3	economically important species
Option 4	threatened species

Q 63	Conservation within the natural habitat is .....
Option 1	in situ conservation
Option 2	ex situ conservation
Option 3	in vivo conservation
Option 4	ex vivo conservation

Q 64	MAB program stands for...
Option 1	Man and biotechnology
Option 2	Material and biology
Option 3	Man and biology
Option 4	Man and biosphere

Q 65	Marine organisms that require oxygen levels typically in the range of 2-10 % for growth would be classed under
Option 1	facultative anaerobes
Option 2	aerotolerant anaerobes
Option 3	obligate aerobes
Option 4	microaerophiles

Q 66	Along which plate boundaries do the majority of the world's earthquakes occur?
Option 1	divergent
Option 2	transform
Option 3	convergent
Option 4	divergent as well as transform

Q 67	Which of the following will increase the salinity of a particular area of coastal water?
Option 1	Thawing of ice
Option 2	Precipitation
Option 3	River input
Option 4	Freezing of water

Q 68	An individual has the genotype $AaBbccddEe$ . Assuming independent assortment what frequency of gametes will have the genotype $abcde$ ?
Option 1	1/4
Option 2	1/8
Option 3	1/16
Option 4	1/32



Q 69	If the DNA content of a cell in G <sub>1</sub> phase of cell cycle is 'C', what will be its content after meiosis is completed?
Option 1	$\frac{1}{4}$ C
Option 2	$\frac{1}{2}$ C
Option 3	C
Option 4	2C

Q 70	Which type of chemical mutagen is incorporated into the genome by DNA polymerase during replication?
Option 1	Alkylating agents
Option 2	Base analogs
Option 3	Deaminating agents
Option 4	Intercalating agents

Q 71	Which of the following constitutes a necessary and sufficient condition for two proteins to be considered homologous?
Option 1	The sequences of the proteins must show greater than 50% identity in a Global alignment
Option 2	The sequences of the proteins must show greater than 50% identity in a local alignment
Option 3	The proteins should have diverged from a common ancestor
Option 4	The proteins should have very similar structure and function

Q 72	Boiling a mixture of butter, water and eggs, results in a homogenous suspension; However if the eggs are omitted, then the butter and the water separate out. Which component, present in the egg, is responsible for this behaviour?
Option 1	Albumin
Option 2	DNA
Option 3	Various salts of sodium and magnesium that are present in eggs
Option 4	Lecithin

Q 73	Cooking meat in presence of cut pieces of Papaya fruit results in unusually tender meat. What enzyme, present in the Papaya fruit is responsible for this?
Option 1	Pepsin
Option 2	Papain
Option 3	Papase
Option 4	Papaverine

Q 74	Which of the following peptide sequences will match the sequence motif GXX[SVP]XXG?
Option 1	PGQRVGGGR
Option 2	GPQRVGGGR
Option 3	PGQRQYGGGG
Option 4	PGQRFYGGPR

Q 75	In Mass Spectroscopy, a quadrupole mass filter does which of the following?
Option 1	It makes possible the detection of four times larger ions than normal.
Option 2	It specifically filters out those complex ions that have two positive and two negative charges.
Option 3	It specifically allows ions with two positive and two negative charges and blocks the rest.
Option 4	It allows only those ions which have a specific $m/z$ ratio to pass through.

The Biomimics

## SECTION - B

Q 76	If maltose and monosodium glutamate (MSG) are added to a vinegar and palmitic acid and shaken, the mixture will eventually separate into two phases of different density and polarity. Where will most of the sucrose and the MSG be located following phase separation?
Option 1	Both will concentrate in the vinegar.
Option 2	Both will concentrate in the oil.
Option 3	Maltose will concentrate in the oil and MSG will concentrate in the vinegar.
Option 4	Maltose will concentrate in the vinegar and MSG will concentrate in the oil.

Q 77	A slide of macrophage was stained by immunofluorescence using a monoclonal antibody for TAP1/TAP2 complex. Which of the following intracellular compartments would exhibit positive staining with this antibody?
Option 1	Cell surface
Option 2	Endoplasmic reticulum
Option 3	Golgi apparatus
Option 4	Mitochondria

Q 78	Which of the following disorder is not X-linked?
Option 1	Color blindness
Option 2	Rett syndrome
Option 3	Hutchinson muscular dystrophy
Option 4	Swyers syndrome

Q 79	$\alpha$ -amanitin inhibits
Option 1	RNA polymerase I
Option 2	RNA polymerase II
Option 3	DNA polymerase I
Option 4	DNA polymerase II

Q 80	Nullisomy is the term used for the condition when an organism has
Option 1	One additional chromosome than normal
Option 2	One less chromosome than normal
Option 3	Loss of one homologous pair of chromosome
Option 4	Loss of two heterologous chromosomes

Q 81	Tunicamycin blocks
Option 1	N-linked glycosylation
Option 2	O-linked glycosylation
Option 3	Phosphorylation
Option 4	Methylation

Q 82	Which of the following cannot be used in finding the interaction between miRNA and mRNA?
Option 1	TargetScan
Option 2	StarBase
Option 3	PAR- CLIP
Option 4	miRanda

Q 83	H1N1, H1N2, H2N1, H3N1 and H3N2 are subtypes of which influenza virus?
Option 1	influenza A
Option 2	influenza B
Option 3	influenza C
Option 4	influenza D

Q 84	A mother and a father, both CF (cystic fibrosis) carriers, have two children that do not suffer from CF. The probability of a third pregnancy producing a child with the disease is
Option 1	None
Option 2	1:4
Option 3	1:3
Option 4	1:1

Q 85	The overall reaction catalyzed by the electron transport chain is
Option 1	Glucose + ATP → Glucose-6-phosphate + ADP
Option 2	ATP + GDP ↔ ADP + GTP
Option 3	$\text{NADH} + \text{H}^+ + \frac{1}{2} \text{O}_2 \rightarrow \text{NAD}^+ + \text{H}_2\text{O}$
Option 4	$\text{ATP} + \text{H}_2\text{O} \rightarrow \text{ADP} + \text{H}_2\text{PO}_4^-$

Q 86	DNA polymerase III of <i>E. coli</i> is
Option 1	required for <i>de novo</i> synthesis of new strands of DNA
Option 2	involved in the repair of damaged DNA
Option 3	required to restart a replication fork
Option 4	involved DNA recombination

Q 87	The protection against smallpox afforded by prior infection with cowpox represents
Option 1	antigenic specificity.
Option 2	antigenic cross-reactivity.
Option 3	innate immunity.
Option 4	passive protection.

Q 88	Internalized antigens are targeted to which of the following compartments for generation of appropriate peptide for presentation on the cell surface along with MHC molecule
Option 1	Lysosomes
Option 2	Endosome
Option 3	Endoplasmic reticulum
Option 4	Golgi

Q 89	In which receptor system, both receptor and ligand are recycled back to membrane
Option 1	LDL receptor
Option 2	Mannose receptor
Option 3	Transferrin receptor
Option 4	Insulin receptor

Q 90	GTP binding proteins are active in GTP bound form. Which of the following protein converts the GTP bound form to GDP bound form.
Option 1	Guanine nucleotide exchange factor
Option 2	GTPase activating protein
Option 3	Guanine nucleotide dissociation inhibitor
Option 4	Guanine nucleotide dissociation factor

Q 91	Which enzyme is used to remove the phosphate group from 5' end of the DNA?
Option 1	Polynucleotide kinase
Option 2	Terminal phosphoryl transferase
Option 3	Alkaline phosphatase
Option 4	Lyases

Q 92	Which one of the following techniques is suitable for the large scale purification of isozymes (A and B) that are differing from each other by a single positive charged amino acid?
Option 1	Chromatofocusing
Option 2	Gel filtration chromatography
Option 3	Native PAGE
Option 4	Analytical isoelectric focusing

Q 93	Glycogen and cellulose are
Option 1	Helical and beta-sheet structure, respectively
Option 2	Helical structures but with different degree of helicity
Option 3	Beta-sheet structures
Option 4	Helical but glycogen is extensively branched molecule

Q 94	Which one of the following factors influences the binding of oxygen to hemoglobin?
Option 1	concentration of $\text{HCO}_3^-$
Option 2	partial pressure of oxygen
Option 3	concentration of hemoglobin
Option 4	concentration of 2,3-bisphosphoglycerate

Q 95	Which one of the following DNA viruses has part of its life cycle involving Reverse Transcriptase enzyme, which is a hallmark of Retroviruses?
Option 1	Epstein-Barr Virus
Option 2	Herpes Simplex Virus
Option 3	Hepatitis B Virus
Option 4	Hepatitis C Virus

Q 96	Cells are broken to release the contents by using various enzymes. Which of the following combination is FALSE?
Option 1	Lysozyme – bacteria
Option 2	Cellulase – plant cell
Option 3	Chitinase – fungus
Option 4	Cellulase – bacteria

Q 97	Which of the following enzymes is required to release the tension imposed by uncoiling of strands?
Option 1	Endonuclease
Option 2	DNA ligase
Option 3	DNA gyrase
Option 4	DNA helicase

Q 98	DNA fingerprinting is based on
Option 1	Occurrence of VNTR's
Option 2	Knowledge of human karyotype
Option 3	Cloned DNA
Option 4	Recombinant DNA

Q 99	The DNA sequence is ATG. What would be the sequence of bases in anticodon of tRNA
Option 1	CAU
Option 2	AUG
Option 3	UAC
Option 4	TAC

Q 100	All <u>except</u> one of the following are true about the protein kinase A (PKA) pathway
Option 1	PKA phosphorylates proteins at serine or threonine residues
Option 2	PKA phosphorylates proteins at tyrosine residues
Option 3	PKA is activated by cAMP
Option 4	PKA is activated by binding of epinephrine to a transmembrane receptor without enzyme activity

Q 101	A T- cytotoxic cell can be induced to mount a cytotoxic attack on a virus-infected cell if it binds to a cell displaying
Option 1	insufficient MHCI
Option 2	insufficient MHCII.
Option 3	MHC I bearing foreign antigen.
Option 4	MHC II bearing foreign antigen.

Q 102	Testosterone hormone, necessary for spermatogenesis, is secreted by
Option 1	sertoli cells
Option 2	leydig cells
Option 3	spermatozoa
Option 4	cowpers gland

Q 103	Which of the following processes occurs in the formation of disulfide bridge between two cystiene residues?
Option 1	Reduction of sulfhydal group
Option 2	Electrostatic interaction
Option 3	Oxidation of sulfhydal group
Option 4	Hydrogen bond

Q 104	In Ramachandran plot, the values of the dihedral angle $\psi$ ( $\psi$ ) is based on rotation around
Option 1	N-C $^{\alpha}$ bond
Option 2	C $^{\alpha}$ -C' bond
Option 3	C'-N bond
Option 4	N-H bond

Q 105	Which one of the following antibiotics attaches to 50S ribosome and inhibits peptidyl-transferase activity?
Option 1	Penicillin
Option 2	Chloramphenicol
Option 3	Trimethoprim
Option 4	Amphotericin

Q 106	The cytological representation of Klinefelter syndrome is
Option 1	44A + XO
Option 2	44A + XXO
Option 3	44A + XXY
Option 4	43A + XYY

Q 107	A chromosome on which T-cell receptor alpha chain gene rearrangement has occurred lacks which of the following gene segments?
Option 1	Joining
Option 2	Diversity
Option 3	Variable
Option 4	Constant

Q 108	Which one of the following molecule yields higher amount of free energy?
Option 1	Phosphoenolpyruvate
Option 2	Glycerate-1, 3-bisphosphate
Option 3	Acetyl phosphate
Option 4	Phosphocreatine

Q 109	Which region of mRNA contains Shine-Dalgarno sequence?
Option 1	5' untranslated region
Option 2	Protein coding region
Option 3	3' untranslated region
Option 4	Promoter region

Q 110	$\alpha$ -D glucose and $\beta$ -D glucose are
Option 1	Epimers
Option 2	Keto-aldose isomers
Option 3	Anomers
Option 4	Optical isomers

Q 111	Which of the following statements is NOT true for eukaryotic DNA replication?
Option 1	It has multiple origins
Option 2	It is synchronized to phases of cell cycle
Option 3	It does not involve Okazaki fragment
Option 4	It requires licensing of Pre-replicative complex



Q 112	In vitro characterization of <i>E. coli</i> DNA polymerase shows an error rate of $10^{-6}$ - $10^{-7}$ per base pair. However, <i>in vivo</i> , the observed mutation rate is $10^{-9}$ - $10^{-10}$ per base. Such discrepancy is because:
Option 1	<i>In vitro</i> assays for DNA polymerase is less precise than <i>in vivo</i> assays.
Option 2	<i>E. coli</i> has a mechanism of removing such erroneous incorporation of bases.
Option 3	The mechanism by which DNA polymerase amplifies linear DNA used <i>in vitro</i> is different from that of circular DNA <i>in vivo</i> .
Option 4	The reason for such discrepancy is not known yet.

Q 113	The molecular formulae of deoxyribose sugar and ribose sugar, respectively, are
Option 1	$C_5 H_{10} O_4$ and $C_5 H_{10} O_6$
Option 2	$C_5 H_{10} O_4$ and $C_5 H_{10} O_5$
Option 3	$C_5 H_{10} O_5$ and $C_5 H_{10} O_4$
Option 4	$C_5 H_{10} O_5$ and $C_6 H_{10} O_4$

Q 114	Usually intracellular pathogens avoid their transport to lysosome for their survival in the host cell. But which of the following intracellular pathogens survives in the lysosomes?
Option 1	<i>Legionella</i>
Option 2	<i>Salmonella</i>
Option 3	<i>Mycobacterium</i>
Option 4	<i>Leishmania</i>

Q 115	When Hfr strain of <i>E. coli</i> is crossed with $F^-$ strain, recombinant obtained are
Option 1	always $F^+$
Option 2	always HFr <sup>+</sup>
Option 3	rarely $F^+$
Option 4	rarely HFr <sup>+</sup>

Q 116	Archea is considered as a separate group from bacteria and eukaryotes, based on
Option 1	genome sequence.
Option 2	16S rRNA gene sequence.
Option 3	23S rRNA gene sequence.
Option 4	EFTu sequence.

Q 117	How many grams of NaCl will be required to make 10 ml of 10 millimolar solution (MW of NaCl = 58.5)
Option 1	0.585 g
Option 2	0.0585 g
Option 3	0.00585 g
Option 4	0.000585 g

Q 118	Keratin intermediate filaments are synthesized in the cytoplasm of cells. Disulfide bonds cannot be formed in the cytoplasm. However, the keratin fibers in the skin are cross-linked by disulfide bonds. This is because
Option 1	Keratin fibers get transported via endoplasmic reticulum and Golgi to the skin surface
Option 2	Keratinocytes have an oxidizing cytosol
Option 3	Keratin crosslinking happens in dead cells whose contents are oxidized
Option 4	Secreted enzymes of the skin cells form the disulfide bonds after secretion of keratin fibers

Q 119	Which of the following plays a role in changing the antigen binding site of a B cell after antigenic stimulation?
Option 1	Junctional diversity
Option 2	Combinatorial diversity
Option 3	Germline diversity
Option 4	Somatic hypermutation

Q 120	What region of an mRNA is most commonly associated with transcript destabilization?
Option 1	The 5' untranslated region
Option 2	The 3' untranslated region
Option 3	The exonic coding regions
Option 4	The intronic regions

Q 121	Which type of replication requires a break in the nucleotide strand to get started?
Option 1	Theta replication
Option 2	Rolling circle replication
Option 3	Linear eukaryotic replication
Option 4	Theta and linear replication

Q 122	Mismatch repair in bacteria distinguishes between old and new strands of DNA on the basis of
Option 1	Differences in base composition of the two strands
Option 2	Modification of histone proteins
Option 3	Base analogs on the new strand
Option 4	Methyl groups on the old strand

Q 123	Why does the Environmental Protection Agency closely monitors the release of transgenic bacteria used for agricultural purposes?
Option 1	They want to monitor the destruction of crops by the GMOs
Option 2	They want to observe the effect the GMOs have on crops
Option 3	They want to ensure the GMOs do not proliferate in the environment and pose a threat to humans
Option 4	They want to ensure that people are aware that GMOs may have played a role in the production of a particular food product

Q 124	Which of the following events occurs first in the differentiation sequence of human B cells in the bone marrow?
Option 1	Immunoglobulin light chain rearrangement
Option 2	Immunoglobulin heavy chain rearrangement
Option 3	Surface IgD and IgM present on the B cell
Option 4	Surface IgM present on the B cell

Q 125	A zoo blot helps to detect DNA sequences that
Option 1	Are mutating at a fast rate.
Option 2	Are conserved between species.
Option 3	Are lost due to species extinction.
Option 4	Are processed pseudogenes.

Q 126	Addition of which of the following can prevent the precocious germination of the embryos during embryo culture?
Option 1	Cytokinin
Option 2	Sucrose
Option 3	Ammonium chloride
Option 4	Calcium chloride

Q 127	Which of the following techniques can be used to create diploid homozygous plants in a short span (few months to a year)?
Option 1	Cloning
Option 2	Anther culture
Option 3	Selfing
Option 4	Grafting

Q 128	In plant tissue culture experiments, "conditioned medium" refers to a medium in which
Option 1	all the nutrients are added in optimum concentration
Option 2	all the nutrients are added in high concentration for luxuriant growth
Option 3	media in which the plant cells have been grown for about 48 hrs and cells are filtered out
Option 4	plant cells have been grown for about 48 hrs and new cell cultures are added to it.

Q 129	An intron containing $\beta$ -glucuronidase ( <i>gus</i> -intron) is used as a reporter gene to assess plant transformation. The intron is introduced to:
Option 1	prevent any expression in the bacterial cells
Option 2	stabilize the <i>gus</i> transcript
Option 3	allow for alternate splicing
Option 4	use it as a target for <i>in situ</i> hybridization for spatial localization of the transcript

Q 130	Which one of the following is true about epigenetic changes?
Option 1	Changes are caused by deletion and are heritable
Option 2	Changes are caused by mutation and are heritable
Option 3	Changes are caused by mutation but are not heritable
Option 4	Changes are caused by DNA methylation and are heritable

Q 131	A cross between two true breeding lines, one with dark blue flowers and the other with bright white flowers produces F1 offspring that are light blue. When the F1 progenies are selfed, a 1:2:1 ratio of dark blue to light blue to white flowers is observed. What genetic phenomenon is consistent with these results?
Option 1	epistasis
Option 2	incomplete dominance
Option 3	co-dominance
Option 4	inbreeding depression

Q 132	In a tissue culture experiment, a student desires to have more differentiation of shoots. Which of the following plant growth hormone ratios should be used?
Option 1	High cytokinin to auxin
Option 2	High auxin to cytokinin
Option 3	High gibberellin to cytokinin
Option 4	High gibberellin to auxin

Q 133	A yeast mutant shows decreased expression of 5.8S rRNA, 5S rRNA and cdc2 mRNA. In which of the following might mutation lie?
Option 1	TATA binding protein (TBP)
Option 2	Upstream binding factor (UBF)
Option 3	RNA polymerase III
Option 4	RNA polymerase I

Q 134	Photosynthesis is a:
Option 1	Reductive, endergonic, catabolic process
Option 2	Reductive, endergonic, anabolic process
Option 3	Reductive, exergonic, catabolic process
Option 4	Reductive, exergonic, anabolic process

Q 135	Which of the following statements about a genomic library is INCORRECT?
Option 1	The genomic library will be representative if they contain all the genes in an organism
Option 2	The genomic library must be prepared from cDNA
Option 3	The DNA must be fragmented to an appropriate size to be cloned in suitable vector
Option 4	Genomic libraries should contain a minimum number of recombinant clones if they are to contain all the genes in an organism

Q 136	Which one of the following statements CORRECTLY describes the sequential steps in cDNA cloning?
Option 1	reverse transcription of mRNA, second strand synthesis, cDNA end modification, ligation to vector
Option 2	mRNA preparation, cDNA synthesis using reverse transcriptase, second strand synthesis using terminal transferase, ligation to vector
Option 3	mRNA synthesis using RNA polymerase, reverse transcription of mRNA, second strand synthesis, ligation to vector
Option 4	double stranded cDNA synthesis, restriction enzyme digestion, addition of linkers, ligation to vector

Q 137	Hygromycin B, generally used as a selection marker in plant transformation protocols is
Option 1	an aminocyclitol antibiotic produced by <i>Streptomyces hygroscopicus</i>
Option 2	an aminoglycoside bacteriocidal antibiotic isolated from the bacterium <i>Streptomyces kanamyceticus</i>
Option 3	a beta-lactam antibiotic that is part of the amino-penicillin family and is roughly equivalent to amoxicillin in terms of activity
Option 4	an ammonium butanoate antibody produced by <i>Streptomyces hygroscopicus</i>

Q 138	Which of the following statements about transcription in <i>E. coli</i> is CORRECT?
Option 1	The -10 sequence is always exactly 10 bp upstream from the transcription start site
Option 2	The initiating nucleotide is always a G
Option 3	The intervening sequence between -35 and -10 sequences is highly conserved
Option 4	The distance between the -35 and -10 sequences is critical for transcription efficiency

Q 139	In an <i>in vitro</i> culture experiment the colour of explants turned brown just after 24 hours of sub-culturing. This is due to the
Option 1	Release of antioxidant from explants
Option 2	Release of phenolic compounds from explants
Option 3	Deficiency of nutrients
Option 4	Deficiency of hormones in the medium

Q 140	To avoid the somaclonal variation in the development of transgenic plants which one of the following is preferred?
Option 1	Direct regeneration
Option 2	Regeneration through somatic embryos
Option 3	Regeneration through calli
Option 4	Regeneration through immature embryos

Q 141	The transplastomic lines have no risk of gene escape through pollens since the
Option 1	Pollens degenerate before fertilization
Option 2	Transformed mitochondrial DNA is lost during pollen maturation
Option 3	Transformed chloroplast DNA is lost during pollen maturation
Option 4	Transformed genomic DNA is maternally inherited

Q 142	Among the following, which one is NOT a common method of haploid plant production?
Option 1	Embryo rescue of inter-specific crosses
Option 2	Anther culture
Option 3	Ovule culture
Option 4	Colchicine treatment

Q 143	Which one of the following statements about the M13 bacteriophage is INCORRECT?
Option 1	It mediates transduction
Option 2	It is a single-stranded DNA phage
Option 3	It produces progeny without lysing the host cell
Option 4	It is useful in sequencing strategies

Q 144	Which of the following are flowering hormones?
Option 1	Ethylene and florigen
Option 2	Florigen and vernalin
Option 3	Vernalin and Auxin
Option 4	Ethylene and Auxin

Q 145	Which of the following genes are constitutively expressed and control the plant-induced activation of other <i>vir</i> genes?
Option 1	<i>vir A</i> and <i>vir G</i>
Option 2	<i>vir C</i> and <i>vir D</i>
Option 3	<i>vir A</i> and <i>vir B</i>
Option 4	<i>vir B</i> and <i>vir E</i>

Q 146	In case of gametophytic incompatibility system, the self incompatibility phenotype of the pollen is determined by
Option 1	haploid genotype of the pollen
Option 2	haploid genotype of the anther
Option 3	diploid genotype of the pollen
Option 4	diploid genotype of the anther

Q 147	High frequency heterokaryon formation is observed during protoplast fusion by the addition of
Option 1	Glycerol
Option 2	PEG
Option 3	NaNO <sub>3</sub>
Option 4	DMSO

Q 148	Somatic embryo induction generally occurs in presence of the two growth regulators namely
Option 1	Auxin & Cytokinin
Option 2	Auxin & Abscissic acid
Option 3	Cytokinin & Ethylene
Option 4	Cytokinin & Gibberellins

Q 149	A molecular biology student genetically engineered <i>Arabidopsis thaliana</i> to harbour <i>bar</i> gene. The resulting transgenic plant is expected to be resistant to
Option 1	DL-Phosphinothricin
Option 2	Changes in osmotic pressure
Option 3	Barium stress
Option 4	Imidazolinone

Q 150	Which one of the following statements about haploids is INCORRECT?
Option 1	They help in shortening of breeding cycle
Option 2	Using haploids, it is possible to obtain exclusively male plants in dioecious species
Option 3	Haploids are useful in isolation and detection of mutants.
Option 4	Haploid plants cannot be used for gene transfer

Q 151	Refugia approach in cultivation of Bt cotton is used to minimize
Option 1	Contamination of Bt gene in non-Bt cotton
Option 2	Bt gene flow in other crops
Option 3	Damage by pest
Option 4	Emergence of virulent biotypes

Q 152	In which method of plant transformation would multicopy integration be a common feature?
Option 1	Particle bombardment
Option 2	Protoplast fusion
Option 3	Agrobacterium mediated
Option 4	In planta

Q 153	Which one of the following techniques will help to overcome a pre fertilization barrier between the two species?
Option 1	Embryo rescue
Option 2	Protoplast fusion
Option 3	Ovary culture
Option 4	Embryo implantation

Q 154	Genes located in which one of the following do not follow Mendel's laws? (i) Nucleus (ii) Chloroplast (iii) Mitochondria (iv) Cytoplasm
Option 1	Both (i) and (ii)
Option 2	Both (i) and (iii)
Option 3	Both (ii) and (iii)
Option 4	Both (iv) and (i)

Q 155	Seedless fruits may arise as a result of
Option 1	Parthenocarpy
Option 2	Sexual reproduction
Option 3	Autogamy
Option 4	Allogamy

Q 156	An aluminium pot contains water that is kept steadily boiling (100 °C). The bottom surface of the pot, which is 0.012 m thick and $1.5 \times 10^4 \text{ mm}^2$ in area, is maintained at a temperature of 102 °C by an electric heating unit. Find the rate at which heat is transferred through the bottom surface. Given $k_{Al} = 235 \text{ W}\cdot\text{m}^{-1}\cdot\text{K}^{-1}$
Option 1	480.3 W
Option 2	587.5 W
Option 3	640.2 W
Option 4	820.1 W

Q 157	What happens to the viscosity of non-Newtonian fermentation broth upon scale-up?
Option 1	Viscosity increases
Option 2	Viscosity decreases
Option 3	Viscosity does not change
Option 4	Initially viscosity decreases and then increases



Q 158	<p>Estimate the theoretical growth yield coefficient (<math>Y_{X/S}</math>) for ethanol fermentation by <i>S. cerevisiae</i> as described by the following overall reaction:</p> $C_6H_{12}O_6 \longrightarrow 2 C_2H_5OH + 2 CO_2$ <p>Given <math>Y_{X/ATP} = 10.5</math> gdw/mol ATP and glycolysis yields 2ATP/mol of glucose in Yeast</p>
Option 1	0.224 gdw/g glucose
Option 2	0.117 gdw/g glucose
Option 3	0.334 gdw/g glucose
Option 4	0.45 gdw/g glucose

Q 159	Which one of the following is true in the scale-up of medium sterilization?
Option 1	It is an independent process in terms of quality of medium
Option 2	It is an independent process in terms of both quality of medium and number of contaminants
Option 3	It is a dependent process in terms of both quality of medium and number of contaminants
Option 4	It is a dependent process in terms of quality of medium and independent process in terms of number of microorganisms.

Q 160	In order to extract Penicillin G from fermentation broth, the pH of the broth is adjusted to pH 2.5. This is done because:
Option 1	Most of the Penicillin is in neutral uncharged form at this pH and hence extraction is better.
Option 2	Most of the Penicillin is in ionic form and hence extraction is better.
Option 3	Penicillin is highly stable at this pH
Option 4	Most of the enzymes are precipitated at this pH, which increases the extraction efficiency of Penicillin.

Q 161	Dynamic kinetic resolution of a racemic mixture of alcohol ensures its _____ percent conversion to one enantiomer:
Option 1	100
Option 2	50
Option 3	75
Option 4	25

Q 162	Very low values of $K_m$ may cause
Option 1	Product inhibition
Option 2	Substrate inhibition
Option 3	Enzyme denaturation
Option 4	Substrate induction

Q 163	In the stoichiometric equation given below identify which one of the following corresponds to oxygen balance: $C_w H_x O_y N_z + a O_2 + b H_g O_h N_i \rightarrow c C H_\alpha O_\beta N_\delta + d CO_2 + e H_2O$
Option 1	$w = c + d$
Option 2	$x + bg = c\alpha + 2e$
Option 3	$y + 2a + bh = c\beta + 2d + e$
Option 4	$z + bi = c\delta$

Q 164	If the $\Delta G$ of the reaction $A \rightarrow B$ is $-40$ kJ/mol, under standard conditions the reaction
Option 1	is at equilibrium.
Option 2	will never reach equilibrium.
Option 3	will not occur spontaneously.
Option 4	will proceed spontaneously from left to right

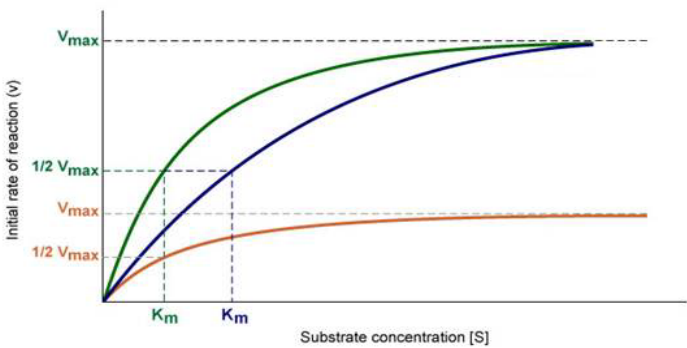
Q 165	Salting out of proteins results in
Option 1	large increase in enthalpy
Option 2	$\Delta G$ being positive
Option 3	small decrease in entropy
Option 4	$\Delta G$ being negative

Q 166	The specific productivity ( $qp$ ) of an enzyme production is fitted linearly with specific growth rate ( $\mu$ ) of a fungal organism according to the equation $qp = \alpha \cdot \mu + \beta$ . The estimated values of constants $\alpha$ and $\beta$ are 0.0006 and 25 respectively. The enzyme production kinetics is
Option 1	growth associated
Option 2	non-growth associated
Option 3	dependent on specific growth rate
Option 4	partially growth associated

Q 167	The partition coefficient of a solute between the stationary phase and the mobile phase is denoted by the
Option 1	capacity factor
Option 2	efficiency
Option 3	height of an equivalent theoretical plate (HETP)
Option 4	zone spreading

Q 168	A fermentor with volume $V$ is vigorously agitated with an impeller of diameter $D_i$ , rotating at an rpm of $n$ . Mixing time $t_m$ in the reactor maximally decreases with
Option 1	increase in $D_i$ alone
Option 2	increase in both $D_i$ and rpm
Option 3	increase in both $D_i$ and rpm and decrease in volume of the reactor
Option 4	decrease in both $D_i$ and rpm and increase in volume of the reactor

Q 169	Identify which one of the following is true of a typical drying curve
Option 1	The moisture content would remain constant throughout the drying period
Option 2	The rate of drying would remain constant throughout the drying period
Option 3	The product temperature will remain constant with time and then decrease
Option 4	The falling rate period is followed by constant rate period

Q 170	<p>Upon addition of reversible inhibitors to an enzymatic reaction following MM kinetics, the following velocity profiles are generated as shown in the figure below (indicated in Red, green and blue line). The red line velocity profile indicates that the reaction is</p> 
Option 1	Un-competitively inhibited
Option 2	Non-competitively inhibited
Option 3	Competitively inhibited
Option 4	Enzyme is not inhibited

Q 171	Common name for Hexadecanoic acid is
Option 1	Myristic acid
Option 2	Palmitic acid
Option 3	Stearic acid
Option 4	Oleic acid

Q 172	The interaction between a solute and a solvent is determined by the balance of forces between solvent molecules, between solute molecules and between solute and solvent molecules. If the sum of two self-interactions balance the cross-interactions, the solvent is referred to as a(n)
Option 1	eta solvent
Option 2	beta solvent
Option 3	theta solvent
Option 4	zeta solvent

Q 173	<p>Given in the table is the list of compounds being produced by the organisms. With appropriate matching indicate which one of the following combinations is most appropriate.</p> <table style="width: 100%; border: none;"> <thead> <tr> <th style="text-align: left;">PRODUCT</th> <th style="text-align: left;">ORGANISM</th> </tr> </thead> <tbody> <tr> <td>1 Propionic acid</td> <td>A Clostridium acetobutylicum</td> </tr> <tr> <td>2 Butanol</td> <td>B Clostridium propionicum</td> </tr> <tr> <td>3 Citric acid</td> <td>C Gluconobacter oxydans</td> </tr> <tr> <td>4 Gluconic acid</td> <td>D Aspergillus niger</td> </tr> </tbody> </table>	PRODUCT	ORGANISM	1 Propionic acid	A Clostridium acetobutylicum	2 Butanol	B Clostridium propionicum	3 Citric acid	C Gluconobacter oxydans	4 Gluconic acid	D Aspergillus niger
PRODUCT	ORGANISM										
1 Propionic acid	A Clostridium acetobutylicum										
2 Butanol	B Clostridium propionicum										
3 Citric acid	C Gluconobacter oxydans										
4 Gluconic acid	D Aspergillus niger										
Option 1	1- D, 2-C, 3-B, 4-A										
Option 2	1- D, 2-A, 3-B, 4-C										
Option 3	1-C, 2-D, 3-A, 4-B										
Option 4	1-B, 2-A, 3-D, 4-C										

Q 174	One advantage of using <i>Pichia pastoris</i> as a protein expression platform over <i>Saccharomyces cerevisiae</i> is that the former
Option 1	has a faster growth rate
Option 2	cannot grow over a wide pH range
Option 3	produces very high levels of ethanol
Option 4	secretes very low level of endogenous proteins

Q 175	The synthesis of aspartame may be carried out in organic solvents using
Option 1	phenylalanine ammonia lyase
Option 2	argininosuccinate synthetase
Option 3	thermolysin
Option 4	<i>Candida antarctica</i> lipase B

Q 176	The water content in solid state fermentation is
Option 1	Between 40-60%
Option 2	Between 20-40%
Option 3	Between 10-20%
Option 4	Between 5-10%

Q 177	When considering submerged fermentation system oxygen transfer is considered to be a more important factor than the supply of other nutrients. Which one of the following statements is correct?
Option 1	Oxygen has a much lower solubility in water than sugars and nutrients
Option 2	Oxygen has a much higher solubility in water than sugars and nutrients
Option 3	Oxygen has similar solubility in water like sugar and other nutrients
Option 4	Oxygen diffuses more slowly compared to other nutrients

Q 178	Which one of the following sugars is not only non-reducing sugar but also does not exhibit muta-rotation
Option 1	Glucose
Option 2	Maltose
Option 3	Sucrose
Option 4	Lactose

Q 179	Calculate the overall order of a reaction which has rate expression: Rate = k [A] <sup>1/2</sup> [B] <sup>3/2</sup>
Option 1	First order
Option 2	Second order
Option 3	Half order
Option 4	Zero order

Q 180	<p>Match the microbial enzymes from Group A with appropriate application processes from Group B</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top;"> <b>Group A</b>            1. Pectinase            2. Glucose isomerase            3. Amylase            4. Protease         </td> <td style="width: 50%; vertical-align: top;"> <b>Group B</b>            a. Meat tenderizing            b. Bread making            c. high fructose corn syrup            d. Fruit juice clarification         </td> </tr> </table>	<b>Group A</b> 1. Pectinase 2. Glucose isomerase 3. Amylase 4. Protease	<b>Group B</b> a. Meat tenderizing b. Bread making c. high fructose corn syrup d. Fruit juice clarification
<b>Group A</b> 1. Pectinase 2. Glucose isomerase 3. Amylase 4. Protease	<b>Group B</b> a. Meat tenderizing b. Bread making c. high fructose corn syrup d. Fruit juice clarification		
Option 1	1-c, 2-d, 3-a, 4-b		
Option 2	1-d, 2-c, 3-b, 4-a		
Option 3	1-d, 2-b, 3-c, 4-a		
Option 4	1-b, 2-a, 3-c, 4-d		

Q 181	Which one of the following statements is FALSE. Microbial secondary metabolites are
Option 1	not essential for growth
Option 2	produced in higher amount as compared to primary metabolites
Option 3	always produced in the exponential phase of the growth
Option 4	biodegradable

Q 182	Rate of centrifugal sedimentation is a
Option 1	square function with respect to rpm
Option 2	linear function with respect to rpm
Option 3	square function with respect to rotor diameter
Option 4	cubic function with respect to rotor diameter

Q 183	The advantage of <b>chemostat with cell recycle</b> system over a simple chemostat is that it can be
Option 1	operated at lower dilution rate
Option 2	used for achieving higher cell mass
Option 3	adapted for achieving higher specific productivity
Option 4	adapted for achieving higher specific oxygen uptake rate

Q 184	Which one of the following amino acids is the most effective contributor of protein buffer?
Option 1	Alanine
Option 2	Glycine
Option 3	Histidine
Option 4	Arginine

Q 185	Fluorescence microscopy is based on the ability of certain molecules to
Option 1	absorb light of a constant wavelength
Option 2	absorb light of many different wavelengths
Option 3	absorb light at a given wavelength and then emit light of a longer wavelength
Option 4	absorb light at a given wavelength and then emit light at shorter wavelength

Q 186	Hemorrhagic lymphadenitis is seen in
Option 1	Tuberculosis
Option 2	Actinomycosis
Option 3	Glanders
Option 4	Anthrax

Q 187	In equine infectious anemia, central nervous system shows
Option 1	Cytoplasmic vacuolation in neurons
Option 2	Intranuclear inclusions
Option 3	Non-purulent encephalomyelitis
Option 4	Infiltration of neutrophils

Q 188	Hjarre's disease in poultry is caused by
Option 1	<i>Mycoplasma gallisepticum</i>
Option 2	Mucoid strain of <i>E. coli</i>
Option 3	Newcastle disease virus
Option 4	<i>Mycobacterium avium</i>

Q 189	After infection of cattle, <i>Dictyocaulus viviparus</i> larvae reach the lungs via
Option 1	Intestine, portal vein, liver, heart, lung
Option 2	Intestine, abdominal cavity, liver, heart, lung
Option 3	Intestine, lymphatics, mesenteric lymph nodes, thoracic duct, heart, lungs
Option 4	Intestine, abdominal cavity, thoracic duct, heart, lungs

Q 190	Which one of the following is found in overloaded rumen?
Option 1	High rumen pH and high plasma phosphorus
Option 2	Low plasma phosphorus and low packed cell volume
Option 3	Low rumen pH and high plasma sodium
Option 4	Low rumen pH and high plasma lactate

Q 191	Pressing of head against wall by cow is the clinical symptom of
Option 1	Babesiosis
Option 2	Theileriosis
Option 3	Trypanosomiasis
Option 4	Toxoplasmosis

Q 192	Which one of the following factors released from damaged tissue initiate a chain of clotting events?
Option 1	Thrombin
Option 2	Prothrombin
Option 3	Tissue thromboplastin
Option 4	Fibrin

Q 193	Which one of the following breeds of cattle is known as a milch breed?
Option 1	Hariana
Option 2	Gir
Option 3	Kankrej
Option 4	Amritmahal

Q 194	Tarry color blood from natural orifice is a symptom of
Option 1	Anthrax
Option 2	Strangle
Option 3	Hemorrhagic septicemia
Option 4	Tuberculosis

Q 195	Which one of following cartilages lacks a distinct perichondrium in horse?
Option 1	Hyaline cartilage
Option 2	Elastic cartilage
Option 3	Fibrocartilage
Option 4	Cartilage of the appendicular skeleton

Q 196	Creutzfeldt-Jakob disease is caused by
Option 1	PrP <sup>C</sup>
Option 2	PrP <sup>Sc</sup>
Option 3	West Nile virus
Option 4	Varicella-Zoster virus

Q 197	The natural reservoir of Ebola virus is
Option 1	Fruit bat
Option 2	Dog
Option 3	Sheep
Option 4	Pig

Q 198	A disease diagnostic assay with high specificity should yield
Option 1	more false positives
Option 2	fewer false negatives
Option 3	fewer false positives
Option 4	more false negatives

Q 199	Which one of the following statements is INCORRECT for cystic fibrosis?
Option 1	It results in the reduced secretion of sodium chloride in sweat
Option 2	It results in the increased secretion of sodium chloride in sweat
Option 3	It is an autosomal recessive disease
Option 4	It results in build up of mucus

Q 200	Drug resistance among bacteria involved in hospital infections is commonly due to
Option 1	Multi drug therapy
Option 2	Probiotic bacteria
Option 3	Transfer of resistance genes
Option 4	Mutation in target genes



Q 201	Vaccine is available for all except one of the following pathogens
Option 1	<i>Bordetella pertussis</i>
Option 2	<i>Haemophilus influenzae</i> type b
Option 3	<i>Clostridium tetani</i>
Option 4	<i>Helicobacter pylori</i>

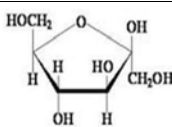
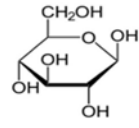
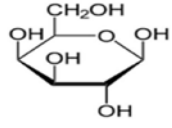
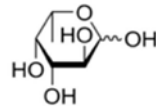
Q 202	Toxic shock syndrome is caused by
Option 1	TNF- $\alpha$
Option 2	TGF- $\beta$
Option 3	Interferon- $\gamma$
Option 4	Interleukin-1

Q 203	BCG vaccine _____
Option 1	is an attenuated <i>M. tuberculosis</i> strain
Option 2	reduces the incidence of tubercular meningitis
Option 3	induces protective CMI response against atypical mycobacteria
Option 4	protects against pulmonary tuberculosis

Q 204	Which one of the following is commonly used to prevent microbial growth in polyclonal sera?
Option 1	DMSO
Option 2	Polyethylene glycol
Option 3	Sodium azide
Option 4	Glycerol

Q 205	The prescribed treatment for swine flu is
Option 1	Azacytidine
Option 2	Oseltamivir
Option 3	Lamivudine
Option 4	Acyclovir

Q 206	A chimeric therapeutic monoclonal antibody consists of
Option 1	Human constant region and mouse variable region
Option 2	Mouse constant region and human variable region
Option 3	Human constant and variable regions with CDR loops of mouse origin
Option 4	One side mouse variable region and other side human variable region

Q 207	In individuals with galactosemia, the enzymes needed for further metabolism of which one of the following sugars is severely diminished or missing entirely?
Option 1	
Option 2	
Option 3	
Option 4	

Q 208	Which one of the following is INCORRECT about Fragile X syndrome?
Option 1	Father to son transmission
Option 2	Presence of CGG repeats
Option 3	Presence of CAG repeats
Option 4	Symptoms of Mental retardation

Q 209	Which one of the following statements is true about superantigens?
Option 1	They are processed in the cytosol
Option 2	They are processed in endosomes
Option 3	They do not require processing
Option 4	They are processed in the lysosome

Q 210	Retrograde transport may be used for
Option 1	nerve path tracing
Option 2	determining nerve fiber diameter
Option 3	determining soma size
Option 4	estimating number of dendrites

Q 211	The conscious state of an individual may be best understood by studying ones
Option 1	electromyogram
Option 2	electrocardiogram
Option 3	electroretinogram
Option 4	electroencephalogram

Q 212	Acetylcholine is released by exocytosis of synaptic vesicles; this release is triggered by
Option 1	Na <sup>+</sup>
Option 2	Ca <sup>2+</sup>
Option 3	K <sup>+</sup>
Option 4	Cl <sup>-</sup>

Q 213	Resting membrane potential of a neuron range between
Option 1	60 mv to 70 mv
Option 2	-60 mv to -70 mv
Option 3	100 mv to 110 mv
Option 4	0 mv

Q 214	The pathological hallmark of Huntington's disease is
Option 1	The degeneration of the substantia nigra
Option 2	The degeneration of globus pallidus
Option 3	The degeneration of striatum
Option 4	The degeneration of sub-thalamic nucleus

Q 215	The patterning of the nervous system along the anterior-posterior axis in embryo is controlled by
Option 1	Pax genes
Option 2	Hox genes
Option 3	SHH signaling
Option 4	BMP signaling

Q 216	Approximately, 50% of total world plant species are present in...
Option 1	tropical rain forest
Option 2	temperate rain forest
Option 3	temperate deciduous forest
Option 4	coral reefs

Q 217	The process of mineralization of environmental pollutants by wild microbes is referred as ...
Option 1	biotransformation
Option 2	bioremediation
Option 3	bioadsorption
Option 4	bioaugmentation

Q 218	Which one of the following is readily available source of nitrogen to plant?
Option 1	Amide fertilizers
Option 2	Ammonia fertilizers
Option 3	Nitrate fertilizers
Option 4	Ammonium phosphate fertilizer

Q 219	Root nodules are pink due to ....
Option 1	haemoglobin
Option 2	leghaemoglobin
Option 3	myoglobin
Option 4	phytoeyanin

Q 220	Which of the following is a GM phytoremediator plant?
Option 1	<i>Populus</i>
Option 2	<i>Portulaca</i>
Option 3	<i>Brassicca</i>
Option 4	<i>Helianthus</i>

Q 221	Which one of the following terms represents the recycling of settled decomposer bacteria in sewage treatment plant?
Option 1	Cyclic treatment
Option 2	Primary treatment
Option 3	Activated sludge treatment
Option 4	Tertiary treatment

Q 222	The relationship between species A and species B is described as commensalism. This means that.....
Option 1	both species suffer
Option 2	both species benefit
Option 3	one species benefits and the other species suffers
Option 4	one species benefits and the other species is unaffected

Q 223	Which one of the following is the best indicator of SO <sub>2</sub> pollution?
Option 1	Bryophyte
Option 2	Pteridophyte
Option 3	Lichen
Option 4	Algae

Q 224	Which one of the following groups of enzymes is primarily involved in microbial bioremediation?
Option 1	Hydrolases
Option 2	Transferases
Option 3	Oxidoreductases
Option 4	Mutase

Q 225	Why catalase is induced in microbes during exposure to the pollutants?
Option 1	Because it involve in biotransformation of that pollutant.
Option 2	Because of oxidative stress produced due to exposure of pollutant.
Option 3	Pollutants are general inducers of catalase
Option 4	Because catalase in involved in the metabolism of metabolite generated from pollutants.

Q 226	The solute concentration of the body fluids of some marine organisms are maintained the same as that of the external medium in which the organism lives. Such organisms are referred to as
Option 1	stenohaline
Option 2	osmoconformers
Option 3	euryhaline
Option 4	osmoregulators

Q 227	Remote sensing is done in the microwave channels by virtue of
Option 1	emission.
Option 2	reflection.
Option 3	scattering.
Option 4	diffraction

Q 228	Which of the following drugs was not isolated from a natural source?
Option 1	Artemisinin
Option 2	Isoniazid
Option 3	Quinine
Option 4	Morphine

Q 229	Antifreeze molecules that prevent intracellular ice formation in marine organisms are generally
Option 1	calcium salts
Option 2	glycoproteins
Option 3	membrane phospholipids
Option 4	long chain alcohols

Q 230	Which term refers to the distance that the wind travels across open water?
Option 1	Fetch
Option 2	Current
Option 3	Throw or Reach
Option 4	Drift

Q 231	The typical residence time of water in the oceans is of the order of
Option 1	3,500 years
Option 2	1,000 years
Option 3	10,000 years
Option 4	350 years

Q 232	The spring bloom of phytoplankton in the surface waters of high latitude oceans occurs when
Option 1	zooplankton grazing declines as large copepods go into diapause.
Option 2	the mixed layer depth becomes shallower than the critical depth.
Option 3	increased wind mixing injects nutrients into the surface waters.
Option 4	nutrients are regenerated rapidly by zooplankton grazers.

Q 233	The vertical movement of lithosphere to accommodate additional weight or removal of weight is called
Option 1	isometric rebounding.
Option 2	interval submersion.
Option 3	isostatic adjustment.
Option 4	isotonic positioning.

Q 234	Which family of motile bacteria with polar flagella is predominant in coastal and marine environments?
Option 1	Enterococcaceae
Option 2	Vibrionaceae
Option 3	Lactobacillales
Option 4	Staphylococcaceae

Q 235	Which is the oceanic zone that extends from the low tide line to the edge of the continental shelf?
Option 1	intertidal zone
Option 2	open ocean zone
Option 3	neritic zone
Option 4	abyssal zone

Q 236	Evidence of past climate conditions is best revealed by studying
Option 1	metal sulphide deposits.
Option 2	lagoon features.
Option 3	deep sea sediments.
Option 4	rock formations.

Q 237	The gases making highest relative contribution to “green house gases” are
Option 1	NO <sub>2</sub> and CO <sub>2</sub>
Option 2	CFC and NO <sub>2</sub>
Option 3	CO <sub>2</sub> and CH <sub>4</sub>
Option 4	NO <sub>2</sub> and CH <sub>4</sub>

Q 238	Which of the following types of coral reefs (given below as 1-3) are found in India? 1. Atoll 2. Fringing 3. Barrier
Option 1	1 & 2 only
Option 2	1, 2 & 3
Option 3	2 & 3 only
Option 4	1 & 3 only

Q 239	What part of a tidal cycle has minimal current?
Option 1	Ebb tide
Option 2	Slack tide
Option 3	Flood tide
Option 4	Lunar tide

Q 240	What is the function of nucleators in freeze-tolerant animals?
Option 1	To prohibit the formation of ice crystals within cells.
Option 2	Act as hormones that induce changes in the expression of enzyme proteins that are more tolerant of cold temperatures.
Option 3	To control the location and kinetics of ice crystal growth.
Option 4	To increase the metabolic rate of the animal to keep it from freezing.

Q 241	The most effective Foul release coatings presently used in the marine environment are
Option 1	biocides such as lead, arsenic and mercury.
Option 2	tributyltin compounds
Option 3	fluoropolymer and silicone based polymer coatings.
Option 4	spray coatings.

Q 242	The first marine derived cancer drug, "Cytosar-U" used for the treatment of leukemia and lymphoma was isolated from
Option 1	Indian sea hare.
Option 2	a Caribbean sea sponge.
Option 3	southeast asian corals.
Option 4	Australian waters.

Q 243	Altemicidin isolated from <i>Streptomyces sioyaensis</i> SA 1758 has antitumor activity and has been widely used in aquaculture
Option 1	for the control of <i>Alteromonas sp.</i>
Option 2	as an iron chelator.
Option 3	due to its toxicity to <i>Artemia salina</i> .
Option 4	to clear up organic carbon.

Q 244	A marine bryozoan, normally causing a problem as a biofouler on boats, harbors this bacterium that has shown promise in cancer treatment and also as a memory enhancer for patients with Alzheimer's disease:
Option 1	<i>Bugula neritina</i>
Option 2	<i>Bugula dentate</i>
Option 3	<i>Cephalosporium acremonium</i>
Option 4	<i>Ectoprocta sp</i>

Q 245	A system incorporating unilateral eye stalk ablation, high salinity, good water quality and optimum temperature can
Option 1	induce maturation in male crustaceans in captivity.
Option 2	induce maturation in female crustaceans in captivity.
Option 3	maintain viability in juveniles in captivity.
Option 4	facilitate mortality in mature adults.

Q 246	Which of the following can help determine if two mutations are allelic?
Option 1	Lack of recombination between the two mutations
Option 2	The two mutants do not complement each other
Option 3	Suppression of one mutation by the other
Option 4	Co-segregation of the two mutations

Q 247	An individual has the genotype <i>AaBb</i> . The two genes are linked in cis and is 5cM apart. What percentage of gametes will have the genotype <i>ab</i> ?
Option 1	2.5
Option 2	5.0
Option 3	47.5
Option 4	90.0



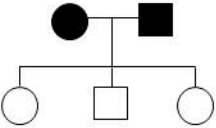
Q 248	An <i>E. coli</i> mating between Hfr $trp^+ his^+ str^S$ and $F^- trp^- his^- str^R$ was allowed to proceed for 30 minutes. The mixture was plated on medium containing either (i) streptomycin + histidine or (ii) streptomycin + tryptophan. Replica plating revealed that in the first case 'i' 48 out of 104 colonies were <i>his</i> <sup>-</sup> while in the second case 'ii' 10 out of 70 colonies were <i>trp</i> <sup>-</sup> . Which of the following is the best representation of the location of the <i>trp</i> and <i>his</i> genes relative to the origin of transfer (>) of the Hfr chromosome?
Option 1	.....his.....>.....trp.....
Option 2	.....>...trp.....his.....
Option 3	.....trp.....his.....>.....
Option 4	.....his.....trp.....>.....

Q 249	Color blindness is an X- linked recessive character. A color blind man and his wife with normal vision have a colour-blind daughter. What is the probability that their new born son would be colour-blind?
Option 1	0
Option 2	1/4
Option 3	1/2
Option 4	1

Q 250	Alkaptonuria is a metabolic disorder controlled by a recessive autosomal allele. The frequency of Alkaptonuria in an ethnic population is about 1 in million persons. What is the proportion of heterozygous 'carriers' in the population?
Option 1	1 in 1000
Option 2	1 in 500
Option 3	1 in 10,000
Option 4	1 in 100

Q 251	Of a population of cells undergoing meiosis, 1% of the cells undergo recombination between genes <i>A</i> and <i>B</i> . What is the distance between the two genes?
Option 1	0.5kb
Option 2	1.0kb
Option 3	0.5cM
Option 4	1.0cM

Q 252	Variation in which types of repeat sequence commonly arise by replication slippage?
Option 1	Microsatellites
Option 2	Minisatellites
Option 3	Retrotransposons
Option 4	DNA transposon

Q 253	<p>One form of congenital deafness in human is inherited as a recessive condition and controlled by two independent genes (A and B). In the pedigree depicted below, two deaf individuals have children with normal hearing ability.</p>  <p>What would be the probable genotypes of the deaf parents?</p>
Option 1	<i>AaBb</i> and <i>AaBb</i>
Option 2	<i>aaBB</i> and <i>AABB</i>
Option 3	<i>aaBB</i> and <i>Aabb</i>
Option 4	<i>Aabb</i> and <i>aABB</i>

Q 254	Genetic relatedness between mothers and daughters in haplodiploid organisms is
Option 1	1
Option 2	0.75
Option 3	0.5
Option 4	0.25

Q 255	In a family, among the siblings, there is a heterozygous girl for haemophilia, a normal boy, a haemophilic girl and a haemophilic boy. Which of the following genotypes would be attributed to the parents?
Option 1	$XX$ and $^hXy$
Option 2	$^hXX$ and $XY$
Option 3	$^hX^hX$ and $^hXY$
Option 4	$^hXX$ and $^hXY$

Q 256	Which among the following is a proper definition of a SMILES string ?
Option 1	A SMILES string is a 1-dimensional representation of the 2-dimensional structure of a molecule.
Option 2	A SMILES string is a 2-dimensional representation of the 3-dimensional structure of a molecule.
Option 3	A SMILES string is a 1-dimensional representation of the 3-dimensional structure of a molecule.
Option 4	A SMILES string is a 2-dimensional representation of the 3-dimensional structure of a molecule.

Q 257	Which of the following is a correct statement regarding sensitivity and specificity of a search algorithm?
Option 1	Sensitivity is the ability to detect true positives and specificity is the ability to reject false positives.
Option 2	Sensitivity is the ability to reject false positives and specificity is the ability to detect true positives.
Option 3	Sensitivity is ability to simultaneously detect true positives and reject false positives, while specificity the ability to simultaneously reject true negatives as well as false negatives.
Option 4	Sensitivity is the ability to reject true negatives and specificity is the ability to reject false negatives.

Q 258	Which of the following statements is true for the BLAST algorithm for sequence comparison?
Option 1	It is a heuristic algorithm.
Option 2	BLAST alignments are guaranteed to be the best possible alignment subject to the correctness of the scoring function.
Option 3	The size of the sequence alphabet has no effect on the efficiency of the BLAST algorithm.
Option 4	The algorithmic complexity is given by $O(n \log(n))$ where $n$ is the number of sequences in the database.

Q 259	A mixture containing L-Aspartate, D-Aspartate and L-Lysine was set up for crystallization and produced a single crystal belonging to space group P2/m (Primitive cell with a 2-fold rotation axis and a mirror plane perpendicular to the rotation axis). Which of the following is the most likely composition of the crystal?
Option 1	L-Aspartate and D-Aspartate in equal proportions without any L-Lysine
Option 2	All three components in equal proportions.
Option 3	L-Aspartate, D-Aspartate and L-Lysine in the ratio 1:1:2
Option 4	It is not possible to predict the composition of the crystal from the information given.

Q 260	Which of the following statements best describe the significance of the Temperature factor (B-factor) column in a PDB file?
Option 1	The B-factor signifies the positional uncertainty of a particular atom in a crystal structure due to the inherent dynamics of the atom.
Option 2	The B-factor signifies the positional uncertainty of a particular atom in the crystal structure, which may be due to refinement errors besides the inherent dynamics of the atom.
Option 3	The B-factor specifies the average of the two temperatures in which the molecule was crystallized and the temperature in which X-ray diffraction data was collected from the crystal.
Option 4	The B-factor is an inherent property of the atom and is not related to any other parameter like temperature or dynamics.

Q 261	Peaks in $^1\text{H}$ -NMR spectra are often split into multiplets due to spin-spin coupling with neighbouring protons. Surprisingly, peaks in $^{13}\text{C}$ -NMR spectra appear much simpler with very little evidence of $^{13}\text{C}$ - $^{13}\text{C}$ coupling. Which one of the following statements offers the best explanation for the above observation?
Option 1	The value of the Magnetogyric ratio ( $g$ ) for $^{13}\text{C}$ is much smaller than the corresponding value for $^1\text{H}$ . As a result $^{13}\text{C}$ - $^{13}\text{C}$ couplings have an extremely small magnitude and are not detectable.
Option 2	The natural abundance of the $^{13}\text{C}$ nucleus is very small ( $\sim 1.1\%$ ) hence the chance of finding a neighbouring $^{13}\text{C}$ nucleus for spin-spin coupling is very small.
Option 3	The presence of $^{12}\text{C}$ nuclei in the vicinity, inhibit spin-spin coupling between $^{13}\text{C}$ - $^{13}\text{C}$ neighbours.
Option 4	$^{13}\text{C}$ - $^{13}\text{C}$ coupling constants are so large that the multiplets appear as separate single peaks.

Q 262	For any molecule with $N$ atoms ( $N > 3$ ), the minimum number of internal coordinates (bond lengths, bond angles and dihedral angles) sufficient to describe the structure of the molecule is given by:
Option 1	$3N - 6$
Option 2	$3N - 5$
Option 3	$3N - 4$
Option 4	$3N$

Q 263	A scientist screening for monoclonal antibodies against a protein antigen isolates two antibodies, the first of which recognizes a conformational epitope in the form of an $\alpha$ -helix in the protein, and a second one that also recognizes a conformational epitope, but in the form of just one strand in a multi-stranded $\beta$ -sheet. The scientist then synthesizes small peptides with the same sequences corresponding to the two epitopes and tests for binding with antibodies. Which of the following is the most likely outcome of her experiments?
Option 1	The first antibody recognizes the $\alpha$ -helical epitope but the second antibody fails to recognize the $\beta$ -strand epitope.
Option 2	The first antibody fails to recognize the $\alpha$ -helical epitope but the second antibody successfully recognizes its $\beta$ -strand epitope.
Option 3	Both antibodies successfully recognize their respective epitopes.
Option 4	Both antibodies fail to recognize their respective epitopes.

Q 264	Which of the following cases will most likely lead to sequence specific recognition of DNA by a protein?
Option 1	When the protein binds through the minor groove of DNA.
Option 2	When the protein binds through the major groove of DNA.
Option 3	When the protein binds with the phosphate groups avoiding both the minor and major grooves.
Option 4	Sequence specific DNA binding by proteins has no relationship with groove preference.

Q 265	Which of the following algorithms is most likely to be used as an optimizer for Docking calculations?
Option 1	4 <sup>th</sup> - order Runge-Kutta algorithm
Option 2	Maximum Parsimony algorithm
Option 3	Genetic Algorithm
Option 4	Biochemical Algorithm

Q 266	A certain chemical carcinogen causes a lethal chemical modification in DNA bases with a probability of $10^{-7}$ . It was found that if cultured human cells are treated with this compound then approximately 1% of the amount added makes its way to the nucleus and attacks the chromosomes. What is the approximate probability of obtaining at least one base modification event per cell, if cultured human cells are treated with the compound at a concentration of 1mmol/cell.
Option 1	0
Option 2	0.1
Option 3	0.5
Option 4	1

Q 267	When $p$ and $q$ are lengths of sequences, the computational complexity of the Smith-Waterman algorithm is
Option 1	$O(pq)$
Option 2	$O(p + q)$
Option 3	$O(q \log p)$
Option 4	$O(pq)$

Q 268	Which among the following is a measure of similarity between two chemical structures of small molecules?
Option 1	RMSD
Option 2	Tanimoto coefficient
Option 3	E-value
Option 4	P-value

Q 269	A closed circular DNA molecule is treated with saturating concentrations of an intercalator followed by treatment with topoisomerase until it is completely relaxed. If the intercalator is now removed by dialysis, the DNA molecule will become
Option 1	Positively supercoiled
Option 2	It will become negatively supercoiled
Option 3	It will remain relaxed without any change in supercoiling.
Option 4	Exactly half the molecules will become positively supercoiled and the other half will become negatively supercoiled, so that there is no net change in supercoiling.

Q 270	Which among the following amino acids has at least ONE asymmetric carbon atom in its side-chain?
Option 1	Valine
Option 2	Isoleucine
Option 3	Tryptophan
Option 4	Histidine

Q 271	A right handed $\alpha$ -helix made up of L-amino acids has $\phi, \psi$ angles of $-60$ and $-40$ degrees respectively. Which of the following will be the $\phi, \psi$ angles of a left handed $\alpha$ -helix made up of D-amino acids only?
Option 1	$+60$ and $+40$ degrees
Option 2	$-60$ and $+40$ degrees
Option 3	$+60$ and $-40$ degrees
Option 4	cannot be predicted

Q 272	The membrane permeability of Dimethyl urea is:
Option 1	Less than that of urea
Option 2	More than that of urea
Option 3	Comparable to that of urea
Option 4	Depends on the properties of the membrane

Q 273	Which of the following statements is true with respect to the formation of disulfide bonds in a protein produced by eukaryotic cells?
Option 1	Disulfide bonds are formed inside the endoplasmic reticulum (ER) or outside the cell in contact with the atmosphere.
Option 2	Disulfide bonds are formed outside the ER but within the cytosol.
Option 3	Disulfide bonds are formed within the ER but the process continues within the Golgi complex.
Option 4	Disulfide bonds are formed only within the nucleus.

Q 274	Circular dichroic spectra of some proteins show a strong negative ellipticity band at $200$ nm. Which of the following secondary structures is characterized by the presence of this band?
Option 1	$\pi$ -helix structure
Option 2	intrinsically disordered structure
Option 3	$\alpha$ -helical structure
Option 4	$\beta$ -sheet structure

Q 275	Water has a high dielectric constant of 80 in contrast with many non-polar solvents having very low dielectric constants. Due to this property the electrostatic interactions between various side-chains of amino acids in proteins after their transfer from non-polar solvent to water would:
Option 1	Decrease
Option 2	Increase
Option 3	Remain unaffected
Option 4	Attain a value of zero

The Biomimics

## Answer Keys – BET 2015 Question Paper

<b>SECTION-A</b>									
Q 1	4	Q2	2	Q3	3	Q4	2	Q5	3
Q6	3	Q7	1	Q8	1	Q9	1	Q10	3
Q11	2	Q12	4	Q13	3	Q14	3	Q15	4
Q16	1	Q17	2	Q18	3	Q19	1	Q20	4
Q21	4	Q22	2	Q23	4	Q24	2	Q25	4
Q26	2	Q27	3	Q28	4	Q29	2	Q30	3
Q31	3	Q32	4	Q33	4	Q34	1	Q35	2
Q36	1	Q37	2	Q38	2	Q39	3	Q40	3
Q41	4	Q42	3	Q43	2	Q44	2	Q45	2
Q46	1	Q47	1	Q48	1	Q49	2	Q50	4
Q51	1	Q52	2	Q53	2	Q54	3	Q55	1
Q56	2	Q57	4	Q58	2	Q59	4	Q60	3
Q61	4	Q62	4	Q63	1	Q64	4	Q65	4
Q66	3	Q67	4	Q68	2	Q69	2	Q70	2
Q71	3	Q72	4	Q73	2	Q74	1	Q75	4
<b>SECTION-B</b>									
Q76	1	Q77	2	Q78	4	Q79	2	Q80	3
Q81	1	Q82	3	Q83	1	Q84	2	Q85	3
Q86	1	Q87	2	Q88	1	Q89	3	Q90	2
Q91	3	Q92	1	Q93	1	Q94	2	Q95	3
Q96	4	Q97	3	Q98	1	Q99	1	Q100	2
Q101	3	Q102	2	Q103	3	Q104	2	Q105	2
Q106	3	Q107	2	Q108	1	Q109	1	Q110	3
Q111	3	Q112	2	Q113	2	Q114	4	Q115	3
Q116	2	Q117	3	Q118	3	Q119	4	Q120	2
Q121	2	Q122	4	Q123	3	Q124	2	Q125	2
Q126	2	Q127	2	Q128	3	Q129	1	Q130	4
Q131	2	Q132	1	Q133	1	Q134	2	Q135	2
Q136	1	Q137	1	Q138	4	Q139	2	Q140	1
Q141	3	Q142	4	Q143	1	Q144	2	Q145	1
Q146	1	Q147	2	Q148	2	Q149	1	Q150	4



Q151	4	Q152	1	Q153	2	Q154	3	Q155	2
Q156	2	Q157	1	Q158	2	Q159	1	Q160	1
Q161	1	Q162	2	Q163	3	Q164	4	Q165	4
Q166	2	Q167	1	Q168	3	Q169	4	Q170	2
Q171	2	Q172	3	Q173	4	Q174	4	Q175	3
Q176	4	Q177	1	Q178	3	Q179	2	Q180	2
Q181	3	Q182	1	Q183	2	Q184	3	Q185	3
Q186	4	Q187	3	Q188	2	Q189	3	Q190	4
Q191	3	Q192	3	Q193	2	Q194	1	Q195	3
Q196	2	Q197	1	Q198	3	Q199	1	Q200	3
Q201	4	Q202	1	Q203	2	Q204	3	Q205	2
Q206	1	Q207	3	Q208	3	Q209	3	Q210	1
Q211	4	Q212	2	Q213	2	Q214	3	Q215	2
Q216	1	Q217	2	Q218	3	Q219	2	Q220	1
Q221	3	Q222	4	Q223	3	Q224	3	Q225	2
Q226	2	Q227	1	Q228	2	Q229	2	Q230	1
Q231	1	Q232	2	Q233	3	Q234	2	Q235	3
Q236	3	Q237	3	Q238	2	Q239	2	Q240	3
Q241	3	Q242	2	Q243	3	Q244	1	Q245	2
Q246	2	Q247	3	Q248	4	Q249	3	Q250	2
Q251	3	Q252	1	Q253	3	Q254	3	Q255	4
Q256	1	Q257	1	Q258	1	Q259	1	Q260	2
Q261	2	Q262	1	Q263	1	Q264	2	Q265	3
Q266	4	Q267	1	Q268	2	Q269	1	Q270	2
Q271	1	Q272	2	Q273	1	Q274	2	Q275	1

## **Biotechnology Eligibility Test (BET)- 2016**

### Question Paper Structure (Revised)

<b><u>Sections</u></b>	<b><u>No. of Questions</u></b>	<b><u>No of Questions to be attempted</u></b>	<b><u>Time (In Minutes)</u></b>	<b><u>Marks</u></b>
1) Section A (General science, Mathematics, Chemistry, General aptitude, analytical, quantitative ability, general biotechnology etc.)	50	50		3*50=150
2) Section B (Specific areas of Biotechnology)	150	50		3*50=150
<b>Total</b>	<b>200</b>	<b>100</b>	<b>180</b>	<b>300</b>

Section- A  
All 50 questions are compulsory

1. Two sides of an isosceles triangle measure 3 cm and 7 cm. Which one of the following is the measure (cm) of the third side?
  - (A) 9
  - (B) 7
  - (C) 5
  - (D) 3
2. At 9 AM, the shadow of a 5' (feet) tall boy is 8'. At the same time, shadow of a flagpole beside is 28 feet. What is height of the flagpole?
  - (A) 8.5'
  - (B) 16'
  - (C) 17.5'
  - (D) 20'
3. What number should appear next in this series: 8, 12, 10, 14, 12, 16....?
  - (A) 10
  - (B) 14
  - (C) 18
  - (D) 12
4. Two numbers are more than a third number by 20 % and 50 %, respectively. The ratio of the first two numbers is
  - (A) 2:4
  - (B) 3:5
  - (C) 4:5
  - (D) 5:7

5. Identify from the options given below the unwritten number (?) in the series: 360, ?, 180, 60, 15, 3
- (A) 180  
(B) 300  
(C) 360  
(D) 320
6. For the chemical reaction  $C_2H_5OH(l) + 3O_2(g) \rightarrow 2CO_2 + 3H_2O(l)$ , if change in internal energy at 298K is 1368 KJ/mole, the change in enthalpy will be
- (A) greater than 1368  
(B) less than 1368  
(C) equal to zero  
(D) negative
7. If a drop of sweat evaporates from body, the work done is
- (A)  $w = \Delta U$   
(B)  $w = \Delta H$   
(C)  $w = \Delta G$   
(D)  $w = P(V_2 - V_1)$
8. Dissociation of an aqueous acid (HA) gives  $HA + H_2O \rightleftharpoons H_3O^+ + A^-$ , then  $pK_a$  is
- (A)  $\Delta G^\circ_R$   
(B)  $\Delta H^\circ_R$   
(C)  $\Delta G^\circ / 2.303RT$   
(D) Equilibrium constant  $K_a$
9. The sides of a rectangle are in the ratio of 4:3 and its area is  $108 \text{ cm}^2$ . The perimeter of the rectangle in cm is
- (A) 22  
(B) 32  
(C) 42  
(D) 52
10. If each side of a cube is increased by 1%, the percentage change in the volume would be approximately
- (A) 1  
(B) 2  
(C) 3  
(D) 4

11. A brick weighs  $\frac{3}{4}$  of itself and  $\frac{3}{4}$  of a Kg. The weight of the brick in Kg is
- (A) 2
  - (B) 3
  - (C) 4
  - (D) 5
12. In an enzyme assay, the corrected absorbance reading obtained on addition of 100  $\mu$ l of the enzyme extract is 0.025. Given that one unit of the enzyme is the amount of enzyme required to increase the absorbance by 0.001 units under assay conditions, the enzyme activity (units/ml) of the extract is:
- (A) 2.5
  - (B) 2500
  - (C) 25
  - (D) 250
13. The cell-free extract prepared from *E. coli* cells over-expressing enzyme  $\beta$ -glucosidase showed the activity of 1.5 units per ml (protein concentration 2 mg per ml). The Ni-NTA purified preparation showed the activity of 75 units per ml (protein concentration 100  $\mu$ g per ml). Calculate the fold purification of the enzyme achieved?
- (A) 0.001
  - (B) 0.02
  - (C) 50
  - (D) 1000
14. Enzyme X showed its activity on substrate A (375 units per ml), substrate B (185 units per ml) and substrate C (75 units per ml). With respect to substrate A, the percent activities on substrate B and C are -----, respectively.
- (A) 0.49 & 0.2
  - (B) 2.02 & 5
  - (C) 49 & 20
  - (D) 202 & 500

15. Protein 'A' from *Pseudomonas putida* contains 135 amino acids. The number of nucleotides present in the gene encoding the protein will be -----.
- (A) 405
  - (B) 408
  - (C) 411
  - (D) 421
16. The molarity of a 15 % of NaCl solution in water is ----.
- (A) 2.56
  - (B) 0.256
  - (C) 25.6
  - (D) 0.025
17. The reaction velocity, ( $V$ ) vs substrate concentration  $[S]$  profile was performed for Enzyme A using 1  $\mu\text{g}$  enzyme per assay. Similar experiment was carried out under identical conditions except that the concentration of enzyme used was 2  $\mu\text{g}$  per assay. Under these conditions, the kinetic constants
- (A)  $K_m$  and  $V_{\text{max}}$  will remain unchanged
  - (B)  $K_m$  will change while  $V_{\text{max}}$  will remain same
  - (C)  $K_m$  will remain same but  $V_{\text{max}}$  will increase
  - (D)  $K_m$  and  $V_{\text{max}}$  will increase
18. Which one of the following bacterial cell suspension at  $A_{540\text{nm}} = 0.2$  will have the maximum number of cells per ml?
- (A) *Mycoplasma*
  - (B) *Pseudomonas*
  - (C) *Streptococcus*
  - (D) *Bacillus*
19. Two solutions of a substance (non-electrolyte) are mixed in the following manner: 480 ml of 1.5 M first solution + 520 ml of 1.2 M second solution. What is the molarity (M) of the final mixture?
- (A) 1.250
  - (B) 1.344
  - (C) 1.433
  - (D) 1.479

20. A 29 %  $\text{H}_2\text{SO}_4$  solution having a molarity of 3.60, would have a density ( $\text{g}\cdot\text{ml}^{-1}$ ) of --.  
(MW of  $\text{H}_2\text{SO}_4$  is 98)
- (A) 1.45
  - (B) 1.64
  - (C) 1.88
  - (D) 1.22
21. Calculate the turnover number ( $\text{sec}^{-1}$ ) for an enzyme, if  $K_m = 0.001 \mu\text{M}$ ;  $V_{\text{max}} = 10 \mu\text{M}/\text{sec}$ ; and  $E_0 = 0.001 \mu\text{M}$ .
- (A)  $1 \times 10^4$
  - (B)  $1 \times 10^5$
  - (C)  $1 \times 10^6$
  - (D)  $1 \times 10^7$
22. *Zymomonas mobilis* cells are grown in a chemostat culture in a 60 litre (l) fermenter. The  $K_s$  and  $\mu_{\text{max}}$  for the organism is  $0.2 \text{ g}\cdot\text{l}^{-1}$  and  $0.2 \text{ h}^{-1}$ , respectively. What flow rate ( $\text{l}\cdot\text{h}^{-1}$ ) is required for a steady-state substrate concentration of  $0.2 \text{ g}\cdot\text{l}^{-1}$ ?
- (A) 6
  - (B) 8
  - (C) 10
  - (D) 12
23. Consider three independently assorting gene pairs, A/a, B/b, and C/c. The probability of obtaining an offspring of AABbCc from parents that are AaBbCC and AABbCc is
- (A) 4/9
  - (B) 3/4
  - (C) 1/8
  - (D) 1/9
24. Given that husband and wife are both heterozygous for a recessive allele for albinism. If they have dizygotic twins, the probability that both the twins will have the same phenotype for pigmentation will be
- (A) 5/8
  - (B) 1/4
  - (C) 3/4
  - (D) 1/16

25. In a family with three children, what is the probability that two are boys and one is a girl?

- (A)  $2/3$
- (B)  $1/2$
- (C)  $3/8$
- (D)  $1/3$

26. LDL binds with cell surface receptor and gets internalized via clathrin-mediated endocytosis. This process helps in maintaining the cholesterol-LDL level in the plasma. However, in a disease known as familial hypercholesterolemia (FH), very high levels of plasma cholesterol is found. This could be due to mutation in which one of the following genes in FH patients?

- (A) Clathrin
- (B) LDL
- (C) LDL receptor
- (D) Adaptor

27. Digestion of a 5Kb linear DNA fragment with EcoRI generates two fragments of 2 Kb and 3 Kb, while digestion of the same molecule with HindIII yields three fragments of 0.7 Kb, 3.5 Kb and 0.8 Kb. When the same DNA is digested with both the enzymes, it yields fragments of 0.7 Kb, 1.3 Kb, 2.2 Kb and 0.8 Kb. The right sequence of restriction sites in the DNA fragment is

- (A) One EcoRI site in between two HindIII sites
- (B) One HindIII site in between two EcoRI sites
- (C) Two HindIII sites followed by only one EcoRI site
- (D) One EcoRI site followed by two HindIII sites.

28. GFP, when overexpressed in a cell, remains mostly in the cytosol. A GFP construct is modified such that the resultant GFP protein will have a conjugated peptide Pro-Lys-Lys-Lys-Arg-Lys-Val at its N-terminus. If such a GFP construct is expressed in a cell, the modified GFP protein will be localized in the

- (A) lysosome
- (B) Golgi bodies
- (C) nucleus
- (D) endoplasmic reticulum

29. Succinate dehydrogenase converts succinate to fumarate. Which one of the following is TRUE when the competitive inhibitor malonate is added in the reaction mixture?



- (A) Both  $K_m$  and  $V_{max}$  increase.
- (B) Both  $K_m$  and  $V_{max}$  decrease.
- (C)  $K_m$  increases and  $V_{max}$  remains the same.
- (D)  $K_m$  increases and  $V_{max}$  decreases.

30. In a mammalian cell, protein synthesis is regulated at the level of initiation by various kinases. During viral infection, which one of the following kinases is involved in regulating the step of formation of eIF2.GTP.Met tRNA<sub>i</sub> ternary complex in the host?

- (A) Heme-regulated inhibitor kinase (HRI)
- (B) Protein kinase RNA dependent (PKR)
- (C) GCN2-like kinase
- (D) PKR-like endoplasmic reticulum kinase (PERK)

31. Which one of the following side chains of an amino acid is responsible for fluorescence in proteins?

- (A) Indole ring
- (B) Guanidino group
- (C) Phenolic group
- (D) Imidazole group

32. DNA molecules labeled with <sup>15</sup>N and <sup>14</sup>N can be separated by

- (A) Pulse field gel electrophoresis
- (B) Density gradient ultracentrifugation
- (C) Capillary electrophoresis
- (D) Differential centrifugation

33. Match the chromatographic technique from Group A with the appropriate elution conditions given in Group B

- Group A
- (P) Chromatofocusing
  - (Q) DEAE-Sephadex
  - (R) G-150 Sephadex
  - (S) Phenyl Sepharose

- Group B
- (i) Decreasing [(NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>] gradient
  - (ii) pH gradient
  - (iii) Isocratic gradient
  - (iv) Increasing NaCl gradient

- (A) P-ii, Q-iv, R-iii, S-i
- (B) P-i, Q-iv, R-iii, S-ii
- (C) P-iv, Q-iii, R-ii, S-i
- (D) P-iii, Q-i, R-ii, S-iv

34. Cytoskeletal organization of a cell is regulated by

- (A) Ras GTPase
- (B) Rab GTPase
- (C) Rho GTPase
- (D) Ran GTPase

35. In comparison to animals residing in a warm climate, animals living in cold climate need thermal insulation. The cell membranes of the latter would have a relatively higher content of .....

- (A) sphingolipid
- (B) saturated fatty acid
- (C) unsaturated fatty acid
- (D) cholesterol

36. In glycolysis, the conversion of 1 mol of fructose 1,6-biphosphate to 2 mol of pyruvate results in the formation of

- (A) 1 mol NAD<sup>+</sup> and 2 mol of ATP
- (B) 2 mol of NAD<sup>+</sup> and 4 mol of ATP
- (C) 2 mol of NADH and 2 mol of ATP
- (D) 2 mol of NADH and 4 mol of ATP

37. In diabetic ketoacidosis, increase in which of the following would cause elevated production of ketone bodies?

- (A) Proteolysis
- (B) Urea production
- (C) Insulin release
- (D) Lipolysis

38. Which one of the following modes of inheritance is seen in Cystic Fibrosis?

- (A) Autosomal recessive
- (B) Autosomal dominant
- (C) Sex linked
- (D) Spontaneous mutation

39. Statins are very effective against hypercholesterolemia, a major cause of atherosclerosis. These drugs reduce plasma cholesterol levels by

- (A) Preventing absorption of cholesterol from the intestine.
- (B) Increasing the excretion of cholesterol from the body via conversion to bile acids.
- (C) Inhibiting the conversion of 3-hydroxy-3-methylglutaryl-CoA to mevalonate in the pathway for cholesterol biosynthesis.
- (D) Increasing the rate of degradation of 3-hydroxy-3-methylglutaryl CoA reductase.

40. Measles, Mumps, Rubella-MMR combined vaccine represents which one of following vaccine categories?

- (A) Inactivated/killed
- (B) Live, attenuated
- (C) Subunit
- (D) Toxoid (inactivated toxin)

41. A haemophiliac man marries a normal woman. They have a daughter who does not show symptoms of haemophilia. If she marries a haemophiliac man, what will be the probability of their son displaying symptoms of haemophilia?

- (A) 0%
- (B) 25%
- (C) 50%
- (D) 100%

42. The conventional treatment for methanol toxicity is to administer ethanol. Which of the following explains the basis of this treatment?

- (A) Ethanol acts as a competitive inhibitor to methanol
- (B) Ethanol acts as a non-competitive inhibitor to methanol
- (C) Ethanol destroys the enzymatic activity of alcohol dehydrogenase
- (D) Ethanol blocks the entry of methanol within the cells.

43. What will be the angular velocity of a rotor in a centrifuge operating at 6000 revolution per minute?

- (A) 62.8 radians per second
- (B) 628 radians per second
- (C) 6.28 radians per second
- (D) 6280 radians per second

44. Lysosomes of a cell were labelled with lysotracker Red. Subsequently, these cells were infected with GFP-transfected Mycobacterium and observed under a fluorescence microscope. What will you observe?

- (A) GFP-Mycobacterium will be colocalized with lysotracker Red labeled lysosomes.
- (B) GFP-Mycobacterium will be separated from lysotracker Red labeled lysosomes.
- (C) GFP-Mycobacterium will not be detected as they are degraded in the cell.
- (D) Lysotracker Red labeled lysosomes will be degraded in GFP-Mycobacterium infected cells

45. A linear DNA fragment which has 3 restriction sites for BamH1, is labeled only at the 5' end. This DNA is partially digested with BamH1 in such a way that all kinds of fragments are generated. Under these conditions, how many labeled and unlabeled fragments will be produced?

- (A) 3 labeled and 4 unlabeled
- (B) 3 labeled and 5 unlabeled
- (C) 4 labeled and 5 unlabeled
- (D) 4 labeled and 6 unlabeled

46. In the preparation of humanized antibody, part of the antibody molecule is taken from mouse and the remaining is taken from that of human, through genetic engineering technique. Which one of the following statements is true for humanized antibody?

- (A) CDRs of mouse IgG is fused with framework regions of human IgG
- (B) CDRs of human IgG is fused with framework regions of mouse IgG
- (C) CDRs of mouse IgG is fused with CDRs of human IgG
- (D) framework regions of mouse IgG is fused with framework regions of human IgG

47. Approximately how many molecules of CO<sub>2</sub> are produced daily by oxidative metabolism in adult human? Avagadro's number is  $6.02 \times 10^{23}$ .

- (A)  $1.2 \times 10^{24}$
- (B)  $1.2 \times 10^{23}$
- (C)  $1.2 \times 10^{26}$
- (D)  $1.2 \times 10^{25}$

48. A 25-year old man undertakes a prolonged fast for religious reasons. Which one of the following metabolites will be elevated in his blood plasma after 24 hours?

- (A) Lactic acid
- (B) Glycogen
- (C) Ketone bodies
- (D) Non-esterified fatty acids

49. Which one of the following is not a deficiency disorder?

- (A) Beriberi
- (B) Night Blindness
- (C) Poliomyelitis
- (D) Pernicious Anemia

50. Electrophoresis of a purified protein in SDS-PAGE in the presence of 2-mercaptoethanol yields two bands of 35 kDa and 45 kDa. However, in a gel filtration chromatography, the same protein elutes as 80 kDa. What conclusion will you draw from the results?

- (A) The protein is not purified to homogeneity.
- (B) Two bands generated in SDS-PAGE due to degradation.
- (C) The protein is a homodimer
- (D) The protein is a heterodimer

## Section-B

(Answer any 50 out of 150 questions)

51. Which one of the following virus is the odd one out?

- (A) Epstein-Barr Virus
- (B) Human Immunodeficiency Virus.
- (C) Human Papilloma Virus
- (D) Human T-cell leukemia Virus

52. DAPI 4',6-diamidino-2-phenylindole is a fluorescent stain used for staining of:

- (A) DNA only
- (B) DNA and RNA
- (C) DNA and proteins
- (D) protein Only

53. During antigen presentation by antigen presenting cells, viral antigens are processed and presented to T cells in the context of MHC antigens. Viral antigens are processed

- (A) By proteasomes and are presented along with MHC class I antigen
- (B) In endosomes and are presented along with MHC class I antigen
- (C) In endosomes and are presented along with MHC class II antigen
- (D) By proteasomes and are presented along with MHC class II antigen

54. Which of the following is not specifically protected by intellectual property legislation?

- (A) Industrial designs.
- (B) Patents.
- (C) Trademarks.
- (D) Trade secrets.

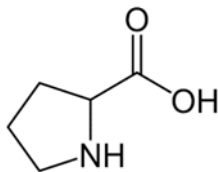
55. Teichoic acid possibly plays a role in growth of bacterial cell by regulating the activity of

- (A) lysin
- (B) autolysin
- (C) peptidase
- (D) protease

56. The fungus that causes athlete's foot is

- (A) *Aspergillus*
- (B) *Trichophyton*
- (C) *Neurospora*
- (D) *Trichoderma*

57. The following amino acid is



- (A) hydrophobic
- (B) nucleophilic
- (C) aromatic
- (D) basic

58. A DNA fragment was cloned at the *EcoRI* restriction site of a plasmid vector that contains antibiotic resistance genes, *kan<sup>R</sup>* and *spec<sup>R</sup>*. It was observed that all the positive clones (containing the DNA fragment of interest) grew on medium with kanamycin but not on media containing spectinomycin. In the absence of any other confounding factors, which one of the following statements would explain this observation?

- (A) The *spec<sup>R</sup>* gene contains a mutation, which generates a stop codon within the gene.
- (B) The *EcoRI* site was located within the *spec<sup>R</sup>* gene.
- (C) The cloned fragment of interest produces a protein, which confers resistance to spectinomycin.
- (D) The cloned DNA fragment was lethal to the cell.

59. A cDNA encoding an eukaryotic gene was ligated to an expression vector which was then introduced into *E. coli* for expression of the protein. The experiment resulted in poor expression of the protein. However, expression improved significantly in a Rosetta strain of *E. coli* which demonstrate that the initial poor level expression was due to

- (A) absence of capping at 5' end of the transcript
- (B) absence of polyadenylation at 3' end of the transcript
- (C) codon bias
- (D) lack of splicing machinery in *E. coli*.

60. In *Drosophila* embryogenesis, the signal received from Gurken proteins by follicle cells results in posteriorization of these cells. Knocking out the gene for Gurken in *Drosophila* will NOT result in failure of

- (A) Accumulation of maternal mRNAs
- (B) rearrangement of maternal mRNA at the two ends of the embryo
- (C) establishment of gradients of Gurken
- (D) establishment of anterior-posterior axis

61. A patient suffering from an infectious disease had high levels of TNF alpha and IL-6. Assuming there are no other interactions, which T cell population is likely to dominate in his blood sample?

- (A) Th2
- (B) Th17
- (C) Treg
- (D) Naive T cells

62. The niche of stem cells in human skin is the

- (A) dermal papillae region of hair follicle
- (B) bulge region of the hair follicle
- (C) sebaceous gland
- (D) malpighian layer

63. In persons suffering from sickle cell anemia, the 6<sup>th</sup> amino acid of beta globin protein is valine instead of glutamic acid. This has occurred due to substitution mutation leading to a change in glutamic acid codon to valine codon in the gene. The mutation is a

- (A) transition where a purine base changes to another purine base
- (B) transition where pyrimidine base changes to another pyrimidine base
- (C) transversion where pyrimidine base changes to a purine base
- (D) transition where purine base changes to a pyrimidine base

64. A covalently closed circular DNA was in relaxed state in water at 30<sup>o</sup>C. What will happen to the supercoiling state of the molecule, if water temp increases to 60<sup>o</sup>C or decreases to 10<sup>o</sup>C?

- (A) The DNA will remain in relaxed state also at 60<sup>o</sup>C as well as at 10<sup>o</sup>C
- (B) The DNA will undergo positive supercoiling at 60<sup>o</sup>C as well as at 10<sup>o</sup>C



- (C) The DNA will undergo positive supercoiling at 60°C and will undergo negative supercoiling at 10°C
- (D) The DNA will undergo negative supercoiling at 60°C and will undergo positive supercoiling at 10°C

65. 1000 color blind males underwent random mating with 1000 normal females (neither carrier nor color blind). After how many generations, the allele frequency in both the sexes in the population will reach equilibrium?

- (A) One
- (B) Two
- (C) Three
- (D) More than three

66. Acclimatization to high altitude in humans induces differentiation of

- (A) basophil
- (B) platelets
- (C) erythrocytes
- (D) neutrophils

67. The protection against smallpox afforded by prior infection with cowpox presents

- (A) specificity.
- (B) antigenic cross-reactivity.
- (C) innate immunity.
- (D) passive protection.

68. What is glycosuria?

- (A) Low amount of sugar in urine
- (B) Low amount of fat in urine
- (C) Average amount of carbohydrate in urine
- (D) High amount of sugar in urine

69. The mechanism that permits immunoglobulins to be synthesized in either a membrane bound or secreted form is

- (A) allelic exclusion

- (B) codominant expression
- (C) differential RNA processing
- (D) class switching

70. Which of the following is NOT involved in antigen- antibody complexes?

- (A) Van der Waals forces
- (B) Hydrogen bonds
- (C) Covalent bonds
- (D) Electrostatic interactions

71. Iron uptake by the cells from extracellular environment is mediated through

- (A) LDL receptor
- (B) Mannose receptor
- (C) Transferrin receptor
- (D) Mannose 6-phosphate receptor

72. Which of following viruses causes liver cancer?

- (A) Papilloma virus.
- (B) Herpes simplex virus.
- (C) Hepatitis B virus.
- (D) Hepatitis C virus.

73. Which one of the following enzymes is an established intracellular anti-oxidant?

- (A) Lactate dehydrogenase
- (B) Phenylalanine hydroxylase
- (C) Superoxide dismutase
- (D)  $\gamma$ -Secretase

74. A given cytokine has different biological effects on different target cells. This is known as

- (A) pleiotropy
- (B) redundancy
- (C) synergy
- (D) totipotency

75. Influenza virus contains 11 proteins, of which the two major glycoproteins are H and N. What do H and N stand for in influenza strains nomenclature?

- (A) H: Hemagglutinin; N: Nucleoprotein
- (B) H: Hemagglutinin; N: Neuraminidase
- (C) H: Hyaluronidase; N: Nucleoprotein
- (D) H: Hyaluronidase; N: Neuraminidase

76. Inosine in the tRNA anticodon will base pair with all **except** which one of the following bases in the codon of mRNA?

- (A) adenine
- (B) uracil
- (C) cytosine
- (D) guanine

77. In Electrophoresis if the buffer pH is above the isoelectric point of the protein, the protein will

- (A) migrate towards the anode
- (B) migrate towards the cathode
- (C) not migrate at all
- (D) migrate partly to anode and partly to cathode

78. In the ABO blood group system in humans, alleles  $I^A$  and  $I^B$  are codominant and both are dominant to the allele  $i$ . If a type B with genotype ( $I^B i$ ) woman marries a type A with genotype ( $I^A i$ ). The probable children to the couple would be of the type

- (A) A, B, O and AB
- (B) A and B only
- (C) A and AB only
- (D) O and AB only

79. Circulating testosterone is mostly present in bound form, which of the following proteins binds weakly to the major amount of circulating testosterone?

- (A) Transferrin
- (B) Prothrombin
- (C) Fibrinogen
- (D) Albumin

80. *T. brucei* complex transmitted to man by bite of several species of tsetse fly can cause

- (A) Thymoma
- (B) Sleeping sickness
- (C) Toxoplasmosis
- (D) Leishmaniasis

81. In immune responses at mucosal surfaces, particularly in the context of gut immunology, which of the following is NOT true?

- (A) Mucosal surfaces have continuous and close contact with numerous and diverse commensal microorganisms.
- (B) M cells transport microbes and antigens from the gut lumen to gut associated lymphoid tissue.
- (C) B cells activated in mucosal tissues give rise to plasma cells preferentially secreting IgG.
- (D) Inflammation is prevented at mucosal surfaces, generally by recruitment of T regulatory cells.

82. You have developed a H-2 k/d mouse model with grafted thymus for studying T cell maturation. The phenotype of the grafted thymus is H-2d/d. You have immunized the mouse with antigens derived from *Listeria monocytogenes* and would like to assess the activation of cytotoxic T cells. Which among the following would be your choice of target cell?

- (A) Cells expressing MHC class I molecules taken from H-2k/k mouse
- (B) Cells expressing MHC class II molecules taken from H-2k/k mouse
- (C) Cells expressing MHC class I molecules taken from H-2d/k mouse
- (D) Cells expressing MHC class II molecules taken from H-2d/k mouse

83. While analyzing protein sequences of *rpoB* gene among different bacteria, different changes in amino acid sequences were observed among the homologs due to base substitution. If transition is more frequent than transversion, single mutation is more frequent than double mutation, which one of the following changes will occur most frequently than others?

- (A) Ala → Gly
- (B) Ala → Ser
- (C) Ala → Leu
- (D) Ala → Val

84. If G2/M check point and DNA repair proteins are working optimally in a cell and there are some DNA damages during G2 phase, which one of the following would be the response of the cells to damage?

- (A) Cell cycle will continue and cell will undergo mitosis.
- (B) Cell will undergo cytokinesis.
- (C) Cells will enter into mitosis and arrest at metaphase.
- (D) Cells will arrest at G2 until the damages are repaired.

85. Transferrin binds with its receptor and recruits clathrin via which one of the following proteins?

- (A) Caveolin
- (B) AP1 adaptor
- (C) AP2 adaptor
- (D) Dynamin

86. Which one of the following is the major product of fatty acid synthase?

- (A) Acetyl-CoA
- (B) Palmitoyl-CoA
- (C) Acetoacetate
- (D) Palmitate

87. Intracellular transport in mammalian cells through vesicular fusion is regulated by which among the following GTPases?

- (A) Rho
- (B) Ran
- (C) Rab
- (D) Ras

88. Which one of the following processes is NOT regulated by the kidney?

- (A) Body temperature
- (B) Blood pressure
- (C) Coordinated muscle movement
- (D) Ionic balance of the blood

89. Rapid removal of large quantities of blood will cause an animal to go into hypovolemic shock and may even cause death. If the weight of a mouse is 20 gms, what is the amount of maximum blood one can withdraw from a single bleed to prevent the mouse from going into hypovolemic shock?
- (A) 2.0 ml
  - (B) 3.0 ml
  - (C) 0.2 ml
  - (D) 1.0 ml
90. In order to have a desired shRNA cassette integrated in target cells, which of the following gene transfer vectors is preferable?
- (A) Baculovirus vector
  - (B) Herpes virus vector
  - (C) Adenoviral vector
  - (D) Lentiviral vector
91. Which one of the following statements regarding naturally occurring *Agrobacterium* strains is true?
- (A) The T-DNA region of *Agrobacterium* does not contain functional genes.
  - (B) All the *virulence* genes of *Agrobacterium* are constitutively expressed.
  - (C) *Agrobacterium*-induced galls require exogenous application of phytohormones for their growth.
  - (D) *Agrobacterium*-induced galls in nature do not require bacterial persistence for their growth.
92. The integration of T-DNA in the plant nuclear genome is most likely due to
- (A) homologous recombination
  - (B) non-homologous recombination
  - (C) non-homologous end joining
  - (D) single-stranded recombination during transcription

93. Variation in transgene expression levels among independent transgenic events generated using the same transgene construct could be due to
- (i) position effects
  - (ii) strength of the promoter used to express the transgene
  - (iii) variation in copy number of the transgene
  - (iv) presence of restriction enzyme sites in the transgene sequence
- (A) (i) and (iv)
  - (B) (ii) and (iii)
  - (C) (i) and (iii)
  - (D) (iii) and (iv)
94. A typical flowering plant has a combination of sporophytic (diploid) and gametophytic (haploid) tissues. Which of the following types of plant tissues do NOT contribute to the formation of a mature fruit?
- (A) sporophytic tissue from the previous generation
  - (B) gametophytic tissue from the previous generation
  - (C) sporophytic tissue from the next generation
  - (D) gametophytic tissue from the next generation
95. The submerged leaves of an aquatic plant are feathery (to avoid damage due to flowing underwater currents) while leaves on the surface are padded (to help in floatation). The correct statement related to the above phenotype is
- (A) The gene content of the submerged leaves is different from that of leaves on the surface.
  - (B) The submerged and floating leaves have differential expression of structural and/or regulatory genes.
  - (C) The observed phenotypic variation in leaves is not influenced by diverse growth conditions.
  - (D) These phenotypic variations are due to transient somatic mutations.
96. Which one of the following statements related to the development of insect-resistant transgenic plants is correct?
- (A) The targeted insects cannot develop resistance against transgenic plants generated using a single candidate gene.
  - (B) A transgenic plant developed using multiple genes might be more effective in inducing and maintaining resistance.
  - (C) The level of transgene expression does not influence the efficacy of the transgenic plant.
  - (D) It is easier to propagate and maintain multi-copy integration events than single copy events of insect resistant plants.

97. When the gene and the promoter used for modification of a plant using transformation technology are derived from sexually compatible species, the modified plant thus generated is known as a
- (A) cisgenic plant
  - (B) selfgenic plant
  - (C) intragenic plant
  - (D) hemilogous plant
98. A transgenic plant segregates in a 3:1 ratio for the transgenic: non-transgenic phenotype in  $T_1$  progeny derived by self-pollination. This indicates that
- (A) the transgenic plant cannot contain more than one copy of the transgene.
  - (B) the transgenic plant may contain two unlinked copies of the transgene.
  - (C) the transgenic plant contains more than two unlinked copies of the transgene.
  - (D) the transgenic plant may contain two tightly linked copies of the transgene.
99. Which one of the following reporter genes can be used for real-time visualization of living cells/tissues in transgenic plants?
- (A) *gus*
  - (B) *gfp*
  - (C) *cat*
  - (D) *beta-galactosidase*
100. Which of the following statements represent correct features of sexual and asexual modes of reproduction in flowering plants?
- (i) In sexual reproduction, progeny are genetically different from each other.
  - (ii) In asexual mode of reproduction, progeny are genetically identical to each other but different from the parent.
  - (iii) Development of greater adaptive ability is possible only in case of progeny derived by sexual reproduction.
  - (iv) A minor change in the habitat may adversely affect all offspring derived by asexual reproduction.
- (A) i, iii and iv
  - (B) i, ii and iii



- (C) ii and iv  
(D) ii, iii and iv
101. Which one of the options given below represents the correct combination of plant defense responses listed in Column A and Column B?
- | Column A |                    | Column B |                |
|----------|--------------------|----------|----------------|
| (i)      | Anatomical defense | (1)      | salicylic acid |
| (ii)     | Elicitors          | (2)      | chitinases     |
| (iii)    | Systemic response  | (3)      | waxes          |
| (iv)     | PR proteins        | (4)      | beta-glucans   |
- (A) i – 2, ii – 3, iii – 1, iv - 4  
(B) i - 3, ii – 4, iii – 1, iv – 2  
(C) i – 4, ii – 1, iii – 2, iv - 3  
(D) ii – 3, iii – 4, i – 2, iv - 1
102. Non-conditional, negative selection marker genes are usually expressed under a
- (A) developmentally regulated promoter  
(B) substrate-induced promoter  
(C) constitutive promoter  
(D) minimal promoter
103. A method in which a strong enhancer is randomly inserted in a plant genome by transformation, resulting in mutant plants with dominant phenotypes, is known as
- (A) enhancer trapping  
(B) TILLING  
(C) activation tagging  
(D) gene trapping
104. Which one of the following organisms is used by plant biologists to study translocation in phloem?
- (A) aphids  
(B) nematodes  
(C) grasshoppers  
(D) butterflies
105. In a genetic transformation experiment, a researcher failed to add the antibiotic selection agent in the shoot regeneration medium for selection of transgenic plants. In the absence of any other confounding factors, which one of the following statements is expected to be correct?

- (A) The number of regenerating shoots would be reduced in this experiment as compared to those in which the antibiotic is added.
- (B) The number of regenerating shoots is comparable to results obtained in the “negative control” of the experiment.
- (C) Transgenic plants cannot be generated from the above experiment.
- (D) The regenerating shoots would consist of a mixture of transgenic and non-transgenic plants.
106. Orientation of a cloned passenger gene cassette in a binary plasmid vector, containing the expression cassette of a selectable marker gene, can be checked by PCR using
- (A) passenger gene-specific primers
- (B) selectable marker gene-specific primers
- (C) a combination of passenger gene-specific and vector-specific primers
- (D) vector-specific primers
107. Somatic hybrid plants with full or nearly full complement of the two parental species are called
- (A) asymmetric hybrids
- (B) symmetric hybrids
- (C) complete hybrids
- (D) chimeric hybrids
108. In CAGE,
- (A) only 5'-end information of the transcript is analysed
- (B) only 3'-end information of the transcript is analysed
- (C) both 5'-end and 3'-end information of the transcript are analysed
- (D) complete exonic sequence of the transcript is analysed.
109. Which one of the following statements about associative nitrogen fixing bacteria is NOT true?
- (A) *Rhodobacter* and *Rhodospirillum* are autotrophic photosynthetic N-fixing bacteria
- (B) *Clostridium*, *Desulfotomaculum* and *Desulfovibrio* are heterotrophic anaerobic N-fixing bacteria
- (C) *Azospirillum* is an associative autotrophic microaerophilic nitrogen fixing bacteria
- (D) *Beijerinckia* is an heterotrophic aerobic associative nitrogen fixing bacteria

110. According to the Seeds Act of 1966, which one of the following functions is NOT applicable to a Seed Certification Agency?

- (A) It should be an autonomous body.
- (B) It should involve itself in the production and marketing of seeds.
- (C) It should have close linkages with technical and other related institutions.
- (D) Its long-term objective should be to operate on no-profit no-loss basis.

111. Which one of the combinations given below represents populations with a similar genetic composition?

- (A)  $F_1$  and  $F_2$
- (B)  $F_2$  and  $BC_1F_2$
- (C) RIL and DH
- (D) DH and  $F_2$

112. Which one of the following statements represents a correct definition of Gene Pyramiding?

- (A) Introducing different genes for resistance to a specific pest in a single genotype
- (B) Introducing different genes for resistance to a specific pest in different genotypes
- (C) Introducing a single gene for resistance to multiple pests in a single genotype
- (D) Introducing multiple genes conferring resistance to multiple pests in different genotypes.

113. A marker closely linked to the gene of interest for an agronomic trait will be used for

- (A) foreground selection
- (B) background selection
- (C) both foreground and background selection
- (D) selection of unlinked genes

114. The vitrification of cultured explants is generally caused by

- A. low light irradiance, high temperature and intensive sterilization

- B. high auxin, low temperature and high light irradiance  
C. high agar, high nutrients and high pH  
D. low pH, low temperature and low micronutrient concentration
115. The *Rht* mutations in wheat that were pivotal for 'Green Revolution' reduce plant height due to impairment in
- (A) gibberellic acid biosynthesis pathway
  - (B) gibberellic acid signaling pathway
  - (C) auxin biosynthetic pathway
  - (D) auxin response pathway
116. Steady state for a closed system implies
- (A) Input = Output
  - (B) Accumulation = 0
  - (C) Input – Output = Accumulation
  - (D) System is in equilibrium
117. In a lab scale reactor, the size of the air bubbles in the reactor is primarily determined by
- (A) agitator speed
  - (B) viscosity of the broth
  - (C) density of the broth
  - (D) size of the holes in the sparger
118. Generally fungal fermentations are pseudoplastic. Hence in large reactors the cells
- (A) are better aerated near walls of the reactor
  - (B) are better aerated in the centre of the reactor
  - (C) are evenly aerated
  - (D) get better aerated at the top rather than bottom
119. Mixing time increases with the volume of the reactor because of increase in the
- (A) circulation time
  - (B) shear

- (C) turbulence
- (D) flow rate

120. The Reynolds number is a ratio of

- (A) external forces/inertial forces
- (B) inertial forces/axial dispersion
- (C) inertial forces/viscous forces
- (D) external forces/ viscous forces

121. The equation  $\tau = \mu \, du/dy$  is also termed as

- (A) pressure flux equation
- (B) force flux equation
- (C) mass flux equation
- (D) momentum flux equation

122. Match the Transport process with appropriate time constants given below.

	Transport process	Time constants
1.	Oxygen transfer	p. $V/Q$
2.	Heat transfer	q. $4V/(1.5ND^3)$
3.	Flow	r. $V\rho C_p/UA$
4.	Mixing	s. $1/K_L a$

Where V is volume; Q is pumping rate; N is agitation rate; D is diameter of the impeller; A is area and  $\rho$  is the density of the liquid

- (A) 1-s, 2-r, 3-p, 4-q
- (B) 1-s, 2-r, 3-q, 4-p
- (C) 1-s, 2-q, 3-p, 4-r
- (D) 1-q, 2-r, 3-p, 4-s

123. When a liquid of density  $1200 \text{ kg/m}^3$  and viscosity  $0.01 \text{ kg m}^{-1}\text{s}^{-1}$  flows through a 1 cm ID pipe at 0.2 m/s, the flow is referred as a

- (A) Piston flow
- (B) Turbulent flow
- (C) Laminar flow
- (D) Transition flow

124. In a dynamic gassing out technique for determination of  $K_L a$  in a bioreactor, upon restart of the aeration the increase in DO slows down with time because

- (A) the cultures specific OUR declines to reach a steady state
- (B)  $K_L a$  changes when the cells get sufficient oxygen supply
- (C)  $C^* - C_L$  increases
- (D)  $C^* - C_L$  decreases

125. Under unaerated conditions in a fermenter, the power consumed by a single impeller is 10 KW and upon changing the agitation rate from 200 to 600 rpm, the new power consumption (KW) would be ----- . (Assuming that the power number remains constant)

- (A) 270
- (B) 90
- (C) 30
- (D) 10

126. Fill in the blanks with appropriate option: Vinegar is a liquid consisting of acetic acid produced by the fermentation of \_\_\_\_\_ by \_\_\_\_\_.

- (A) glucose, *S. cerevisiae*
- (B) ethanol, *A. aceti*
- (C) lactose, *L. acidophilus*
- (D) starch, *B. amyloliquefaciens*

127. A food stored in a refrigerator has caused an outbreak of food borne illness. Which one of the following is most likely to be the pathogen responsible for this?

- (A) *S. typhimurium*
- (B) *E. coli*
- (C) *L. monocytogenes*
- (D) *B. cereus*

128. To reduce the tartness in wine due to malic acid, a secondary fermentation is carried out using

- (A) *Saccharomyces cerevisiae*
- (B) *Oenococcus oeni*

- (C) *Aspergillus niger*
- (D) *Pichia pastoris*

129. Which one of the following statements is INCORRECT with respect to food rheology?

- (A) Yoghurt demonstrates thixotropy
- (B) Ketchup is an example of shear thinning, pseudoplastic liquid
- (C) Wheat dough is viscoelastic
- (D) Molten chocolate is a perfect Newtonian fluid

130. Which one of the following enzyme(s) would result in high glucose yield from starch hydrolysis?

- (A)  $\alpha$ - amylase
- (B)  $\beta$ - amylase
- (C)  $\alpha$ - amylase and amyloglucosidase
- (D)  $\alpha$ - amylase and  $\beta$ - amylase

131. The major metabolite formed and the succession of microorganisms responsible for Sauerkraut fermentation are

- (A) citric acid, yeast- Coliform- Leuconostoc
- (B) acetic acid, Aspergillus- Lactobacilli- Leuconostoc
- (C) lactic acid, Coliform- Leuconostoc- Lactobacilli
- (D) malic acid, Leuconostoc- Lactobacilli- Coliform

132. Omega 3 fats are good for health and play an important role in prevention of heart disease. If you have to formulate a food product rich in omega 3 fats which one of the following options would you choose?

- (A) rice bran oil because it contains C 18:2  $\Delta$ 9c, 12c
- (B) flax seed oil because it contains C 18:3  $\Delta$ 9c, 12c, 15c
- (C) olive oil because it contains C 18:1  $\Delta$ 9c
- (D) black- currant seed oil because it contains C 18:3  $\Delta$  6c, 9c, 12c

133. For a well-established enzyme assay method where the reaction kinetics should remain zero order, what percentage of substrate is converted to product during the incubation period?

- (A) 80 – 90%
- (B) 50 – 60%

- (C) 30 – 20%
- (D) 6 – 10%

134. As the viscosity increases, the method used for mixing is changed in the following order

- (A) Paddle, Turbine, Propeller, Helical ribbon and Screw
- (B) Propeller, Turbine, Paddle, Helical ribbon and Screw
- (C) Propeller, Paddle, Turbine, Helical ribbon and Screw
- (D) Propeller, Turbine, Paddle, Screw and Helical ribbon

135. On scale up, the effective area available for heat transfer in a bioreactor

- (A) Increases
- (B) Decreases
- (C) Depends on viscosity of the medium
- (D) Remains constant

136. A fermenter produces 100 kg lysine per day. If the volumetric productivity is  $0.8 \text{ g l}^{-1} \text{ h}^{-1}$ , what is the volume of the fermenter in liter?

- (A) 2200
- (B) 3200
- (C) 4200
- (D) 5200

137. Chemostat cultivation is carried out at steady state with a dilution rate of  $0.1 \text{ h}^{-1}$ . Given  $\mu_m = 1.1 \text{ h}^{-1}$  and  $K_s = 0.1 \text{ g/L}$ . What will be steady state substrate concentration?

- (A) 0.01 g/L
- (B) 0.1 g/L
- (C) 1.0 g/L
- (D) 10.0 g/L

138. For degradation of crude oil in ocean by microorganisms, the two limiting nutrients are

- (A) nitrates and ammonia
- (B) nitrates and phosphates
- (C) sulphates and iron



(D) phosphates and nitrites

139. The first circumpolar expedition in the history of Marine Sciences was

- (A) Challenger
- (B) Beagle
- (C) International Indian Ocean Expedition
- (D) Voyager

140. Paralytic shellfish poisoning (PSP) is caused by the consumption of molluscan Shellfish contaminated with

- (A) Brevetoxins
- (B) Domoic Acid
- (C) Saxitoxins
- (D) Okadaic acid

141. Biofilm/capsular material produced by the soil bacteria is detected by

- (A) Saffranin
- (B) Malachite green
- (C) Basic fuchsin
- (D) Congo red

142. A compound secreted by a soil bacterium capable of reducing the surface tension at air-water interface is called as

- (A) Osmolyte
- (B) Detergent
- (C) Primary metabolite
- (D) Biosurfactant

143. Match the organism in Group A with the appropriate habitat from Group B.

- | Group A                  | Group B         |
|--------------------------|-----------------|
| P) <i>Pseudomonas</i>    | i) Hot springs  |
| Q) <i>Thermus</i>        | ii) Rhizosphere |
| R) <i>Photobacterium</i> | iii) Soil       |
| S) <i>Thiobacillus</i>   | iv) Marine      |

- (A) P-ii, Q-i R-iv S-iii
- (B) P-i, Q-iii, R-ii, S-iv
- (C) P-iv, Q-iii, R-ii, S-i
- (D) P-ii, Q-iv, R-ii S-i

144. Match the type of Organism in Group A with appropriate phenotype/property from Group B.

- Group A
- P) *Pseudomonas aeruginosa*
  - Q) *Staphylococcus aureus*
  - R) *Thiobacillus ferrooxidans*
  - S) *Bradyrhizobium*

- Group B
- i) Sulfur oxidizing organism
  - ii) Elemental N<sub>2</sub> fixation
  - iii) Biofilm formation
  - iv) Quorum sensing

- (A) P-ii, Q-iii, R-iv, S-i
- (B) P-iii, Q-iv, R-i, S-ii
- (C) P-iii, Q-iv, R-ii, S-i
- (D) P-i, Q-iii, R-ii, S-iv

145. Which one of the following reactions is performed by Cytochrome-P450 to detoxify the xenobiotics?

- (A) Hydroxylation
- (B) Ligation
- (C) Hydrolysis
- (D) Group transfer

146. Which one of the following is NOT true regarding Zika virus?

- (A) It was first isolated in Uganda
- (B) It is transmitted by *Anopheles* mosquito
- (C) It is an RNA virus
- (D) It may result in microcephaly

147. The vaccine currently used in India's Pulse polio campaign is

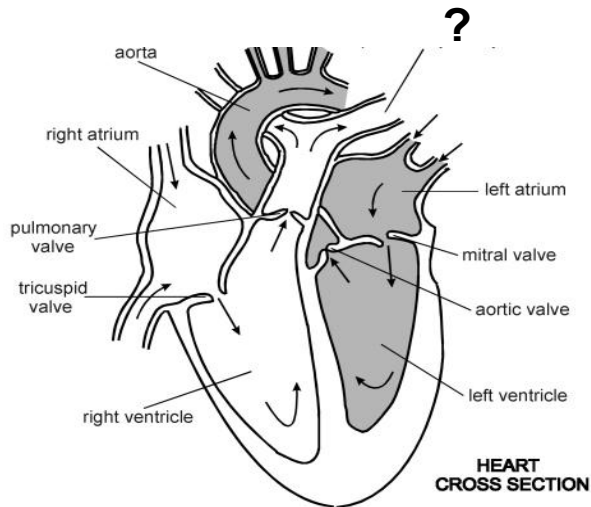
- (A) heat killed
- (B) chemically attenuated
- (C) live attenuated
- (D) vaccine with adjuvant

148. Which one of the following enzymes helps in the survival of *Helicobacter pylori* in the stomach?
- (A) carbonic anhydrase
  - (B)  $\beta$ -lactamase
  - (C) urease
  - (D) transpeptidase
149. Which one of the following is INCORRECT about Streptokinase?
- (A) It was originally obtained from  $\beta$  hemolytic streptococci
  - (B) It is highly antigenic
  - (C) It is used as a therapeutic anti-thrombogenic agent
  - (D) It is used as a therapeutic fibrinolytic agent
150. The utility of positron emission tomography to diagnose tumors is based on
- (A) uptake of 2-fluoro-2 deoxyfructose
  - (B) uptake of 2-fluoro-2-deoxyglucose
  - (C) activation of hypoxia-inducible transcription factor HIF-1
  - (D) detection of hypoxia by pimonidazole
151. Which one of the following imaging techniques is non-invasive?
- (A) Ultrasound imaging
  - (B) Contrast CT imaging
  - (C) Nuclear imaging
  - (D) PET imaging
152. Amphotericin B is clinically used against which one of the following pathogens?
- (A) Herpes simplex virus I
  - (B) *M. tuberculosis*
  - (C) *Candida* spp.
  - (D) *P. vivax*
153. The therapeutic index (TI) indicates the relative margin of safety of a drug and it is deduced from the values of mean lethal dose (LD<sub>50</sub>) and median effective dose (ED<sub>50</sub>). Which of the following represents TI of a drug?
- (A)  $TI = LD_{50} \times ED_{50}$
  - (B)  $TI = LD_{50} + ED_{50}$
  - (C)  $TI = LD_{50} / ED_{50}$
  - (D)  $TI = LD_{50} - ED_{50}$

154. Which one of the following is a frequently used radio-opaque dye?

- (A) Barium chloride
- (B) Barium sulphate
- (C) Barium nitrite
- (D) Barium iodide

155. The name of the blood vessel marked [?] in the figure below is



- (A) pulmonary vein
- (B) pulmonary artery
- (C) cardiac vein
- (D) cardiac artery

156. Which one of the following is a reason for administering general anesthesia to experimental animals?

- (A) It reduces the toxicity of a test drug
- (B) It provides reasonable degree of muscle relaxation
- (C) It maintains the normal level of haemoglobin
- (D) It maintains the normal body temperature

157. During the pathogenesis of rabies, the replication of virus first starts in the

- (A) Spinal ganglia
- (B) Muscle fibers and connective tissues
- (C) Lungs
- (D) Central nervous system

158. Route of entry for canine distemper virus is

- (A) Skin dermal fibroblasts
- (B) Respiratory epithelial cells
- (C) Lymphocytes
- (D) Mesenchymal stem cells

159. Callipyge gene mutation in sheep leads to increased muscle growth. The gene presents a typical case of Polar over-dominance. Which of the four genotypes given below shows increased muscle growth? (N= wild type allele, C= mutant allele for callipyge)

- (A)  $N^{\text{mat}} C^{\text{pat}}$
- (B)  $N^{\text{pat}} C^{\text{mat}}$
- (C)  $C^{\text{mat}} C^{\text{pat}}$
- (D)  $N^{\text{Pat}} N^{\text{pat}}$

160. The technique used in animal biotechnology for the rapid multiplication and production of animals with a desirable genotype is:

- (A) protoplast fusion and embryo transfer
- (B) hybrid selection and embryo transfer
- (C) in vitro fertilization and embryo transfer
- (D) artificial insemination

161. A primary culture of neurons isolated from the mouse brain responded positively when exposed to a chemical for a few seconds, but the neurons were less responsive and eventually stopped responding when exposed to the same chemical for prolonged duration. However, if the culture was left for some time and washed, the neurons started responding to the same chemical at the same concentration as before. The reduced response was due to

- (A) increased apoptosis of the neurons.
- (B) necrosis of the neurons.
- (C) change in the pH of the medium.
- (D) desensitization/down-regulation of the receptors.

162. If a neuron is tyrosine hydroxylase positive, it could be either:

- (A) Noradrenergic or Histaminergic
- (B) Dopaminergic or Serotonergic
- (C) Noradrenergic or Dopaminergic
- (D) Serotonergic or Noradrenergic

163. Pain sensation is a subjective and conscious feeling. However, although the autonomic organs viz. brain, heart etc. do not get represented in the cerebral cortex, one feels pain in those parts as well. The reason is

- (A) these parts receive less blood supply.
- (B) increased pH in those parts.
- (C) it is a referred pain.
- (D) these organs are metabolically compromised.

164. Neurons are formed from precursor proneural cells due to

- (A) relatively low level notch activity.
- (B) relatively high level notch activity.
- (C) inactivation of notch.
- (D) activation of delta.

165. A neuron at resting state when treated with "X" showed transmembrane potential  $-50\text{mV}$ , while when treated with "Y" it showed  $-90\text{mV}$ . Given such a condition, which of the following statements would be most appropriate?

- (A) "X" induced depolarization, while "Y" induced hyperpolarization.
- (B) The threshold for inducing a response by the neuron was higher for "X" than that for "Y".
- (C) Both the treatments induced depolarization of the neuron.
- (D) Both the treatments induced hyperpolarization of the neuron.

166. In a population which is in Hardy-Weinberg equilibrium, the frequency of a recessive allele for a certain genetic trait is 0.40. What percentage of individuals would be expected to show the dominant trait in the next generation?

- (A) 16%
- (B) 32%
- (C) 84%
- (D) 96%

167. Color blindness in human is a sex-linked recessive trait. If two individuals with normal color vision have a color blind son, what will be the genotypes of the parents?

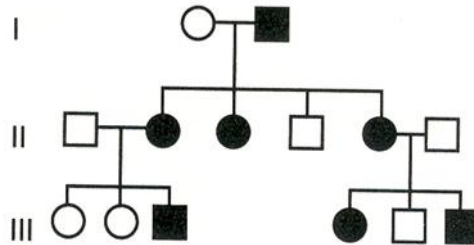
- (A)  $X_cX_c$  and  $X_cY$
- (B)  $XCX_c$  and  $XCY$
- (C)  $X_cX_c$  and  $XCY$

(D) XCXC and XcY

168. A human is phenotypically female, but her interphase somatic nuclei do not display the existence of Barr bodies. Which of the following conditions could explain the above feature?

- (A) Klinefelter syndrome
- (B)  $2n+XXX$
- (C) Turner syndrome.
- (D)  $2n+YY$

169. For the pedigree depicted below, which mode(s) of inheritance CANNOT be possible?



- (A) X-linked dominant
- (B) Autosomal dominant
- (C) X-linked recessive
- (D) Autosomal recessive

170. C banding of human chromosomes specifically reveals

- (A) polymorphism of constitutive heterochromatin of chromosomes 1, 9, 16 and Y
- (B) polymorphism of constitutive heterochromatin of chromosomes 3, 7, 12 and X
- (C) polymorphism of facultative heterochromatin of chromosome X
- (D) satellite sequences

171. Which one of the following expressions is likely to retrieve more matches in a database search?

- (A) D-A-V-I-D
- (B) [DE]-A-V-I-[DE]
- (C) [DE]-[AVILM]-X-E
- (D) D-A-V-E

172. Which substitution matrices should you prefer to find distantly related orthologs through BLAST search?

- (A) BLOSUM 40 and PAM 250
- (B) BLOSUM 82 and PAM 250
- (C) BLOSUM 40 and PAM 120
- (D) BLOSUM 60 and PAM 120

173. Match the items in Group 1 with an appropriate description in Group 2

Group 1

P. UPGMA

Q. CLUSTALW

R. SWISS-PROT

S. RasMol

Group 2

1. Protein sequence database

2. Phylogenetic Analysis

3. 3-D structure visualization

4. Multiple sequence alignment

- (A) P-4, Q-1, R-2, S-3
- (B) P-2, Q-4, R-1, S-3
- (C) P-2, Q-3, R-1, S-4
- (D) P-2, Q-1, R-4, S-3

174. The rate of substitutions in a certain region of DNA of length 1000 bases is estimated as  $10^{-9}$  per base per year. If two species diverged approximately 10 million years ago, the fraction of sites that differ between them should be approximately

- (A) 0.2%
- (B) 2%
- (C) 20%
- (D) 25%

175. When searching the Blocks and PRINTS databases, a match is judged significant if

- (A) a single motif is matched
- (B) two motifs are matched
- (C) the E-value is above  $e^{-4}$
- (D) a combined E-value above a given threshold is reported for a multiple -motif match



176. Two species are found to share a cluster of 8 genes, but the genes are in different orders in the two species. The orders are represented by signed permutations as given below:

Species X 1,2,3,4,5,6,7,8  
Species Y 1, 2,-5,-4,-3,8,6,7

The transformation between the two gene orders

- (A) cannot be achieved by inversions alone.
- (B) can be achieved by one translocation and one inversion.
- (C) can be achieved by three inversions.
- (D) requires six separate genome rearrangement events.

177. As the E value of a BLAST search becomes smaller

- (A) the value K also becomes smaller
- (B) the score tends to be larger
- (C) the probability  $p$  tends to be larger
- (D) the extreme value distribution becomes less skewed

178. In a genome with average GC-content 40%, the expected frequency of occurrence of the tetranucleotide AACG is

- (A) 0.24 %
- (B) 0.36 %
- (C) 0.42 %
- (D) 0

179. Consider that you have collected X-ray diffraction data on three different protein crystals, referred to as Protein A, B and C. Data set for crystal A has the best diffraction spot at 8Å, crystal B at 5Å and crystal C has the best diffraction at 3Å. Which data set is likely to yield a higher resolution crystal structure?

- (A) Protein A
- (B) Protein B
- (C) Crystal C
- (D) All will have same resolution structure

180. In a protein crystallization experiment, you have identified an optimal protein concentration and precipitant concentration which yield crystals. Now if you are asked to grow crystals again with a protein solution that is four times more concentrated, how will you alter the precipitant concentration?

- (A) Increase precipitant concentration
- (B) Decrease precipitant concentration
- (C) Keep the precipitant concentration the same
- (D) Remove the precipitant altogether

181. Which of the following statements is true for two different tripeptides consisting of either glycine or proline?

- (A) Glycine tripeptide will have relatively larger allowed area on the Ramachandran plot.
- (B) Proline tripeptide will have relatively larger allowed area on the Ramachandran plot.
- (C) Both the tripeptides will fall primarily in the disallowed regions of the Ramachandran plot.
- (D) Both the tripeptides will fall primarily in the overlapping allowed regions of the Ramachandran plot.

182. In a Fluorescence Resonance Energy Transfer (FRET) experiment, the donor is Cyan Fluorescent Protein (CFP) which has excitation and emission maxima at 435 and 485 nm, respectively. The acceptor in this experiment is Yellow Fluorescent Protein (YFP) that has excitation and emission maxima at 513 and 545 nm, respectively. Under the conditions, where a significant FRET is observed, what will happen to the FRET signal if the emission maxima of CFP is made to shift to 475nm.

- (A) Increase
- (B) Decrease
- (C) Remains unchanged
- (D) May increase or decrease

183. Consider that the following polypeptides are being analyzed by Mass-spectrometry (MS). These peptides are generated by proteolytic cleavage of a protein that is expressed in mammalian cells and it has undergone glycosylation, phosphorylation and acetylation. What will the expected positioning of the spectra corresponding to these peptides (smaller to larger)?

- (A) Asn-Lys-Ser/Asn-Lys-Thr/ Ser-Lys-Asn/ Thr-Arg-Asn
- (B) Thr-Arg-Asn/ Ser-Lys-Asn/ Asn-Lys-Thr/ Asn-Lys-Ser
- (C) Asn-Lys-Thr/ Asn-Lys-Ser/ Thr-Arg-Asn/ Ser-Lys-Asn
- (D) Ser-Lys-Asn/ Asn-Lys-Thr/ Asn-Lys-Ser/ Thr-Arg-Asn

184. Assuming that the sequence of CDRs of an antibody are heavily enriched with Tyrosine and Serine, what is likely to be the driving force stabilizing its interaction with the antigen?

- (A) Hydrophobic interaction
- (B) Hydrogen bonding
- (C) Van-der Waals interaction
- (D) Covalent interactions

185. Hydrophobic amino acids are prevalent in transmembrane regions of membrane embedded proteins because

- (A) Hydrophobic amino acids destabilize the membrane bilayer and increase membrane fluidity
- (B) Phospholipid tails are hydrophobic and therefore membrane embedded regions can be stabilized through hydrophobic interactions
- (C) The side chains of hydrophobic amino acids interact covalently with phospholipids
- (D) It is just a random occurrence originated from heavy bias of hydrophobic amino acids in protein sequences

186. Bryostatin is an anticancer agent obtained from

- (A) *Tethya crypta*
- (B) *Salinospora tropica*
- (C) *Bugula neritina*
- (D) *Trididemnum solidum*

187. Synthesis of White spot syndrome virus envelop takes place in

- (A) endoplasmic reticulum
- (B) nucleus
- (C) mitochondria
- (D) cytoplasm

188. Primary etiology of Epizootic Ulcerative Syndrome is a Fungus *Aphanomyces invadans*. Its zoospores have the property to

- (A) colonize gill epithelium
- (B) cause ulcerations on skin
- (C) travel long distances and penetrate deep in to the tissue
- (D) cause multiple infections with protozoans

189. Gonad Inhibiting Hormone (GIH) in crustaceans is synthesized in

- (A) Thoracic ganglion
- (B) Sinus gland
- (C) X-organ
- (D) Y-organ

190. The synthetic equivalent of neuro-pharmacologically active peptides obtained from the marine snail *Conus magus* is

- (A) Zinconotide
- (B) Discodermin
- (C) Didemnins
- (D) Dolastatins

191. Viral encephalopathy and retinopathy in fishes are caused by

- (A) Betanodavirus
- (B) Rhabdovirus
- (C) Baculovirus
- (D) Rotavirus

192. A pigment isolated from marine red algae that finds application in flow cytometry is

- (A) Xanthophyll
- (B) Phycoerythrin
- (C) Chlorophyll
- (D) Fluorescamine

193. Which of the following electron acceptor that is used by the bacteria is mainly responsible for marine corrosion?

- A)  $O_2$
- B)  $NO_3^-$
- C)  $SO_4^{2-}$
- D)  $CO_2$

194. Which one of the following bacterial species is responsible for the Scombroid fish poisoning?

- (A) *Aeromonas hydrophila*
- (B) *Photobacterium phosphoreum*
- (C) *Vibrio parahaemolyticus*
- (D) *E. coli*

195. The larval stage of *Macrobrachium rosenbergii* is referred to as

- (A) Nauplii
- (B) Zoea
- (C) Mysis
- (D) Megalopa

196. The group of marine algae which have urea cycle is

- (A) Green algae
- (B) Cyanobacteria
- (C) Diatoms
- (D) Red algae

197. Which of the following algae is responsible for the red color of RED SEA?

- (A) *Trichodesmium erythraeum*
- (B) *Noctiluca scintillans*
- (C) *Karenia brevis*
- (D) *Chaetoceros* sp.

198. An oligotrophic lake has

- (A) High level of nutrients in water
- (B) High aquatic productivity
- (C) Algal blooms
- (D) Low nutrients and low productivity

199. After sodium chloride, which one of the following compounds has the maximum concentration in sea water?

- (A) Magnesium sulphate
- (B) Calcium sulphate
- (C) Magnesium chloride
- (D) Potassium sulphate

200. Which of the following is an example of an intellectual property right?

- (A) A book that you own
- (B) The copyright on a book
- (C) The deed to a plot of land
- (D) An airline ticket

The Biomimics

Q. No.	Key
1	2
2	3
3	2
4	3
5	3
6	2
7	4
8	3
9	3
10	3
11	2 ✓
12	4
13	4
14	3
15	2 ✓
16	1
17	3
18	1
19	2
20	4
21	1
22	1
23	3
24	1
25	3
26	3 ✓
27	1
28	3 ✓
29	3
30	2
31	1 ✓
32	2
33	1
34	3
35	3 ✓
36	4
37	4
38	1
39	3 ✓
40	2

Q. No.	Key
41	3 ✓
42	1 ✓
43	2
44	1 ***
45	4
46	1
47	4
48	4 ✓
49	3
50	4
51	2 ✓
52	1 or 2 **
53	1
54	4 ✓
55	2
56	2
57	1 ✓
58	2
59	3
60	1
61	2 ✓
62	2
63	*
64	3 ✓
65	4
66	3
67	2
68	4 ✓
69	3
70	3
71	3
72	3 or 4 **
73	3
74	1
75	2
76	4
77	1
78	1
79	4
80	2

Q. No.	Key
81	3
82	3
83	4
84	4
85	3
86	4
87	3
88	3 ✓
89	3
90	4
91	4 ✓
92	3 ✓
93	3 ✓
94	4
95	2
96	2
97	3
98	4 ✓
99	2 ✓
100	1
101	2
102	1
103	3
104	1
105	4
106	3
107	2
108	1
109	2 ***
110	2
111	3
112	1 ✓
113	1 ✓
114	1
115	2
116	4 ✓
117	1
118	2
119	1
120	3

Q. No.	Key
121	4
122	1
123	3
124	4
125	1
126	2
127	3✓
128	2
129	4
130	3
131	3
132	2
133	4
134	2✓
135	2
136	4
137	1***
138	2
139	*
140	3
141	4
142	4
143	1
144	2
145	1
146	2✓
147	3
148	1 or 3**
149	3✓
150	2
151	1
152	3
153	3
154	2
155	2
156	2
157	2
158	2
159	1
160	3

Q. No.	Key
161	4
162	3
163	3
164	1
165	1
166	3
167	2✓
168	3
169	3✓
170	1
171	3
172	1
173	2
174	2
175	4
176	1 or 2**
177	2
178	2
179	3
180	2
181	1✓
182	2
183	2
184	2
185	2
186	3
187	2
188	3
189	3
190	1
191	1
192	2
193	3
194	*
195	2***
196	3
197	1
198	4
199	1
200	2

\* Benefit of marks to all those candidates who attempted    \*\*Both options are correct

\*\*\*Option changed

✓ No Change



**BET 2017****Question Paper****Part A**

- For a single substrate reaction, doubling the substrate concentration increases the rate by 10 fold. The order of the reaction is
  - 2
  - 3
  - 4
  - Between 3 and 4
- An enzyme reaction follows Michaelis Menten kinetics. What will be the reaction velocity at a substrate concentration =  $K_m/3$ ?
  - $V_{max}$
  - $V_{max}/3$
  - $V_{max}/2$
  - $V_{max}/4$
- What will be the required volumes of 1N HCl and 4N NaOH to prepare one litre solution of pH 7?
  - 500 ml; 500 ml
  - 800 ml; 200 ml
  - 600 ml; 400 ml
  - 200 ml; 800 ml
- During a batch culture experiment, the following data was obtained

Time (h)	Substrate (g/l)	Cell (g/l)	Product (g/l)
2	40	1	2
8	20	5	7

What will be the product yield (g) per gram of substrate?

- 10
- 0.25
- 0.5
- 2

5. In a bacterial growth experiment, the concentration of cells increased from 10,000 cells/ml to 30,000 cells/ml in 3 h during the exponential growth phase. The doubling time (h) of the bacteria is:
- 2.5
  - 3.0
  - 1.0
  - 1.9
6. A 20mer DNA contains A, G and C only. In how many ways can this DNA sequence be constructed?
- $4^{20}$
  - $20^4$
  - $3^{20}$
  - $20^3$
7. Match the Matrices in Group I with appropriate gradient elution condition from Group II

	Group I		Group II
1	DEAE-Sephacel	P	Isocratic gradient
2	Phenyl-Sepharose	Q	Increasing concentrations of sodium chloride
3	Chromatofocusing	R	Decreasing concentrations of ammonium sulphate
4	Sephadex-G100	S	pH gradient

- 1-Q; 2-R; 3-S; 4-P
  - 1-Q; 2-R; 3-P; 4-S
  - 1-R; 2-Q; 3-P; 4-S
  - 1-S; 2-P; 3-Q; 4-R
8. The activity of Enzyme X (total volume 5.3 ml) is 2.34 micromoles of product formed per min. The total protein content of this solution is 0.8 mg. What is the specific activity?
- 2.93
  - 1.87
  - 18.2
  - 15.5

9. Match the techniques in Group I with applications given in Group II

	Group I		Group II
1	Salting out	P	pI determination
2	Ultracentrifugation	Q	Protein precipitation
3	Dialysis	R	Sedimentation coefficient
4	Isoelectric focusing	S	Removal of low molecular weight impurities

- a. 1-Q; 2-R; 3-S; 4-P
- b. 1-P; 2-R; 3-Q; 4-S
- c. 1-S; 2-P; 3R-; 4-Q
- d. 1-Q; 2-S; 3-R; 4-P

10. What would be the number of protein molecules present in 1.0 mg of protein having a molecular weight of 25 kDa?

- a.  $2.4 \times 10^{15}$
- b.  $2.4 \times 10^{16}$
- c.  $2.4 \times 10^{17}$
- d.  $2.4 \times 10^{18}$

11. Calculate the ionic strength (M) of 50 ml of 0.75 % (w/v) NaCl solution?

- a. 0.128
- b. 0.256
- c. 7.8
- d. 0.064

12. A cell suspension ( $1.5 \times 10^5$  cells per ml) was treated with 1mM  $\text{HgCl}_2$  for 30 min. After treatment, the cell suspension was diluted 10 fold and 100 microliter was plated which gave 5 colonies. Calculate the percentage of cells that survived?

- a. 0.00033
- b. 3.3
- c. 0.033
- d. 0.33

13. Purification data for an enzyme is given below:

Steps	Purification step	Volume (ml)	Total protein (mg)	Total activity (micromoles per min)
I	Cell-free extract	20	100	150
II	Ni-NTA chromatography	4	10	120

What is the fold-purification?

- a. 8
  - b. 13.5
  - c. 10.5
  - d. 18
14. Competent cells prepared in your lab have a transformation efficiency of  $10^8$  cfu/ $\mu$ g of plasmid DNA. These competent cells (100  $\mu$ l) were transformed with 10 ng of plasmid DNA using heat shock method followed by addition of 900  $\mu$ l of LB medium. 100  $\mu$ l of transformed cells were plated on antibiotic containing plates. The number of colonies expected to be on the plate would be:
- a.  $10^5$
  - b.  $10^4$
  - c.  $10^3$
  - d.  $10^2$
15. A disease has a prevalence of 1 in 1000 in the general population. A diagnostic kit for the disease has 10% false positives and no false negative. In a general population, if a person tested with the kit gives a positive result, the probability that he **DOES NOT** have the disease is approximately:
- a. 9%
  - b. 90%
  - c. 99%
  - d. 99.9%
16. From the start point on the runaway to final take off, an aircraft takes 50 seconds. During this period it covers a distance of 1 km. What is the acceleration ( $m/s^2$ ) during take-off?
- a. 0.6
  - b. 0.8
  - c. 1.0
  - d. 1.2

17. A ladder of 5 m length is standing against a wall. The distance between the wall and the base of the ladder is 4 m. If the top of ladder slips down by 0.5 m, the foot of the ladder will shift by:
- 0.25 m
  - 0.33 m
  - 0.5 m
  - 0.6 m
18. A person jogs from his home to the playground at 6 km/h. He walks back from the playground to his home at 4 km/h. What is his average speed (km/h)?
- 4.25
  - 4.8
  - 5
  - 5.25
19. Which one of the following numbers is equal to three times the sum of its digits?
- 15
  - 12
  - 24
  - 27
20. If 5 ml of 20% ethanol is mixed with 25 ml of 80% ethanol, the resulting solution will approximately be:
- 50% ethanol
  - 70% ethanol
  - 100% ethanol
  - 80% ethanol
21. When DNA is extracted from bacterial cells and analyzed for base composition, it is found that 38% of bases are Cytosine (C). What percentage of bases is Adenine (A)?
- 12
  - 24
  - 38
  - 62

22. Equal volumes of cell suspensions of *Escherichia coli*, *Saccharomyces cerevisiae*, *Streptococcus lactis* and *Mycoplasma pneumoniae*, all have the same  $OD_{600nm} = 0.50$ . Which cell suspension would have the minimum and maximum number of cells, respectively?

- a. *Saccharomyces cerevisiae* and *Mycoplasma pneumoniae*
- b. *Saccharomyces cerevisiae* and *Streptococcus lactis*
- c. *Escherichia coli* and *Mycoplasma pneumoniae*
- d. *Mycoplasma pneumoniae* and *Streptococcus lactis*

23. A bag contains 4 red, 5 green and 7 yellow balls. If 2 balls are picked simultaneously in a random manner from the bag, the probability of both being green is:

- a. 1/16
- b. 1/8
- c. 1/12
- d. 5/16

24. The spectroscopic method for detection of functional groups is:

- a. CD spectroscopy
- b. FTIR spectroscopy
- c. ESR spectroscopy
- d. UV-VISIBLE spectroscopy

25. Match the native microbial sources in Group I with the products in Group II

Group I

M. *Leuconostoc mesenteroides*

N. *Lactococcus lactis*

O. *Brevibacterium brevis*

P. *Penicillium roqueforti*

Group II

1. Lysine

2. Cheese

3. Dextran

4. Nisin

- a. M-2. N-1. O-4. P-3.
- b. M-1. N-2. O-3. P-4.
- c. M-3. N-4. O-1. P- 2.
- d. M-4. N-3. O-2. P-1.

26. Match the enzyme in Group I with the application/function in Group II

Group I

- M. Pectinase
- N. Papain
- O. Glucose isomerase
- P.  $\beta$ - Galactosidase

Group II

- 1. Lactose free milk products
- 2. High Fructose Corn Syrup
- 3. Juice Clarification
- 4. Meat tenderisation

- a. M-4. N-3. O-2. P-1.
- b. M-3. N-4. O-2. P-1.
- c. M-1. N-2. O-4. P- 3.
- d. M-2. N-1. O-3. P-4.

27. Histone code implies which of the following?

- a. Combination of different histone proteins to form a nucleosome.
- b. Modification of histones.
- c. Different histone proteins present in different eukaryotic organisms.
- d. Different order of histone proteins in a given nucleosome.

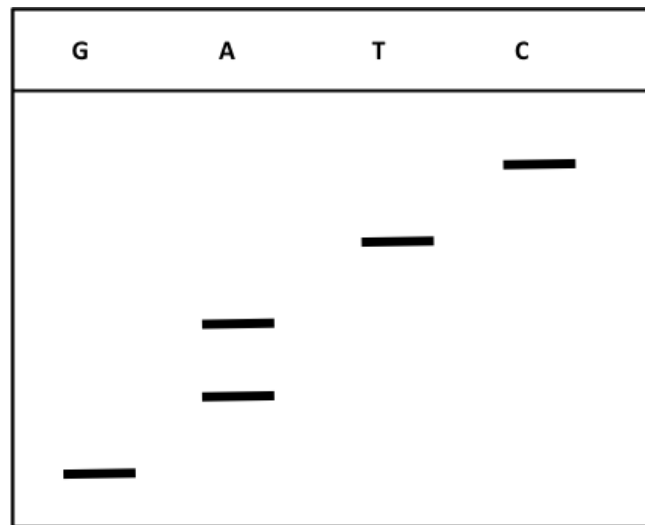
28. The  $A_{260}$  of a plasmid solution after 100-fold dilution is 0.2. Given that  $A_{260}$  of 1.0 represents 50  $\mu\text{g/ml}$  of DNA and the total volume of isolated plasmid solution is 50  $\mu\text{l}$ , what will be the concentration and amount respectively of the isolated plasmid?

- a. 1.0  $\mu\text{g}/\mu\text{l}$  and 50  $\mu\text{g}$
- b. 1.0  $\text{mg}/\mu\text{l}$  and 50  $\text{mg}$
- c. 10  $\mu\text{g}/\mu\text{l}$  and 50  $\mu\text{g}$
- d. 10  $\text{mg}/\mu\text{l}$  and 50  $\text{mg}$

29. A gene was cloned into a unique *Hind*III restriction site present in the ampicillin resistance gene of a vector that contains both ampicillin and kanamycin resistance genes. To select for only recombinant clones, the transformation mixture should be plated on which of the following plates?

- a. Ampicillin containing plate
- b. Ampicillin plus Kanamycin containing plate
- c. Ampicillin containing plate followed by replica-plating on kanamycin containing plate
- d. Kanamycin containing plate followed by replica-plating on ampicillin containing plate

30. A student sequenced a DNA using Sanger's method and obtained the following autoradiogram.



The sequence of DNA is:

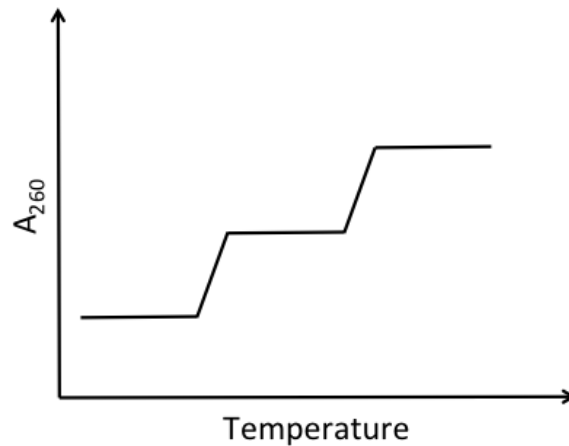
- a. 5' CTTAG 3'
- b. 5' GAATC 3'
- c. 5' CTAAG 3'
- d. 5' AATTG 3'

31. From among the options given below, RNA polymerase II transcribes which one of the following?

- a. rRNA
- b. tRNA
- c. MicroRNA
- d. None of the given options



32. The melting curve of a DNA solution is represented below.



It suggests that:

- The given DNA has one stretch with a biased base composition
- The given DNA has two stretches with a biased base composition
- The given DNA has three stretches with a biased base composition
- The given DNA has an unbiased base composition

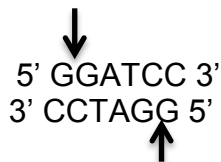
33. The DNA binding domain of a transcription factor that is specifically required for the regulation of gene A is exchanged with the DNA binding domain of another transcription factor that is required specifically for the regulation of gene B. This chimeric transcription factor will regulate:

- Gene A only
- Gene B only
- Both Gene A and B
- Neither Gene A nor Gene B

34. Protein synthesis in eukaryotic cells terminates at the stop codon because:

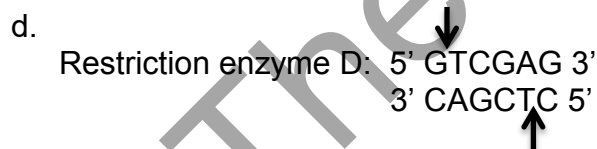
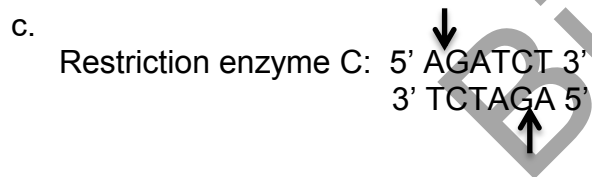
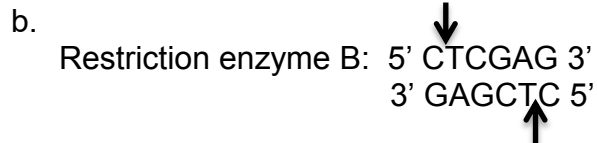
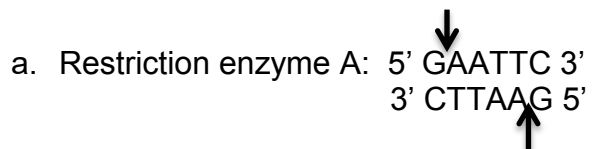
- mRNA synthesis stops at the stop codon.
- The tRNA corresponding to the stop codon cannot bind to an amino acid.
- There is no naturally occurring tRNA with an anticodon corresponding to the stop codon.
- The conformation around stop codons prevents binding of aminoacyl tRNA.

35. A DNA fragment was digested with a restriction enzyme X with the recognition sequence



that would cleave at the position of the arrow as shown. You want to clone this fragment in a vector which does not contain the restriction site for X. Which one of the following enzymes will you use to digest the vector?

The sequence of the restriction site and position of cleavage for each enzyme is shown below:



36. Which one of the following is **NOT** important for regulation of the tryptophan operon by attenuation?

- Presence of two adjacent codons for tryptophan in the leader peptide sequence
- Coupled transcription-translation
- Concentration of tRNA charged with tryptophan
- The operator sequence of tryptophan operon

37. A plasmid DNA when digested with *EcoRI* gave a single band of 16 Kb. When the same plasmid was digested with *BamHI* it gave two bands of 6Kb and 4 Kb. The plasmid has:
- Single site of *EcoRI* and 2 sites of *BamHI*
  - Single site of *EcoRI* and 3 sites of *BamHI*
  - Single site of *EcoRI* and 2 sites of *BamHI*
  - 2 sites of *EcoRI* and 2 sites of *BamHI*
38. Myeloma cells fused with spleen cells in hybridoma technology are:
- Immortal and antibody producing cells
  - Mortal and antibody producing cells
  - Hypoxanthine guanine phosphoribosyl transferase lacking cells
  - Thymidine kinase lacking cells
39. Enzyme inactivation by suicide inhibitors should be:
- allosteric-site directed
  - active-site directed
  - regulatory-site directed
  - both allosteric and regulatory-site directed
40. Resolution in adsorption chromatography is achieved at:
- Elution stage only
  - Binding stage only
  - Equilibration stage only
  - Both binding and elution stage
41. Protein kinases phosphorylate proteins at hydroxyl groups on amino acid side chains. Which one of the following groups of amino acids contain side chain hydroxyl groups?
- Aspartate, glutamate and serine
  - Serine, threonine and tyrosine
  - Lysine, arginine and proline
  - Threonine, phenylalanine and arginine
42. In a segment of a transcribed gene, the non-template strand of DNA has the following sequence 5'..AGCTCACTG..3'. What will be the corresponding 5' to 3' sequence in the RNA produced from this segment of the gene?
- CAGUGAGCU
  - AGCUCACUG
  - CAGTGAGCT
  - UCGAUGAC

43. If the DNA content of a diploid cell in the G1 phase of the cell cycle is X, then the DNA content of the same cell at metaphase of meiosis I would be:

- a. 2X
- b. 4X
- c. 0.5X
- d. X

44. The  $\alpha$ -helix in a protein is primarily due to:

- a. Intramolecular hydrogen bond
- b. Intermolecular hydrogen bond
- c. van der Waals interaction between amino acids
- d. covalent interactions

45. Amino acids with asymmetric  $C_{\beta}$  atoms are:

- a. Pro, Met
- b. Lys, Ile, Val
- c. Thr, Ile
- d. Cys, Ser, Met

46. The strength of the hydrogen bond represented by D-H...A (where D is the donor atom, H is the hydrogen atom and A is the acceptor atom) depends on

- a. the D-H bond length and the nature of the D and A atoms.
- b. the nature of the D and A atoms and the D...A distance.
- c. the D...A distance and linearity of the angle DHA.
- d. the H...A distance, linearity of the angle DHA and the nature of the atoms D & A.

47. The van der Waals energy of a single water molecule is:

- a. 0
- b. -0.2 Kcal/mol
- c. -0.5 Kcal/mol
- d. 0.2 Kcal/mol

48. What is the minimum number of edges that meet at every branch node in a phylogenetic tree?
- 1
  - 2
  - 3
  - 4
49. According to the Induced-fit theory, an agonist is defined as:
- A compound which produces an exothermic effect
  - A compound which occupies the receptor for a longer period
  - A compound that induces a specific conformational change in the macromolecule
  - A compound which hits the receptor center more often.
50. A recombinant protein is found to be expressed very poorly in *E.coli*. It is hypothesized that the expression is blocked at the translational step. The first experimental technique to test this is:
- PCR followed by sequencing
  - Quantitative RT PCR
  - Western Blot
  - EMSA

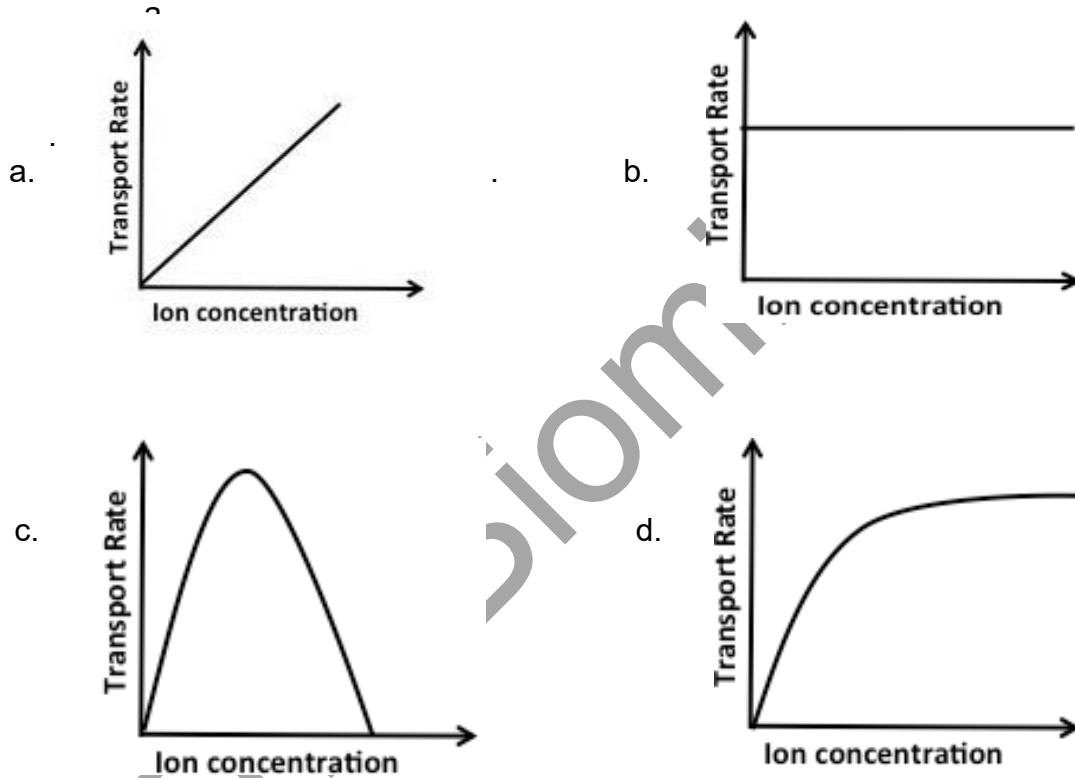
**Part B**

51. There are 3 genes A, B and C that are functionally related. There is a point mutation in gene A due to which gene B is not expressed resulting in a non-functional gene C product. What is the possible relationship between these 3 genes?
- A is an enzyme, B and C are substrates of A
  - A is transcription factor for B and B is needed for C to be functional.
  - B is transcription factor for C and A
  - C is enzyme that requires A and B as its substrate
52. Detectable serum antibody against a T-independent pathogen is a good indication that:
- A functional B-cell system exists
  - A functional T-cell system exists
  - The patient has immune suppression
  - Both T and B cell systems are not functional
53. If a 1000 kb fragment of DNA has 10 evenly spaced and symmetric replication origins and DNA polymerase moves at 1 kb per minute, how many minutes will it take to produce two daughter molecules ignoring the potential problem at the end of the linear piece of DNA? Assume that the 10 origins are evenly spaced from each other, none starting from the ends of the chromosome.
- 20
  - 30
  - 50
  - 100
54. In an experiment, 4 different N-terminal blocked purified proteins were treated with glutaraldehyde, individually. One of the proteins did not get modified. What may be the reason?
- The protein lacks histidine
  - The protein lacks phenylalanine
  - The protein lacks lysine
  - The protein lacks arginine

55. Which of the following signatures (the stretch of amino acids) in a protein will target it to the nucleus?
- Arg-Glu-Glu-Trp-Glu-Cys
  - Arg-Lys-Lys-Lys-Arg-Lys
  - Trp-Phe-Phe-Phe-Phe-Gly
  - Phe-Pro-Pro-Arg-Tyr-Tyr
56. Which one of the following rearrangements is **NOT** permitted during somatic recombination in the heavy chain and light chain immunoglobulin loci?
- $D_H:J_H$
  - $V_L:J_L$
  - $V_H:J_H$
  - $V_H:D_H$
57. Junctional diversity in CDR3 during gene rearrangement results from the addition of:
- Switch region nucleotides
  - P and N nucleotides
  - V, D and J nucleotides
  - Recombination signal sequences
58. The function of negative selection of thymocytes in the thymus is to eliminate:
- Single-positive thymocytes
  - Double-positive thymocytes
  - Alloreactive thymocytes
  - Autoreactive thymocytes
59. Antigen recognition by T cells in the absence of co-stimulation results in:
- Upregulation of B7.1
  - T-cell apoptosis
  - T-cell anergy
  - Upregulation of B7.2

60. Mutation of homeotic genes often result in which one of the following developmental defects in *Drosophila*?
- Absence of a group of contiguous segments
  - Transformation of one segment to another
  - Tumor formation in imaginal discs
  - Absence of every other segment along the antero-posterior axis

61. Which one of the following graphs represent the kinetics of ion transport through a membrane channel?



62. Transition type of gene mutation is caused when

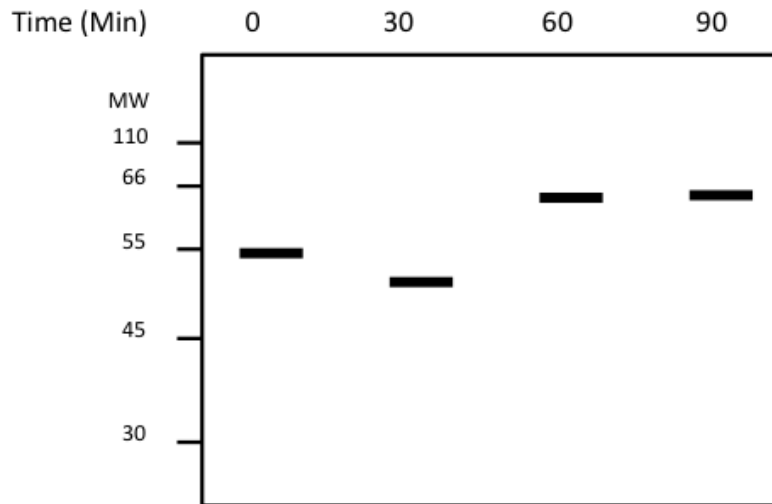
- GC is replaced by TA
- CG is replaced by GC
- AT is replaced by CG
- AT is replaced by GC



63. Which one of the following is **NOT** enriched in eukaryotic promoters located in active chromatin?
- Acetylated histones
  - DNAse I hypersensitive sites
  - Methylated cytosine
  - Bound TFIID
64. One of the reasons why non-substrate inducers (e.g. IPTG) are preferred over substrate inducers (e.g. lactose) for induction of an inducible operon is because:
- They directly interact with the promoter sequences
  - They directly interact with the repressor
  - They directly interact with operator region
  - They interact with the activation sequences and induce enhancers
65. In humans, the enzyme having reverse transcriptase activity is:
- Ribonuclease P
  - Ribonuclease D
  - Recombinase
  - Telomerase
66. To prepare a DNA probe of high specific activity for detecting a single copy gene in a Zoo-blot experiment, which one of the following procedures would be preferred?
- 5' end labelling
  - 3' end labelling
  - In vitro transcription
  - Random primer labelling
67. The function performed in the smooth ER is:
- Biosynthesis of secretory proteins
  - Folding of membrane proteins
  - Addition of N-linked sugars
  - Detoxification of drugs
68. In human carcinomas, many proteins including most cytoskeletal proteins undergo modifications, thereby making it difficult for a clinician to identify the origin of the cancer cells. In this context, which one of the following can be relied upon for identification of the origin of cancer cells?
- microtubules

- b. F-actin
  - c. G-actin
  - d. Intermediate filament
69. Most organisms can regulate membrane fluidity by changing the lipid composition. If cells are transferred from a warm environment to a cold one, it can be expected that:
- a. There will be a decrease in the proportion of 16-carbon fatty acids compared to 18-carbon fatty acids
  - b. There will be an increase in the proportion of 16-carbon fatty acids compared to 18-carbon fatty acids
  - c. There will be an increase in the proportion of saturated fatty acids
  - d. Phospholipids will not be incorporated into the membrane
70. Glycosylation of membrane proteins and lipids is carried out by enzymes present in the lumen of endoplasmic reticulum and Golgi. The glycosylated part of membrane proteins and lipids in the plasma membrane is likely to be:
- a. Oriented towards the cytosol
  - b. Exposed to the extracellular environment
  - c. The glycosylated parts of the proteins are towards the cytoplasm but glycosylated lipids are exposed to the extracellular environment
  - d. The glycosylated parts of the lipids are towards the cytoplasm but glycosylated proteins are exposed to the extracellular environment
71. Lysosomal storage diseases are a group of inherited diseases that are characterized by the accumulation of specific substances or class of substances within the lysosomes. All of the following mechanisms can cause lysosomal storage disease **EXCEPT**:
- a. Defects in the enzyme N-acetylglucosamine phosphotransferase
  - b. Defective or missing acid hydrolases
  - c. Defects in the transport of lysosomal enzymes to the cell surface
  - d. Defects in the transport proteins that transport proteins from Golgi to lysosomes
72. The gene encoding an enzyme A that functions in a metabolic pathway for conversion of metabolite 'x' to 'y' was knocked out but it still resulted in the formation of metabolite 'y'. From this it can be concluded that:
- a. Enzyme A is necessary but not sufficient for formation of 'y'
  - b. Enzyme A is sufficient but not necessary for formation of 'y'
  - c. Enzyme A is neither necessary nor sufficient for formation of 'y'
  - d. Enzyme A is both necessary and sufficient for formation of 'y'

73. The following figure shows the electrophoretic migration of a secretory protein in SDS-PAGE from the time of its synthesis (0 min) to its secretion (90 min) from the cells.



Assuming that there was no problem in sample preparation and SDS-PAGE, the reason for a lower band at 30 min and a higher band at 60 and 90 min compared to that at 0 min could be due to:

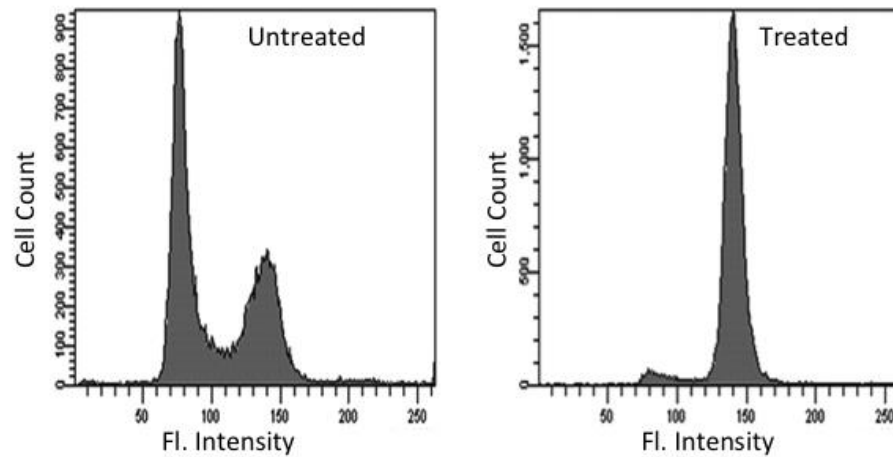
- Changes in the rate of protein synthesis at various time points
  - The protein was associated with other proteins at different time points resulting in change in its migration
  - The protein underwent processing and posttranslational modifications as a function of time
  - Small changes observed in the migration of the protein do not give enough information to derive a meaningful conclusion
74. Four yeast mutants block membrane and secretory proteins in following compartments:

Mutant A: Golgi  
 Mutant B: Endoplasmic reticulum  
 Mutant C: Cytosol  
 Mutant D: Secretory vesicles

If two new mutants are made that have combined defects of A+C and B+D, proteins of the new mutants will accumulate in:

- Golgi and ER, respectively
- Golgi and secretory vesicle, respectively
- Cytosol and ER, respectively
- Cytosol in both cases

75. Asynchronous animal cells were stained with a fluorescent DNA binding dye and analyzed by flow cytometry. The histogram of cell count versus fluorescence intensity is shown below with or without treatment.



It can be concluded from the histogram that:

- The treatment inhibits the cells from entering the S-phase
  - The treatment increases the proportion of G1 phase
  - The treatment increases the proportion of G2/M phase
  - The treatment increases the proportion of S phase
76. Which one of the following eIF2 $\alpha$  kinases get activated during unfolded protein response (UPR) in mammalian cells?
- PKR
  - GCN<sub>2</sub>
  - PERK
  - HRI
77. *E. coli* RNA polymerase has six subunits two  $\alpha$ , one  $\beta$ , one  $\beta'$ , one  $\omega$  and one  $\sigma$ . Which among these subunits imparts specificity of transcription of a gene and how?
- $\omega$ , by binding to -10 sequence
  - $\sigma$ , by binding to both -10 and -35 sequences
  - $\beta$ , by binding to -10 sequence
  - Both  $\sigma$  and  $\omega$ , by binding to -10 and -35 sequences

78. The use of guide RNA to bind to DNA and target the double strand break at a specific site is a feature of:
- Gene knockout by homologous recombination
  - Gene knock down by RNAi
  - Genome editing by CRISPR/Cas system
  - Gene silencing by siRNA
79. Epidermolysis bullosa simplex (EBS) disease is caused by a mutation in which one of the following genes?
- $\beta$ -tubulin
  - Keratin
  - Collagen
  - Tau
80. The genes that have been used for reprogramming somatic cells of an adult mammal to stem cells called induced pluripotent stem cells (iPSC) are KLF4, SOX2, OCT4 and c-MYC. These code for:
- Transcription factors
  - Both transcription factors and RNA binding proteins
  - Chaperone proteins
  - Growth factors
81. Following fertilization, zygote divides rapidly to form a large number of cells within a short time through a process called cleavage. In some organisms like sea urchin the cells of the early embryos skip some stages of cell cycle in order to achieve this. Which of the following steps may be skipped?
- $G_1$
  - $G_1$  and  $G_2$
  - S
  - $G_0$
82. Cell cycle regulatory genes (cdc) were originally discovered by Paul Nurse in yeasts using genetic approach involving temperature sensitive mutant screening. Which of the following was used to identify cdc?
- Genome sequencing
  - cDNA complementation assay
  - RNAi method
  - Homologous recombination
83. Bindin is a protein that is expressed in the tip of sperm head (acrosome) and is important for sperm-egg interaction. Its distribution pattern changes during sperm maturation. Which one of the following methods may be used to monitor the expression pattern of bindin in a simple light microscope?

- a. Phase contrast microscopy
  - b. Normarski-contrast microscopy
  - c. Immuno cytochemistry
  - d. Immunofluorescence
84. Which of the following mechanisms converts c-erbB (EGFR) to an oncogene?
- a. Point mutation
  - b. Truncation
  - c. Recombination
  - d. Gene amplification
85. Midblastula transition (MBT) is a characteristic process that occurs in early embryogenesis of organisms (like Amphibians) whose eggs are large. MBT refers to:
- a. Transition of structures from early embryonic to late embryonic
  - b. Transition of gene expression from maternal to zygotic
  - c. Regulation of transition of primordial germ cells to Gonadal structure
  - d. Epigenetic modification of gene regulation
86. Introns which are self-splicing and do not require any cofactor for their splicing, are present in the primary transcripts of:
- a. miRNA
  - b. Nuclear mRNA
  - c. tRNA
  - d. Mitochondrial mRNA
87. The phenomenon of transfer of traits from a man to his grandson through his daughter is known as:
- a. Sex influenced inheritance
  - b. Criss-cross inheritance
  - c. Y-linked inheritance
  - d. Sex-limited inheritance
88. If the doubling time of a prokaryotic cell becomes progressively shorter, then it can be predicted that the ribosome concentration will:
- a. remain constant
  - b. decrease
  - c. increase
  - d. remain constant but their composition will be different

89. How many DNA molecules of 6 base pairs length are possible where the first base is a purine and the last base is a pyrimidine?
- 32
  - 256
  - 4096
  - 1024
90. A recombinant protein is expressed in *E. coli* under T7 promoter at 37°C. However no biological activity is obtained in the cell lysate. If the same experiment is carried out at 25°C, the cell lysate shows a reasonable biological activity. The most probable explanation for this is:
- lower temperature increases recombinant protein stability
  - lower temperature increases rate of production of recombinant protein
  - IPTG used for induction does not get degraded
  - recombinant protein is properly folded at low temperature
91. IPTG is used as an inducer in the T7 expression system for recombinant protein expression in *E.coli*. This is because of:
- availability of special *E.coli* cells which have the T7 RNA polymerase gene integrated into their genome under a regulatable promoter
  - T7 promoter is recognized by *E.coli* RNA polymerase
  - High copy number of plasmid allows sequestration of *E.coli* RNA polymerase by T7 promoter
  - IPTG facilitates binding of *E.coli* RNA polymerase to the T7 promoter.
92. Pyrosequencing derives its name from the fact that:
- the bases are detected by pyrolysis
  - it detects pyrophosphate released during base incorporation
  - it uses apyrase to detect the bases
  - it generates a pyrogram as an output
93. Which of the following is a reason that geneticists use mtDNA to study the relatedness of animal populations?
- mtDNA mutates at a slower rate than nuclear DNA
  - mtDNA transmitted from mother to child, is free from recombination
  - All mitochondrial proteins are coded by mitochondrial genes
  - There are only a few single nucleotide polymorphisms in the mtDNA
94. Lyophilization is a method used for preservation of microbes because:
- moisture is removed by sublimation
  - moisture is removed by very slow evaporation
  - ice crystals formed at low temperature improves cell viability
  - removal of air during lyophilization prevents formation of free radicals

95. Stoichiometric matrices in metabolic pathways are used in:

- a. Gene regulatory network analysis
- b. Measuring robustness of a system
- c. Flux Balance Analysis
- d. Analysis of phenotypic characters from genome.

96. The main difference between domain and motif in protein structure is:

- a. Domain can remain stable, independent of the rest of the protein while motif cannot.
- b. Domain cannot remain stable, independent of the rest of the protein while motif can.
- c. Domain can be predicted but motif cannot be predicted.
- d. Both are synonyms and there is no difference

97. Select the best algorithm to do pairwise alignment when two proteins are very different in length.

- a. Smith-Waterman
- b. Needleman-Wunsch
- c. dot-matrix
- d. ClustalW

98. From literature it is known that the length of an *E. coli* bacterium is 1  $\mu\text{m}$  with a standard deviation of 0.1  $\mu\text{m}$ . After treatment with chemical "X" the mean length of 100 cells is 1.1  $\mu\text{m}$  with a standard deviation of 0.1  $\mu\text{m}$ . What will you conclude from this experiment?

- a. Treatment with chemical "X" has increased the length with a statistical confidence of more than 99%
- b. The length has increased with statistical confidence of 67%
- c. Length has not increased and the observed difference is due to statistical error
- d. Length increased can be claimed with 95% statistical confidence.

99. Which one of the following techniques **CANNOT** be used to remove salt from a protein solution

- a. Ultrafiltration
- b. Ion exchange chromatography
- c. Gel filtration chromatography
- d. Dialysis

100. The jelly roll in protein structure is:

- a. made of eight alpha helices
- b. made of four alpha/beta motifs
- c. made of seven hydrophobic strands and an amphipathic helix
- d. formed from eight beta strands



101. Which one of the following is **NOT** a structure or structurally derived database?

- a. PDB
- b. PROSITE
- c. SCOP
- d. CATH

102. Which of the following is **TRUE**?

In the threading approaches for prediction of protein structure, the optimization is used for:

- a. Sequence to sequence alignment
- b. Generation of profile by converting three-dimensional structure to one-dimensional string
- c. Alignment of sequence to structure which minimizes energy of the target sequence in the template fold
- d. Alignment of target sequence to one-dimensional profile of a template fold

103. The statistical significance of the BLAST hit is obtained using:

- a. extreme value distribution
- b. normal distribution
- c. Poisson distribution
- d. random distribution

104. What is referred by the term  $k$  in the following energy expression  $E = \frac{1}{2} k (b - b_0)^2$  where  $b$  and  $b_0$  refer to the bond length and reference bond length respectively?

- a. van der Waals radius
- b. stretching constant for bond length variation
- c. torsional potential
- d. kinetic energy of an atom

105. The estimates of number of false positives from a BLAST search can be made using:

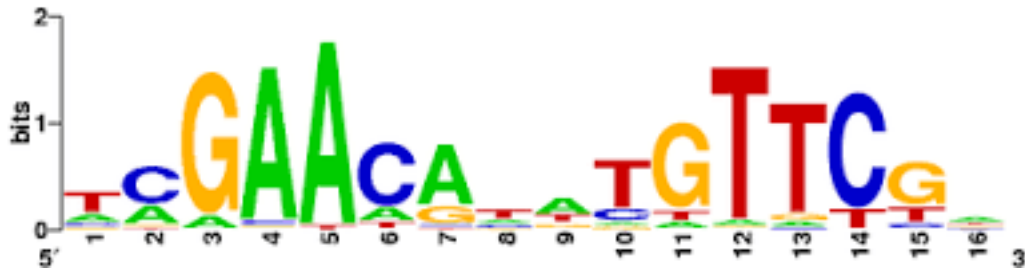
- a. Percent positives
- b. Percent identity
- c. E value
- d. Bit score

106. The length of Beta Hairpin motif is usually:

- a. 2 to 7 residues
- b. 12 to 15 residues
- c. 22 to 25 residues
- d. 6 to 10 residues

107. A scoring function is used in which one of the following drug design technologies?
- QSAR
  - Molecular docking
  - Molecular dynamics
  - Pharmacophore mapping
108. BLOSUM matrices are based on:
- mutations observed throughout a global alignment
  - highly conserved regions in a series of alignments forbidden to contain gaps
  - explicit evolutionary model
  - alignment of same sequences containing highly mutable regions
109. ProDom is a comprehensive set of protein domain families automatically generated from:
- Pfam
  - UniProt Knowledge Database
  - Swiss-prot
  - InterPro
110. Which one of the following methods used to find evolutionary trees is also referred as “the minimum evolution method”?
- Distance Method
  - Maximum Parsimony Method
  - Fitch and Margoliash Method
  - UPGMA Method
111. Z-score =
- $(\text{score of alignment} - \text{mean}) / \sqrt{(\text{standard deviation})}$
  - $(\text{variance} - \text{score of alignment}) / \text{standard deviation}$
  - $(\text{mean} - \text{score of alignment}) / \text{standard deviation}$
  - $(\text{score of alignment} - \text{mean}) / \text{standard deviation}$

112. In a *sequence logo* of the type given below, the sizes of the letters are proportional to the:



- number of residues in the sequences
  - information content of the respective residues
  - frequencies of the respective residues in the sequences
  - resolution of the output device (terminal/printer)
113. For a homology search program such as BLAST, which one of the following best describes the scoring pattern?
- identical residue = 10 pts, conservative substitution = 5 pts, gap = 0 pts
  - identical residue = 10 pts, conservative substitution = 1 to 9 pts, gap = -3 pts
  - identical residue = 10 pts, conservative substitution = 1 to 9 pts, gap = 0 pts
  - identical residue = 10 pts, conservative substitution = 10 pts, gap = -3 pts
114. Given the results of a 'sequence versus fingerprint' search, which of the following would be considered the best hit?
- Motifs: 7 of 7 p-value:  $2.2 \times 10^{-8}$  & e-value:  $4.5 \times 10^{-5}$
  - Motifs: 8 of 8 p-value:  $2.2 \times 10^{-8}$  & e-value:  $4.5 \times 10^{-5}$
  - Motifs: 8 of 8 p-value:  $2.2 \times 10^{-18}$  & e-value:  $4.5 \times 10^{-15}$
  - Motifs: 7 of 8 p-value:  $2.2 \times 10^{-18}$  & e-value:  $4.5 \times 10^{-15}$
115. In a Multi-Locus Variable number tandem repeat Analysis (MLVA) for *Salmonella enterica* subspecies, three tandem repeats loci have been identified inside *yohM* gene of *S. typhimurium* LT2, *S. typhi* CT18 and *S. typhi* Ty2 strains. Motif lengths for the loci are 2, 3 and 5 respectively. Motif AT and ATG are found to be repeated by 13 and 5 times respectively in all the strains. Motif ATGTC is repeated 13 times in *S. typhimurium* LT2, 15 times *S. typhi* CT18 and 12 times *S. typhi* Ty2 strains. Which locus is Variable Number Tandem Repeat (VNTR)?
- AT
  - ATG
  - ATGTC
  - GTCA

116. Of a population of cells undergoing meiosis, 1% of the cells undergo recombination between genes *A* and *B*. What is the distance between the two genes?
- 0.25 cM
  - 0.75 cM
  - 0.50 cM
  - 1.00 cM
117. Which one of the following combinations of marker genes and promoters **CANNOT** be used for selection of transgenic plants under *in vitro* conditions?
- positive selection marker genes under the *Agrobacterium*-derived NOS promoter
  - conditional negative selection marker genes under an inducible promoter
  - positive selection marker genes under CaMV 35S promoter
  - non-conditional negative selection marker genes under CaMV 35S promoter
118. Several experiments have shown leaky/deregulated expression of reporter genes viz., *GUS* from plant promoters in *Agrobacterium* cells. Which one of the following approaches would be most useful in restricting transgene expression in transformed plant cells and prevent their expression in *Agrobacterium*?
- Use of weak promoters to express the transgene
  - Use of 5' and 3' UTRs flanking the transgene
  - Avoiding use of the polyA signal
  - Use of intron(s) within the transgene sequence
119. A  $T_0$  transgenic plant showing two copies of T-DNA on Southern analysis, segregated in a 3:1 ratio for the transgenic:non-transgenic phenotype among  $T_1$  progeny obtained by self-pollination. Which one of the following statements best explains this observation?
- The  $T_0$  plant contains a single copy of the transgene.
  - The  $T_0$  plant contains two linked copies of the transgene.
  - The  $T_0$  plant contains two unlinked copies of the transgene.
  - The  $T_0$  plant contains at least three copies of the transgene.
120. Which one of the following statements is correct?
- All the virulence genes of *Agrobacterium tumefaciens* are expressed in a constitutive manner.
  - Opines are a source of iron for *Agrobacterium* cells.
  - One *Agrobacterium* cell can generate only one T-DNA molecule for transfer into the host cell.
  - Integration of T-DNA in the genome can mutate or modulate endogenous plant genes.

121. Which one of the following statements related to transgene silencing in plants is **INCORRECT**?
- Transgene silencing is usually accompanied by methylation of cytosine residues in 'CG' and/or 'CNG' sites.
  - Events with multi-copy integrations of the T-DNA are more susceptible to transgene silencing.
  - Transgene silencing always occurs in T<sub>0</sub> individuals and never in subsequent generations.
  - Transgene silencing may lead to silencing of endogenous plant gene homologs.
122. Two independent transgenic plants, one with single copy of gene A and another with single copy of gene B were expressed under the same seed-specific promoter. In transgenic plants, seed formation on self-pollination was similar to that of untransformed plants. When homozygous plants with gene A (male parent) were crossed with homozygous plants with gene B (female parent), viable seed formation did not occur although, pollen production was normal. What could be the possible reason for this observation?
- Product of gene A is lethal to the male gametophyte.
  - Interaction between products of genes A and B is lethal to the zygote.
  - Interaction between products of genes A and B is lethal to the male gametophyte.
  - Product of gene B is lethal to the zygote.
123. The range of transformation frequencies obtained in independent transformation experiments using four different constructs with different combinations of promoters (Pr) and selection marker genes, is given below:

Construct	Transformation frequency
CaMV35S Pr – <i>bar</i> – nos polyA	20% – 35%
Nos Pr – <i>bar</i> – nos polyA	2% – 4%
CaMV35S Pr – <i>NPTII</i> – nos polyA	46% – 49%
Nos Pr – <i>NPTII</i> – nos polyA	24% – 28%

In the absence of any other factors, which one of the following statements is **NOT** acceptable as a logical conclusion based on the above data?

- Use of stronger promoters for expression of selection marker genes can increase transformation frequencies.
- Variations in expression levels between the *NPTII* and *bar* genes is not influenced by the nos poly A signal.
- Production of herbicide resistant plants at high frequency can be achieved with lower expression levels of the transgene.
- Use of kanamycin as a selection marker appears to be more favorable for production of larger number of transgenic plants.

124. Callus-mediated regeneration is **NOT** preferred for micropropagation because:
- it takes longer time for regeneration.
  - plant regeneration is problematic due to poor organogenesis
  - it leads to generation of variants
  - hardening of plants is difficult to achieve.
125. In a transgenic plant, the phenomenon of Co-suppression is due to:
- transgene integration within the endogenous gene
  - transgene integration at a locus very close to the endogenous gene
  - similarity between the transgene and endogenous gene sequences
  - lack of similarity between the transgene and endogenous gene sequences
126. In inbred lines, gene and genotypic frequencies are maintained by growing them in isolation followed by:
- self-pollination
  - self-pollination and selection
  - pair-wise crossing
  - random mating without selection
127. Homozygous plants from bi-parental mating for development of mapping populations can be obtained in a short time by:
- development of RILs
  - development of doubled haploids
  - random mating in F<sub>2</sub> followed by selfing in subsequent generations
  - chromosome elimination technique
128. Which one of the following is **NOT** required for QTL analysis in association mapping?
- Phenotypic data from multi-location trials
  - Polymorphic markers
  - Genetic linkage map
  - Diverse germplasm lines
129. Which one of the following hormones promote production of seedless grapes?
- IAA
  - IBA
  - BAP
  - GA<sub>3</sub>

130. Which one of the following molecular markers is associated with bacterial blight resistance in rice?

- a. PiB
- b. Rar
- c. Xa21
- d. Pi9

131. Match the proteins in Group I with members in Group II

	Group I		Group II
1	Alkaline phosphatase	P	Extracellular
2	F <sub>o</sub> component of ATP synthase	Q	Cytoplasm
3	Alcohol dehydrogenase	R	Inner membrane
4	Pectinase	S	Periplasm

- a. 1-S; 2-R; 3-Q; 4-P
- b. 1-P; 2-R; 3-Q; 4-S
- c. 1-R; 2-S; 3-P; 4-Q
- d. 1-Q; 2-P; 3-S; 4-R

132. Application of the herbicide, phosphinothricin, results in death of plants due to accumulation of:

- a. CO<sub>2</sub>
- b. NH<sub>3</sub>
- c. CN
- d. Cl<sub>2</sub>

133. Which one of the following is **NOT** a feature of *Agrobacterium* VirE protein?

- a. Its synthesis is induced by VirG protein
- b. It contains a nuclear localization signal
- c. It protects T-DNA from being destroyed by plant defense mechanism
- d. It is a component of T-pilus

134. Transgenic potato plants with high amylose starch were developed by:

- a. suppression of starch branching enzymes
- b. over-expression of starch branching enzymes
- c. over-expression of ADP-glucose pyrophosphorylase
- d. suppression of granule-bound starch synthase

135. Developing cisgenic disease resistant apple is advantageous over conventional breeding because:
- genes cannot be transferred from sexually compatible species through pollination due to hybridization barriers.
  - there is no linkage drag.
  - apple is vegetatively propagated and produces sterile seeds.
  - cisgenes will not disrupt endogenous genes when introduced by *Agrobacterium* mediated transformation.
136. For development of selection marker-free transgenic plants by co-transformation using *Agrobacterium*, the marker genes are:
- segregated out in T<sub>0</sub> generation
  - excised out in T<sub>0</sub> generation
  - segregated out in T<sub>1</sub> generation
  - excised out in T<sub>1</sub> generation
137. Breakdown of Bt- mediated insect resistance in crops can be delayed by:
- Refugia strategy
  - Cultivation of different Bt cotton varieties with same Bt gene
  - Application of Bt Bio-pesticides
  - application of systemic insecticides
138. Which one of the following is matched **INCORRECTLY**?
- |                         |   |                       |
|-------------------------|---|-----------------------|
| a. Nanopore             | – | DNA sequencing        |
| b. beta-carotene        | – | golden rice           |
| c. <i>bar</i> gene      | – | resistance to viruses |
| d. Figwort Mosaic Virus | – | constitutive promoter |
139. Which one of the following would produce androgenic haploids in anther culture?
- Anther wall
  - Tapetal layer
  - Connective tissue
  - Young microspores
140. Male sterility in plants is induced by expression of the TA29-*barnase*-pA cassette in:
- Pollen mother cell
  - Stamen
  - Tapetum
  - Pollen grain



141. Anchorage dependent CHO cells are grown by aeration using micro carrier beads. The maximum detrimental effect of shear occurs due to agitation if the size (Kolmogorov scale) of eddies is:
- lesser than the size of the beads
  - equal to the size of beads
  - larger than the size of beads
  - independent of the size of beads
142. With progress in the growth of *E. coli* in a minimal medium (constant aeration and agitation), the dissolved oxygen (DO) initially declined and then started to increase. If the DO again starts to decrease on addition of glucose, then the most probable explanation is:
- growth is limited by glucose
  - growth is limited by oxygen
  - decrease in solubility of oxygen occurred due to glucose addition
  - decrease in the number of cells takes place due to cell lysis
143. An organism obeys Andrews model for growth inhibition with  $K_s$  and  $K_i$  values of 0.01 g/l and 1.0 g/l respectively. If the substrate is present at an initial concentration of 1.0g/l, the specific growth rate of the culture upon entering log phase would be approximately:
- $1/5^{\text{th}}$  of  $\mu_{\text{max}}$
  - $1/4^{\text{th}}$  of  $\mu_{\text{max}}$
  - $1/3^{\text{rd}}$  of  $\mu_{\text{max}}$
  - $1/2$  of  $\mu_{\text{max}}$
144. In a stirred tank reactor when the agitation rate is increased, the  $k_L$  and  $k_{L,a}$  values will:
- increase and decrease respectively
  - decrease and increase respectively
  - both increase
  - both decrease
145. Which one of the following is correct regarding cell damage in an agitated and sparged mammalian cell bioreactor?
- High shear stress arising during mixing of the cell culture is the major cause of cell damage.
  - Shear stress arising from the breakup of bubbles at the liquid surface is a major cause of cell damage.
  - Shear stress between bubbles in the foam at the liquid surface is a major cause of cell damage
  - Using agitator blades of a radial flow type with mirror finish reduces shear and hence cell damage

146. Which one of the statements given below is **NOT** true? Equilibrium constant (K) of a chemical reaction at a specific temperature can be determined if the:
- $\Delta G^0$  of the reaction is known
  - Equilibrium concentrations of reactants and products are known
  - $\Delta H$  and  $\Delta S$  of the reaction are known
  - $\Delta H$  and initial concentrations of the reactants and products are known
147. If a big centrifuge with the bowl diameter of 1m rotates at 60 rpm, at what speed (rpm) does a smaller centrifuge with a diameter of 0.5 m need to be operated for achieving the same separation factor?
- 85
  - 120
  - 30
  - 42
148. What is the linear flow rate (superficial velocity in cm/h) in a chromatographic column of 1.0 cm inner diameter with a bed porosity of 0.8 when the volumetric flow rate is 1 ml/min?
- 61.1
  - 76.4
  - 38.2
  - 15.2
149. For a cell growth process, the units for yield, productivity and titre are:
- $g l^{-1}$ ,  $g l^{-1} h^{-1}$  and  $g l^{-1}$
  - $g g^{-1}$ ,  $g l^{-1} h^{-1}$  and  $g g^{-1} l^{-1} h^{-1}$
  - $g l^{-1}$ ,  $g l^{-1} h^{-1}$  and  $g g^{-1}$
  - $g g^{-1}$ ,  $g l^{-1} h^{-1}$  and  $g l^{-1}$
150. In a fermentor the impeller diameter is increased from 0.5 m to 1 m and the rpm is increased from 100 rpm to 400 rpm. Reynolds number will increase by?
- 16 fold
  - 8 fold
  - 2 fold
  - 4 fold
151. *Zymomonas mobilis* is cultivated in a 60 l chemostat. The  $\mu_{max}$  and  $K_s$  values are  $0.2 h^{-1}$  and  $0.5 g l^{-1}$  respectively. The flow rate ( $l h^{-1}$ ) required for a steady state substrate concentration of  $0.5 g l^{-1}$  in the reactor is:
- 6
  - 9

- c. 4  
d. 12
152. Which one of the following statements is **WRONG** for conventional batch filtration of a mycelial fermentation broth?
- Blockage of the membrane pores by cell debris
  - The specific cake resistance remains constant
  - compressible cake deposition on the membrane
  - medium resistance remain constant
153. The reason for the choice of *E. coli* for the production of ethanol from lignocellulose is because it:
- grows efficiently in various hexoses and pentoses
  - can be grown to high cell density
  - can tolerate very high concentration of ethanol
  - is a GRAS organism
154. Two organisms A and B with the same  $\mu_{\max}$  and  $Y_{x/s}$  are cultivated independently in batch culture. They have  $K_s$  values of  $1 \text{ g.l}^{-1}$  and  $3 \text{ g.l}^{-1}$  respectively. Given that the initial substrate concentration was  $5 \text{ g/l}$ , which of the following is **TRUE** after complete exhaustion of the substrate?
- Organism A will have lower average specific growth rate than B.
  - Organism A will have higher average specific growth rate than B.
  - Both the organisms would have same average specific growth rate.
  - The final biomass achieved in B would be higher than in A.
155. *Pseudomonas* with the elemental composition of  $\text{CH}_3\text{O}_{0.5}\text{N}_{0.5}$  (MW = 30) is grown in a bioreactor to a final cell mass of  $30 \text{ g/l}$ . The minimum concentration (g/l) of ammonia ( $\text{NH}_3$ ) (MW = 17) (as the sole nitrogen source) required is:
- 17
  - 8.5
  - 14
  - 15
156. To reduce the level of deactivation of media components for culturing *Lactobacillus* spp., a high temperature and short time (HTST) regime is used for sterilization, **PRIMARILY** because:
- Deactivation energy of contaminants > Deactivation energy of medium components
  - Deactivation energy of contaminants < Deactivation energy of medium components
  - Deactivation energy of contaminants = Deactivation energy of medium components
  - the time required for sterilization is reduced

157. *Acetobacter aceti* converts alcohol to acetic acid according to the stoichiometric relation

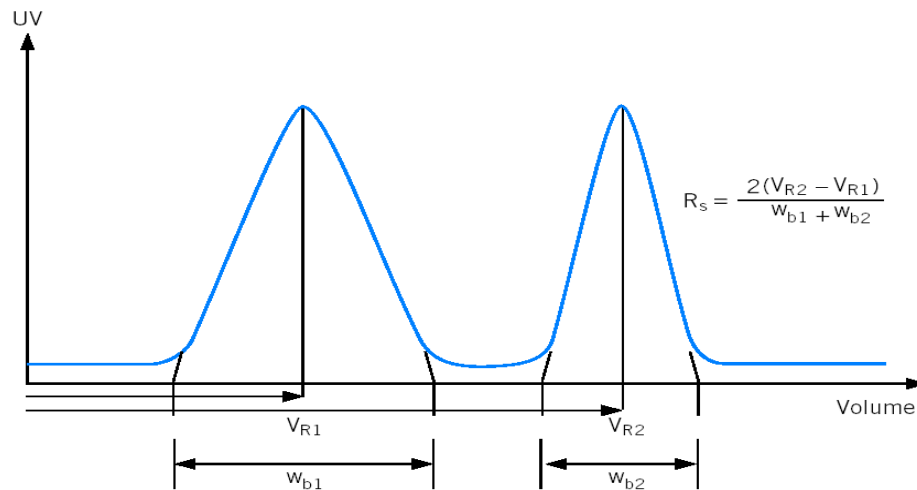


In a vigorously agitated and aerated reactor containing 20 g/l ethanol, the organism produces 16 g/l acetic acid and 2 g/l was the residual ethanol concentration. What are the theoretical and observed yields of acetic acid expressed in g/g ethanol?

- a. 60/46 and 16/18
  - b. 50/46 and 18/16
  - c. 46/60 and 18/16
  - d. 26/60 and 16/18
158. A continuous stirred tank bioreactor produces 48 kg lysine.day<sup>-1</sup>. If the volumetric productivity is 2 g.l<sup>-1</sup>.h<sup>-1</sup>, the volume of the reactor is:
- a. 1 m<sup>3</sup>
  - b. 1.5 m<sup>3</sup>
  - c. 0.1 m<sup>3</sup>
  - d. 2 m<sup>3</sup>
159. Aqueous Two Phase System (ATPS) is used to isolate a protease from a fermentation broth. The partition coefficient (K) is 2.5. For 80 % recovery of protease in a single step, the volume ratios of upper and the lower phases should be:
- i. 1.6:1
  - ii. 3.2:1
  - iii. 2.4:1
  - iv. 1.2:1
160. To have an overall yield of greater than 50% in a three step purification process for a food additive, the minimum average step yield(%) necessary would be around:
- a. 95
  - b. 80
  - c. 50
  - d. 20
161. In a fed batch process for the production of an antibiotic, the dissolved oxygen (DO) level was found to be falling below 30%. If the DO level of 30% is to be maintained in the reactor (without altering the composition of oxygen-air mixture, aeration rate and agitation) then we need to:
- a. increase the feed rate
  - b. decrease the feed rate
  - c. increase the concentration of feed
  - d. decrease the volume of the broth by partial withdrawal

162. In a batch sterilization process if  $\nabla_{\text{overall}}$ ,  $\nabla_{\text{heating}}$  &  $\nabla_{\text{cooling}}$  are 32.2, 9.8 & 10.1 respectively, THEN the holding time at 121°C of the process is (given that the specific death rate ( $k$ ) of microorganisms at 121°C is 2.54 min<sup>-1</sup>):
- 4.84 min
  - 6.75 min
  - 2.96 min
  - 9.25 min

163. To achieve complete separation of two pharmaceutical compounds (shown as two peaks in the chromatogram), the relative separation ( $R_s$ ) should be:



- < 1
  - $\geq 1.5$
  - < 0.5
  - = 0.8
164. The anticancer drug, Halichondrin – D is isolated from:
- Corals
  - Gorgonians
  - Sponges
  - Sea anemone
165. Heparin is a:
- Glycosylated lipid
  - Glycoprotein
  - Lipopolysaccharide
  - Sulphated polysaccharide

166. The only naturally transformable marine cyanobacteria is:

- a. *Agmenellum* sp.
- b. *Spirulina* sp.
- c. *Oscillatoria* sp.
- d. *Nostoc* sp.

167. Marine chemosynthesis is mainly based on:

- a. Oxygen
- b. Carbon dioxide
- c. Sulphate
- d. Manganese nodules

168. Which one is a DNA replication blocking agent produced by sponges?

- a. Clathesine
- b. Spongoides
- c. Spongin
- d. Scleorin

169. Eutrophication in aquatic ecosystems is due to reduction of:

- a. Carbon
- b. Oxygen
- c. Sulphur
- d. Hydrogen

170. Halotolerant and halophilic microbes can be isolated from ----- and -----, respectively.

P. Sea      Q. River      R. Lake      S. Estuary

- a. S and P
- b. P and S
- c. Q and P
- d. R and S

171. Heavy metal pollutants like Cd and Hg inactivate enzymes by interacting with:

- a. cysteine
- b. glutamic acid
- c. lysine
- d. histidine

172. Which of the following class of enzymes initiates aerobic degradation of aromatic pollutants (like naphthalene) in bacteria?
- Oxido-reductases
  - Hydrolases
  - Ligases
  - Lyases
173. Which one of the following organisms is **NOT** able to perform light harvesting reaction?
- Azospirillum*
  - Chlamydomonas*
  - Rhodospseudomonas*
  - Halobacterium*
174. In the soil environment, which one of the following factors is responsible for the biotic stress on the microbial community?
- Nutrients
  - Oxidation-reduction potential
  - Moisture
  - Microflora
175. Match the enzymes in Group I with their appropriate role in the environment from Group II
- |   | Group I         |   | Group II                                       |
|---|-----------------|---|--|
| 1 | Laccase         | P | Xenobiotic detoxification                      |
| 2 | Catalase        | Q | Nitrogen fixation                              |
| 3 | Nitrogenase     | R | Lignin degradation                             |
| 4 | Cytochrome p450 | S | Neutralization of toxic O <sub>2</sub> species |
- 1-R; 2-S; 3-Q; 4-P
  - 1-P; 2-R; 3-Q; 4-S
  - 1-S; 2-P; 3-R; 4-Q
  - 1-R; 2-Q; 3-S; 4-P
176. Which one of the following types of mutation would usually **NOT** be detected in a molecular diagnostic test that is based on sequencing each exon of a gene individually from a male suspected of having an X-linked disorder?
- Missense mutation
  - Nonsense mutation
  - Deletion of an exon
  - Inversion of a part of the gene

177. A couple came for counselling following three first-trimester miscarriages and underwent chromosomal analysis. The man was found to have pericentric inversion with the karyotype 46,XY,inv8(p12q22). Which one of the following would be a correct conclusion?
- This is a normal variant, likely of no significance
  - This is an abnormal chromosome that would cause congenital anomalies if transmitted to a child.
  - This rearrangement might lead to chromosomal imbalance in an offspring and could explain multiple miscarriages.
  - This rearrangement might cause dicentric or acentric chromosomes in an offspring, which would probably not be compatible with survival.
178. Unequal crossing over between two *Alu* repeats can lead to an LDL receptor gene with an internal deletion or duplication. Based on this information, which of the following must be true?
- The LDL receptor gene contains one and only one *Alu* repeat sequence.
  - The LDL receptor gene does not contain *Alu* repeat sequences.
  - The genome contains only one copy of the *Alu* repeat sequence.
  - The LDL receptor gene contains at least two *Alu* repeat sequences
179. Linkage analysis is performed in a large family with an autosomal dominant hemolytic anemia, using a polymorphic marker within the  $\beta$ -globin locus. The LOD score at  $q=0$  is negative infinity. The LOD score at  $q=0.01$  is  $-4.5$ . You conclude that the disorder in this family is:
- not due to a  $\beta$ -globin gene mutation
  - due to a  $\beta$ -globin gene mutation
  - an acquired disorder, due to a somatic gene mutation
  - due to a mutation in a gene on chromosome 11, 10 cM centromeric of  $\beta$ -globin
180. In Li-Fraumeni syndrome most frequent mutation occurs in:
- p53
  - RB
  - BRCA1
  - PTEN
181. Which one of the following promoters is most efficient for transgene expression in mammary gland of livestock?
- Beta-casein
  - Prolactin
  - Uromodulin
  - Immunoglobulin



182. Epinephrine is used along with local anaesthetic because of its:

- a.  $\alpha$ -adrenergic receptor agonist properties
- b.  $\beta_2$  adrenergic receptor agonist properties
- c.  $\beta_1$  adrenergic receptor agonist properties
- d. nicotinic receptor agonist properties

183. Founder effects and bottlenecks are:

- a. expected only in large populations
- b. mechanisms that increase genetic variation in a population
- c. two different modes of natural selection
- d. forms of genetic drift

184. In commercial farms, embryos are routinely recovered by non-surgical methods. On which day are the embryos recovered from the donor cow after the onset of estrus?

- a. 21
- b. 7
- c. 14
- d. 5

185. Human mesenchymal stem cells:

- a. Can differentiate into only one type of cell
- b. Can differentiate into few types of cells
- c. Can differentiate into all types of cells
- d. Do not differentiate at all

186. Vectors are important in transmission of diseases. Match group 1 with group 2.

	Group 1		Group 2
1	Louse	A	West Nile Fever
2	Tick	B	Scrub Typhus
3	Mite	C	Lyme disease
4	Mosquito	D	Epidemic Typhus

- a. 1-D; 2-C; 3-B; 4-A
- b. 1-A, 2-B; 3-C; 4-D
- c. 1-B; 2-C; 3-D; 4-A
- d. 1-C, 2-D; 3-A; 4-B

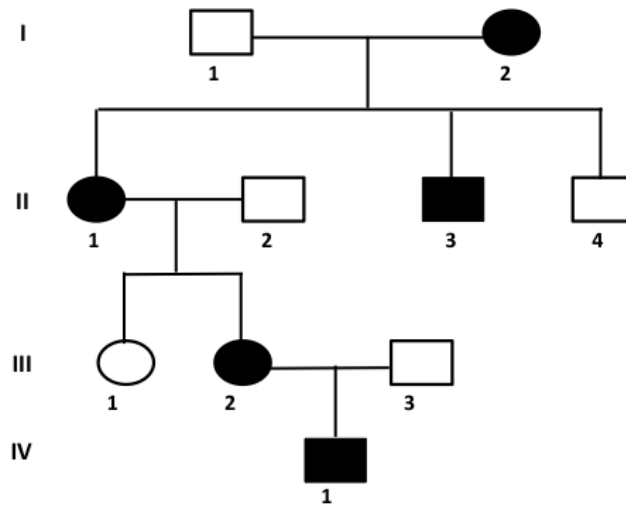
187. Which one of the following is an inhibitory neurotransmitter?

- a. GABA
- b. Glutamate
- c. Acetylcholine
- d. Dopamine

188. Huntington's disease is clinically characterized by chorea (abnormal involuntary movements). Which part of the brain is responsible for this phenotype?
- Basal Ganglia
  - Cerebellum
  - Hippocampus
  - Brain stem
189.  $\alpha$ -Amanitin is a fungal toxin which inhibits eukaryotic RNA polymerases. The three eukaryotic RNA polymerases show differential sensitivity to this toxin. Which one of the following order (higher to lower) is correct with respect to sensitivity towards  $\alpha$ -amanitin?
- RNA POL III > RNA POL II > RNA POL I
  - RNA POL II > RNA POL III > RNA POL I
  - RNA POL I > RNA POL III > RNA POL II
  - RNA POL II > RNA POL I > RNA POL III
190. A primary cell culture can be transformed into a cell line by all EXCEPT:
- Simian Virus 40
  - Hepatitis B virus
  - Human Papillomavirus
  - Epstein-Barr Virus
191. In a randomly breeding population, an autosomal recessive condition affects 1 newborn in 10,000. The expected frequency of carriers will be nearly:
- 1 in 25
  - 1 in 50
  - 1 in 100
  - 1 in 1,000
192. Assessment of the extent of DNA double strand breaks in cultured human cells, following exposure to ionizing radiation, can be done by quantitation of :
- acetylated histones H3 and H4
  - methylated histones H3 and H4
  - ubiquitylated histone H2A.X
  - phosphorylated histone H2A.X
193. There are reports of more than 100 mutations at different sites of Factor IX that manifests Haemophilia B. This is an example of:
- clinical heterogeneity
  - allelic heterogeneity
  - protein heterogeneity
  - locus heterogeneity

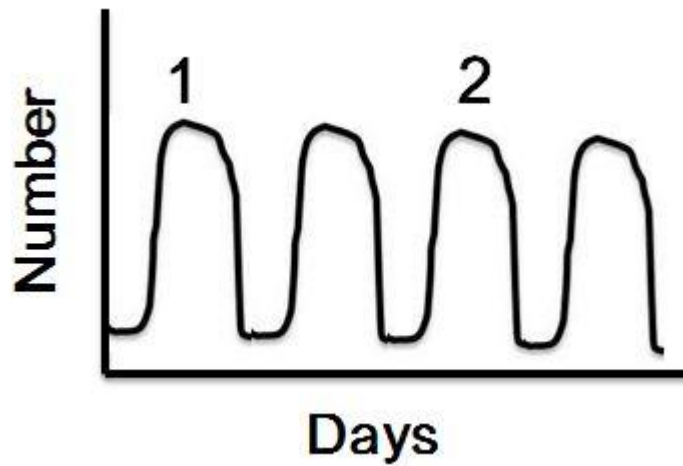
194. Specificity factor which activates ubiquitin ligase activity of APC/C during separation of sister chromatids is:
- CDC10
  - CDC20
  - CDH1
  - CDC45A
195. In a diploid organism, loss of function mutations produce dominant phenotypes when there is:
- pleiotropy
  - epistasis
  - multiple allelism
  - haploinsufficiency
196. In Mendel's dihybrid cross experiment, if the two selected traits were on the same chromosome (linked) and assuming that there is no recombination, what would be the expected genotypic ratio in the  $F_2$  generation?
- 1:2:1
  - 9:3:3:1
  - 1:3
  - 1:1
197. Huntington disease is caused by:
- Expanded dinucleotide repeats sequence in coding region
  - Expanded trinucleotide repeats in non-coding region
  - Expanded trinucleotide sequence in coding sequence
  - Expanded dinucleotide sequence in non-coding sequence

198. The following pedigree shows the inheritance of a very rare human disease. What is the most likely mode of inheritance for the disease trait and what is the probability that the second child of III-2 and III-3 will be a son and will also have the disease?



- a. Sex-linked recessive; 0.5  
 b. Autosomal recessive; 0.25  
 c. Autosomal dominant; 0.75  
 d. Autosomal dominant; 0.25
199. Microscopic evaluation of a post-mortem brain exhibits hyperchromatic areas when stained with glial fibrillary acidic protein (GFAP). This suggests activation of:
- a. astrocytes  
 b. oligodendrocytes  
 c. Microglia  
 d. neurons

200. Parasite numbers in the blood of a patient with *Trypanosoma brucei* (Sleeping sickness) shows the following pattern:



Parasites isolated from population 1 and 2 were found to be antigenically non-cross reactive. The parasite distribution seen may be due to:

- Change in gene expression
- Loss of antigenic epitopes
- Post-translational modification of antigen
- Antigenic switching

**BIOTECHNOLOGY ELIGIBILITY TEST- 2017**

**ANSWER KEY**

Question	Correct Option
1	4
2	4
3	2
4	2
5	4
6	3
7	1
8	1
9	1
10	2
11	1
12	4
13	1
14	1
15	3
16	2
17	2
18	2
19	4
20	2
21	1
22	1
23	3
24	2
25	3
26	2
27	2
28	1
29	4
30	2
31	3
32	2
33	2
34	3
35	3
36	4
37	2
38	1,3
39	2
40	4

Question	Correct Option
41	2
42	2
43	1
44	1
45	3
46	4
47	1
48	3
49	3
50	2
51	2
52	1
53	3
54	3
55	2
56	3
57	2
58	4
59	3
60	2
61	4
62	4
63	3
64	2
65	4
66	4
67	4
68	4
69	2
70	2
71	3
72	2
73	3
74	1,3
75	3
76	3
77	2
78	3
79	2
80	1

Question	Correct Option
81	2
82	2
83	3
84	2
85	2
86	1,2,3,4
87	2
88	3
89	4
90	4
91	1
92	2
93	2
94	1
95	3
96	1
97	1
98	1
99	2
100	4
101	2
102	3
103	1
104	2
105	3
106	1
107	2
108	2
109	2
110	2
111	4
112	3
113	2
114	3
115	3
116	3
117	4
118	4
119	2
120	4

Question	Correct Option
121	3
122	2
123	3
124	3
125	3
126	4
127	2
128	3
129	4
130	3
131	1
132	2
133	4
134	1
135	2
136	3
137	1
138	3
139	4
140	3
141	1
142	1
143	4
144	3
145	2
146	4
147	1
148	2
149	4
150	1
151	1
152	2
153	1
154	2
155	2
156	1
157	1
158	1
159	1
160	2

Question	Correct Option
161	2
162	1
163	2
164	3
165	4
166	1
167	2
168	2
169	2
170	1
171	1
172	1
173	1
174	4
175	1
176	4
177	3
178	4
179	1
180	1
181	1
182	1
183	4
184	2
185	2
186	1
187	1
188	1
189	2
190	2
191	2
192	4
193	2
194	2
195	4
196	1
197	3
198	4
199	1
200	4

**Question Paper**

**Part A**

Question 1 :

10 g of a plant material is extracted in 100mL of a suitable buffer. On performing an assay for amylase activity, 100 $\mu$ l extract produced 6  $\mu$ moles glucose in 30 minutes of incubation. One unit of amylase activity is defined as the amount of enzyme required to produce 1 $\mu$ mole of glucose per minute. The amylase activity (units/g) of the material is:

Answers :

1. 60
2. 200
3. 20
4. 600

Question 2 :

Water vapour transmission rate of a packaging film is 4g/m<sup>2</sup>/day. A food product is packed in a rectangular pouch measuring 0.12m x 0.16m. The maximum amount of moisture lost in 90 days is:

Answers :

1. 0.15 g
2. 13.82 g
3. 0.04 g
4. 18.34 g

Question 3 :

An essential oil has antimicrobial activity with an MIC of 15 mg/Kg and can be used as a bio-preservative. This activity is lost at the rate of 1% of the remaining concentration, per day. The minimum amount of oil to be added (mg) to 1 Kg of food product that is stored for 30 days is:

Answers :

1. 21.43
2. 17.65
3. 20.28
4. 19.50

Question 4 :

The protein concentration and enzyme activity in 100 mL of a cell free extract is 5 mg/mL and 2 units/mL, respectively. After multiple steps of purification, the final 10 mL fraction contains 4 mg/mL of protein and 15 units/mL of enzyme activity. The fold purification and percentage recovery, respectively is:

Answers :

1. 10 and 75
2. 9.4 and 20
3. 9.4 and 75
4. 10 and 20



Question 5 :

Solvent extraction using ethanol is used to purify a target metabolite from an aqueous broth. The partitioning coefficient is 3. The ratio of solvent to broth that is required to extract 80% of the metabolite in a single step is:

Answers :

1. 0.8:1
2. 2.4:1
3. 2.67:1
4. 1.33:1

Question 6 :

Two experiments were conducted with an enzyme following Michaelis Menten kinetics at substrate concentrations of 0.5 g/l and 1 g/l. If the enzymatic reaction velocity increases approximately 2-fold at the higher substrate concentration, the  $K_m$  for the enzyme would be around:

Answers :

1. 0.001 g/l
2. 0.01 g/l
3. 0.1 g/l
4. 1 g/l

Question 7 :

An enzyme is reported to have a  $K_m$  of 10 mM and  $V_{max}$  of 30 mM/s. Assuming Michaelis Menten kinetics, the reaction velocity at a substrate concentration of 20 mM will be:

Answers :

1. 10 mM/s
2. 15 mM/s
3. 20 mM/s
4. 30 mM/s

Question 8 :

An unbiased coin is tossed 100 times in experiment I and 1000 times in experiment II. Which one of the following statements is most likely to be TRUE regarding the ratio between heads and tails in experiment I and II?

Answers :

1. It will be closer to one in experiment I
2. It will be closer to one in experiment II
3. It will be equal to one in both experiments
4. It will be equally away from one in both experiments

Question 9 :

A random number generator produces a uniform distribution of numbers between -1 and 1. The probability that a number produced by this generator is between 0.9 and 1 is

Answers :

1. 0.1
2. 0.05
3. Less than 0.05
4. Between 0.05 and 0.1

Question 10 :

Random DNA hexamers containing A, T, G and C are generated by DNA synthesis. The fraction of the hexamers that will have 3 purines followed by 3 pyrimidines is:

Answers :

1.  $9/4^6$
2.  $1/2^6$
3.  $6/4^6$
4.  ${}^6C_3/3^6$

Question 11 :

A litre of 18% glucose solution is converted anaerobically into methane and carbon dioxide. The theoretical maximum volume of gases at NTP assuming ideality, produced on complete conversion of the entire glucose would be:

Answers :

1. 112 L
2. 67.2 L
3. 134.4 L
4. 22.4 L

Question 12 :

An STE buffer contains 20% sucrose, 100 mM Tris and 10 mM EDTA. Given the stock solutions – 50% sucrose, 1 M Tris, and 200 mM EDTA, the volumes of the stock solutions required to make 1 litre of the buffer solution are respectively:

Answers :

1. 400 ml, 100 ml, 100 ml
2. 200 ml, 50 ml, 100 ml
3. 400 ml, 100 ml, 50 ml
4. 200 ml, 100 ml, 50 ml

Question 13 :

A and B together can clean a lab in 4 days. Independently, A can clean the lab in 20 days. How many days will it take for B to independently complete the task?

Answers :

1. 4
2. 5
3. 16
4. 12.1

Question 14 :

A boy appears for a test and scores 35% but fails by 10 marks. If he had scored 46% marks, he would have passed by 12 marks. The pass mark is:

Answers :

1. 70
2. 74
3. 80
4. 86

Question 15 :

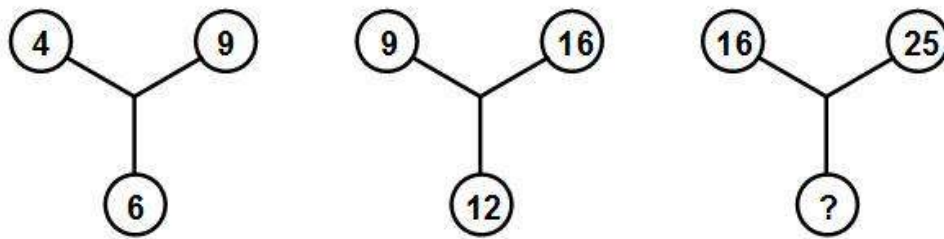
The mean extracellular cellulase activity of 7 *Bacillus* strains isolated from soil was determined to be 12 IU/mL. A new hyper-producing *Bacillus* isolate was found to have an extracellular activity of 36 IU/mL. If equal volumes of the supernatants of all 8 strains are mixed together, the cellulase activity of the solution will be:

Answers :

1. 13.5
2. 15
3. 16.5
4. 17.5

Question 16 :

Find the missing number in the following series:

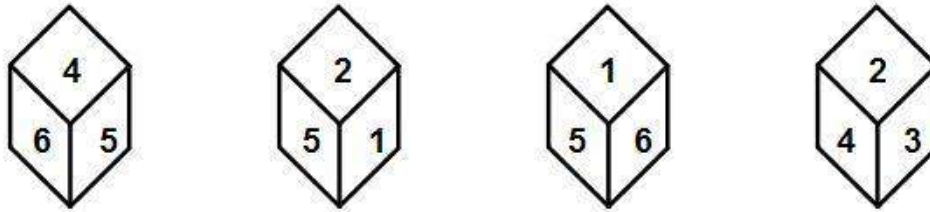


Answers :

1. 18
2. 19
3. 20
4. 24

Question 17 :

If the four different positions of a dice are as given below, find the number that is on the face opposite to 4:

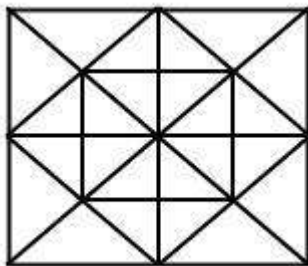


Answers :

1. 5
2. 3
3. 2
4. 1

Question 18 :

How many squares are there in the given diagram?



Answers :

1. 10
2. 15
3. 12
4. 14

Question 19 :

A spherical mammalian cell of radius 'R' is infected by a single coccus bacterium having 100 times smaller radius. Given that the host cell will lyse when  $\frac{1}{2}$  of the cell volume is taken up by the bacterium, approximately how many times will the bacterium divide before the host cell is lysed?

Answers :

1. 19
2.  $3 \times 10^5$
3.  $10^6$
4. 40

Question 20 :

Phosphates, carboxylates, sulfonates are esters of phosphoric, carboxylic and sulfonic acids, respectively. Which one of the following statements is NOT true?

Answers :

1. The nucleophile attack occurs at acyl carbon in carbohydrates.
2. The nucleophile attack occurs at the alkyl carbon in sulfonates.
3. The nucleophile attack occurs at the oxygen or phosphorous in phosphates
4. Sulfonates can be easily hydrolysed.

Question 21 :

The prosthetic group present in a acyl carrier protein is:

Answers :

1. CoASH
2. FAD
3. Heme
4. NAD

Question 22 :

Pyran is a:

Answers :

1. Six membered oxygen heterocycle
2. Five membered oxygen heterocycle
3. Six membered nitrogen heterocycle
4. Five membered nitrogen heterocycle

Question 23 :

The number of 1° hydroxyl group present in fructose and glucose are:

Answers :

1. 2 and 1
2. 2 and 2
3. 1 and 2
4. 1 and 1

Question 24 :

During glycolysis, fructose-1,6-diphosphate undergoes \_\_\_\_\_ to produce two C<sub>3</sub> - fragments.

Answers :

1. Retroaldol reaction
2. Oxidation
3. Isomerisation
4. Hydrolysis

Question 25 :

The core functional unit present in NADH is:

Answers :

1. Pyridine
2. Dihydro Pyridine
3. Purine
4. Pyrimidine

Question 26 :

If a completely radioactive double stranded DNA molecule undergoes two rounds of replication in a non-radioactive medium, what will be the radioactivity status of the four resulting molecules?

Answers :

1. Half the number of molecules contains no radioactivity
2. All four molecules contain radioactivity
3. Three out of four molecules contain radioactivity
4. Radioactivity is lost from all four molecules

Question 27 :

In meiosis, an inversion in one member of a pair of homologous chromosomes will most likely lead to which of the following?

Answers :

1. Non-disjunction of the affected chromosome
2. Chromosome with duplications and deficiencies
3. Increased recombination frequency in the inverted region
4. Mispairing of the affected chromosome with a non-homologous chromosome

Question 28 :

In a cross between two black Labrador retrievers the phenotypic ratio of the offspring is 9 black puppies to 3 chocolate puppies to 4 yellow puppies; this is an example of

Answers :

1. Partial recessiveness
2. Incomplete penetrance
3. Incomplete dominance
4. Epistasis

Question 29 :

What will be the probability of obtaining a plant with AaBBCc genotype from trihybrid (AaBbCc) parents?

Answers :

1. 4 out of 64
2. 1 out of 64
3. 8 out of 64
4. 0 out of 64

Question 30 :

The natural primer for reverse transcriptase in RNA tumor viruses is:

Answers :

1. Oligo-dT
2. rRNA
3. 5S RNA
4. tRNA

Question 31 :

Asymmetry of the DNA denaturation - renaturation curve

Answers :

1. is directly proportional to the genomic complexity
2. is inversely proportional to the genomic complexity
3. is directly proportional to the AT content
4. has no correlation with genomic complexity

Question 32 :

'P' is a *cis*-acting element, while 'Q' is a *trans*-acting element. Possible examples of 'P' and 'Q' are:

Answers :

1. Enhancer and transcription factor
2. Transcription factor and operator
3. Promoter and operator
4. Transcription factor and promoter

Question 33 :

In an organism, the amount of DNA per haploid genome is about  $1.6 \times 10^9$  nucleotide pairs. Given that the length of DNA helix occupied by one nucleotide pair is  $3.4 \text{ \AA}$ , approximately how long a double helix could be formed from this DNA?

Answers :

1. 22 cm
2. 55 cm
3. 1.1meter
4. 2.2 meter

Question 34 :

A hypothetical polypeptide hormone binds to its receptor with an association rate constant ( $k_a$ ) of  $3.0 \times 10^4 \text{ M}^{-1} \text{ sec}^{-1}$  and a dissociation rate constant ( $k_d$ ) of  $6.9 \times 10^{-6} \text{ sec}^{-1}$ . What is the equilibrium dissociation constant?

Answers :

1.  $4.7 \times 10^9 \text{ M}^{-1}$
2.  $2.3 \times 10^{-10} \text{ M}$
3.  $2.3 \times 10^{10} \text{ M}^{-1}$
4.  $3.3 \times 10^{-6} \text{ M}$

Question 35 :

If a fluorescent dye is injected into the lumen of the endoplasmic reticulum (ER), in which of the following compartments can fluorescence signal be observed?

Answers :

1. ER only
2. Golgi only
3. ER and Golgi
4. ER, Golgi and nuclear envelope

Question 36 :

Which of the following statements about Na<sup>+</sup>-K<sup>+</sup> ATPase is correct?

Answers :

1. It is responsible for generating the resting membrane potential
2. It transports Na<sup>+</sup> and K<sup>+</sup> ions down their respective gradients
3. It is responsible for generating an action potential
4. It indirectly regulates the volume of the cell

Question 37 :

Protein glycosylation can take place only on the following amino acid(s):

Answers :

1. Asparagine
2. Serine and Threonine
3. Asparagine, serine and threonine
4. Asparagine, serine, threonine and arginine

Question 38 :

Which one of the following organelles disappears during cell division and is regenerated in the daughter cells?

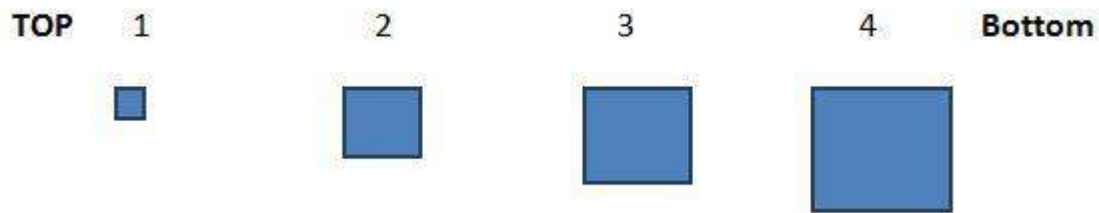
Answers :

1. Endoplasmic reticulum
2. Golgi
3. Mitochondria
4. Peroxisomes

Question 39 :

Cross sectional images of an object taken at fixed intervals from top to bottom reveals the following images (1,2,3,4). Using these images if you had to reconstitute the object, what would be its 3D shape?





Answers :

1. Cube
2. Pyramid
3. Prism
4. Tetrahedral

Question 40 :

In *E. coli*, mismatch during replication is corrected by the mismatch repair (MMR) pathway. For this, the MMR proteins differentiate between the parent and daughter strand by:

Answers :

1. Identifying the methylation on the daughter strand
2. Identifying the methylation on the parent strand
3. Identifying methylation on both strands
4. Identifying lack of methylation on both strands

Question 41 :

Promoter : transcription ::

Answers :

1. Shine-Dalgarno : translation
2. DNA polymerase:replication
3. Ribosome:translation
4. DnaA:replication

Question 42 :

Hair cells in the inner ear act as receptors for which one of the following cues?

Answers :

1. Temperature
2. Chemical
3. Mechanical
4. Orientation

Question 43 :

Which one of the following reactions **DOES NOT** occur in fatty acid synthesis?

Answers :

1. Reduction
2. Dehydration
3. Decarboxylation
4. Phosphorylation

Question 44 :

The amino acid that can act both as an acid and a base in an enzyme catalysed reaction is:

Answers :

1. Tryptophan
2. Lysine
3. Histidine
4. Aspartic acid

Question 45 :

The DNA sequence in the box undergoes an inversion. What is the final DNA sequence after inversion?

5' - TAGCC GGTATC CCGAT - 3'  
3' - ATCGG CCATAG GGCTA - 5'

Answers :

1. TAGCC CCATAG CCGAT  
ATCGG GGTATC GGCTA
2. TAGCC CTATGG CCGAT  
ATCGG GATACC GGCTA
3. CCGAT GATACC TAGCC  
GGCTA CTATGG ATCGG
4. TAGCC GATACC CCGAT  
ATCGG CTATGG GGCTA

Question 46 :

A DNA with the sequence 5'CGCATCGATCATGCCCTGA.....AGTCCCATTAGATGCC3' needs to be PCR amplified. The reverse primer will have the following sequence:

Answers :

1. 5'GGCATCTA3'
2. 5'TAGATGCC3'
3. 5'GGACTCTA3'
4. 5'CGCATCGA3'

Question 47 :

Gamma phosphate labelled ATP molecule was used to label a DNA fragment using the nick translation protocol. This would result in:

Answers :

1. Labelling at 5'end
2. Labelling at 3'end
3. Labelling at both 3'and 5'ends
4. No labelling of DNA

Question 48 :

*Taq* DNA polymerase differs from the Klenow fragment in having:

Answers :

1. 5'-3' polymerase activity
2. 5'-3' exonuclease activity
3. 3'-5' exonuclease activity
4. Endonuclease activity

Question 49 :

A 34 Kb linear DNA was digested with *Hind*III and *Bam*HI. The fragments obtained on complete digestion were as follows:

*Hind*III : 14 Kb, 20 Kb

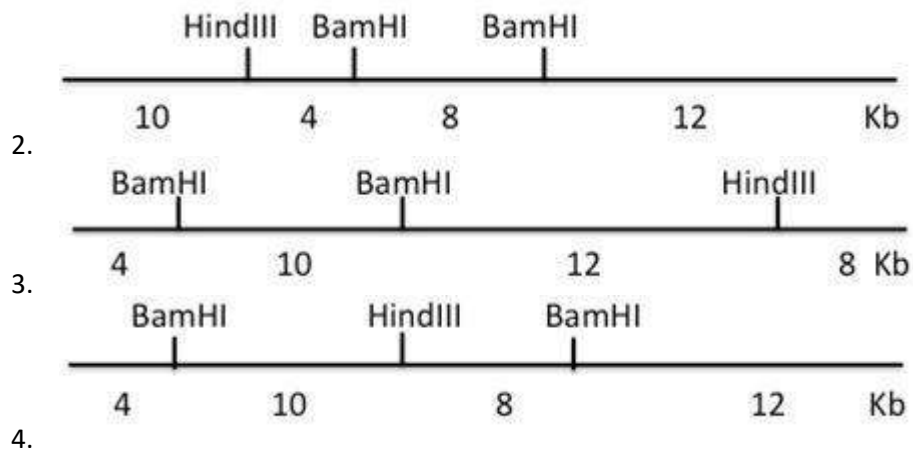
*Bam*HI: 4 Kb, 12 Kb, 18 Kb

*Hind*III + *Bam*HI: 4 Kb, 10 Kb, 8 Kb, 12 Kb

The appropriate restriction map of the DNA is:

Answers :





Question 50 :

In an eukaryotic pre-mRNA the number of positions where polyadenylate modifications occur is:

Answers :

1. 5
2. 2
3. 3
4. 4

The Biomimics

## **PART B**

Question 51 :

Which one of the following amino acid biosynthesis pathways is affected in folic acid deficiency?

Answers :

1. Aspartate from oxaloacetate & glutamate
2. Glycine from glucose and alanine
3. Glutamate from glucose and ammonia
4. Serine from glucose and alanine

Question 52 :

Which one of the following is **NOT** a part of the recombination signal sequence in VDJ recombination?

Answers :

1. A conserved 7 bp consensus sequence
2. Locus control regions (LCR)
3. A less conserved spacer of either 12 or 23 bp
4. A conserved 9 bp consensus sequence

Question 53 :

The mechanism that permits immunoglobulins to be synthesized either in a membrane bound or secreted form is:

Answers :

1. Allelic exclusion
2. Co-dominant expression
3. Differential RNA processing
4. Class-switch recombination

Question 54 :

The transporter associated with antigen processing (TAP) complex is necessary for the loading of peptides onto class I MHC molecules. The cellular compartment harboring the TAP complex is:

Answers :

1. Mitochondria
2. Golgi apparatus
3. Endoplasmic reticulum
4. Lysosomes

Question 55 :

Hemoglobin is made up of two copies each of  $\alpha$  and  $\beta$  globin subunits. The techniques used to establish the stoichiometry of  $\alpha$  and  $\beta$  subunits are:

Answers :

1. SDS -PAGE and hydrophobic interaction chromatography

2. Gel filtration chromatography and Ion-exchange chromatography
3. SDS-PAGE and gel filtration chromatography
4. Isoelectric focusing and Native PAGE

Question 56 :

Hot start PCR is performed to

Answers :

1. Expedite the PCR reaction
2. Prevent mutations
3. Prevent primer – dimer formations
4. Minimize non-specific amplification

Question 57 :

A 1 Kb insert (I) is ligated to a 5 Kb vector (V) in a molar ratio of I:V of 5:1, in a reaction volume of 1 mL at a final DNA concentration at 10  $\mu$ g/mL. How much of the insert and vector was used in the ligation mixture?

Answers :

1. 5  $\mu$ g I and 5  $\mu$ g V
2. 2  $\mu$ g I and 8  $\mu$ g V
3. 8  $\mu$ g I and 2  $\mu$ g V
4. 3  $\mu$ g I and 7  $\mu$ g V

Question 58 :

A human gene is cloned in an *E. coli* expression vector. However, extremely poor protein expression is detected on SDS-PAGE despite high levels of specific mRNA. The most likely explanation is:

Answers :

1. Formation of inclusion bodies
2. Lack of human translation initiation factors
3. Lack of human elongation factors
4. Lack of specific iso-accepting tRNAs

Question 59 :

Aminopterin in HAT medium inhibits:

Answers :

1. Thymidine kinase
2. Hypoxanthine – guanine phosphoribosyl transferase
3. Ribonucleotide reductase
4. Dihydrofolate reductase

Question 60 :

A linear double stranded DNA is self-circularized by ligation with T4 DNA ligase. At which concentration ( $\mu$ g/ml) of DNA would the self-circularization yield be maximum?

Answers :

1. 30
2. 10
3. 5
4. 0.5

Question 61 :

In a cell, a repressor binds to its cognate operator with a  $K_D = 10^{-9}M$ . The cellular concentration of the repressor is  $10^{-8}M$ . The extent of repressor bound to the operator is:

Answers :

1. 100%
2. 50%
3. 37%
4. 0%

Question 62 :

Among the merodiploids of the *lac* operon in *E. coli*, which one is **NOT** inducible by lactose?

Answers :

1.  $i^- p^+ o^+ z^- / i^+ p^+ o^+ z^-$
2.  $i^- p^+ o^+ z^- / i^+ p^- o^+ z^-$
3.  $i^- p^+ o^- z^- / i^+ p^+ o^- z^-$
4.  $i^+ p^+ o^+ z^- / i^+ p^+ o^+ z^-$

Question 63 :

Termination of mRNA transcription in *Saccharomyces cerevisiae* is mediated by:

Answers :

1. Rho-dependent termination
2. Rho-independent termination
3. Polyadenylation signal
4. Sigma factor directed termination

Question 64 :

A *Bacillus* culture growing in a rich medium was shifted to a sporulation medium. Which of the following is expected to occur?

Answers :

1. Genome and transcriptome will change
2. Genome will not change, but transcriptome will change
3. Transcriptome will not change, but proteome will change
4. Genome, transcriptome and proteome will not change

Question 65 :

A DNA fragment digested with *Hind*III and *Eco*RI was ligated with a vector digested with *Hind*III and *Eco*RI sites present in the polylinker of the vector. Upon screening of transformants by digestion with

*HindIII* and *EcoRI*, it was found that all the transformants contained only the self-ligated vector and there was no recombinant clone (containing insert cloned in the vector). This is possibly due to:

Answers :

1. Only one of the restriction enzymes digested the vector
2. Both the restriction enzymes digested the vector
3. Only one of the restriction enzymes digested the insert
4. Both the restriction enzymes digested the insert

Question 66 :

In a cloning experiment, alkaline phosphatase is generally used to dephosphorylate a plasmid vector rather than the insert DNA fragments because:

Answers :

1. Alkaline phosphatase can only dephosphorylate plasmid vector and not insert DNA fragments
2. Vector can self-ligate and form colonies upon introduction into host cells
3. Insert DNA fragments can self-ligate and form colonies upon introduction into host cells
4. Vector cannot ligate to a dephosphorylated insert DNA fragment

Question 67 :

A Yeast plasmid vector has an *XhoI* site in the *LEU2* marker gene and a *SalI* site in the *HIS3* marker gene. A student cloned a gene using the *SalI* site. How should the student select for the recombinant clone?

Answers :

1. Plate the transformation mixture on  $leu^- his^-$  medium
2. Plate the transformation mixture on  $leu^+ his^+$  medium, followed by replica plating on  $leu^+ his^-$  medium
3. Plate the transformation mixture on  $his^+ leu^-$  medium, followed by replica plating on  $leu^- his^-$  medium
4. Plate the transformation mixture on  $leu^+ his^-$  medium

Question 68 :

Which of the following statements about IPTG and lactose is **NOT** correct?

Answers :

1. IPTG is an analog of lactose
2. Both IPTG and lactose are inducers of the *lac* operon
3. IPTG is not metabolized while lactose is metabolized by the cells
4. Both IPTG and lactose need permease for entry into the cell

Question 69 :

Which of the following amino acid changes in the active site of an enzyme is **most likely** to change its activity?

Answers :

1. Lys → Arg
2. Leu → Ile



3. Glu → Asp
4. Lys → Pro

Question 70 :

Which of the following statements is NOT correct about enhancers?

Answers :

1. They can function in either orientation
2. They decrease the binding of activators near the promoter
3. They increase the binding of activators near the promoter
4. They can function upstream or downstream of the gene

Question 71 :

In an experiment, two different mutations in a single gene was observed. This gene was cloned. Northern and Western analysis of each mutant (1 and 2) and the wild type gave the following profiles:



What will be the inference from the result?

Answers :

1. Mutant 1 and 2 both have silent mutation at different positions.
2. Mutant 1 has missense mutation and 2 has silent mutation
3. Mutant 1 has missense mutation and 2 has nonsense mutation
4. Mutant 1 has silent mutation and 2 has missense mutation

Question 72 :

The common feature of Rho-independent and Rho-dependent termination of transcription is:

Answers :

1. the active signal lies in the direct repeats in nascent RNA
2. the active signal lies in double stranded DNA template
3. the active signal lies in nascent RNA
4. both require ATP

Question 73 :

During infection by single stranded RNA viruses, host immune system distinguishes viral RNA from the host RNA based on:

Answers :

1. differences in the length of the RNAs
2. specific signals at the 5' end of the RNAs
3. localization of viral RNA to a particular region in the cell

4. phosphorylation of viral RNA

Question 74 :

The deletion of gene X in mice did not result in any abnormality. Further, to investigate the function of the gene, at least five null mice of the same sex are needed. What is the minimum number of pups from heterozygous parents to be screened to obtain the required number?

Answers :

1. 10
2. 20
3. 40
4. 80

Question 75 :

The Carbon (C<sub>1</sub>) of glucose is labelled with <sup>14</sup>C (specific activity of 10 mCi/mmol). After one round of glycolysis, the specific activity of radiolabelled pyruvate is:

Answers :

1. 0
2. 10
3. 5
4. 20

Question 76 :

*Helicobacter pylori* survives in the acidic environment of the stomach because it:

Answers :

1. has acid resistant cell wall
2. releases alkaline compounds
3. produces urease enzyme
4. uses acid as a nutrient

Question 77 :

During DNA replication the newly generated strand remains attached to the template. However, during transcription newly synthesized RNA dissociates from the template. This is achieved by:

Answers :

1. RNase H
2. RNA polymerase itself
3. DNA Polymerase
4. Spontaneous dissociation

Question 78 :

Rag1 null mice are susceptible to infection because:

Answers :

1. RAG1 is a protein involved in innate immune response
2. RAG1 is involved in gene rearrangement in all somatic cells
3. RAG1 is involved in gene rearrangement in T and B cells

4. RAG1 is involved in NK cell generation

Question 79 :

The restriction site for *Van91I* is 5' CCANNNN↓NTGG 3'. How many times can *Van91I* cut a 4 Mb bacterial genome with 50% GC content?

Answers :

1. ~1000 times
2. ~10 times
3. Once
4. ~100 times

Question 80 :

Phosphorylation of proteins is a typical post-translational modification which modulates their activities. Which one of the following amino acid residues can be phosphorylated?

Answers :

1. Glutamic acid
2. Lysine
3. Asparagine
4. Aspartic acid

Question 81 :

Positive and negative selection markers are utilized to screen for recombinants from wild type populations. Which one of the following can be used for negative selection in bacteria?

Answers :

1. Lac Z
2. β-lactamase
3. Sac B
4. Neomycin aminophosphotransferase

Question 82 :

A mammalian cell culture is treated with cycloheximide. Protein synthesis of cells after treatment was recorded through incorporation of labeled amino acids. In which of the following organelles will fresh protein synthesis be detected?

Answers :

1. Nucleus
2. ER
3. Mitochondria
4. Golgi

Question 83 :

A scientist aims to identify a binding site for a new transcriptional anti-terminator protein. Which one of the following techniques will be most appropriate for this experiment?

Answers :

1. Microarray
2. RNA Sequencing
3. RIP Sequencing
4. ChIP Sequencing

Question 84 :

Primer extension is a technique employed for mapping the:

Answers :

1. Translational start site
2. Transcription factor binding site
3. Transcription initiation site
4. Ribosome binding site

Question 85 :

UGA is **NOT** a stop codon in:

Answers :

1. Plant nuclear encoded proteins
2. Plant mitochondria
3. Yeast nuclear encoded proteins
4. Yeast mitochondria

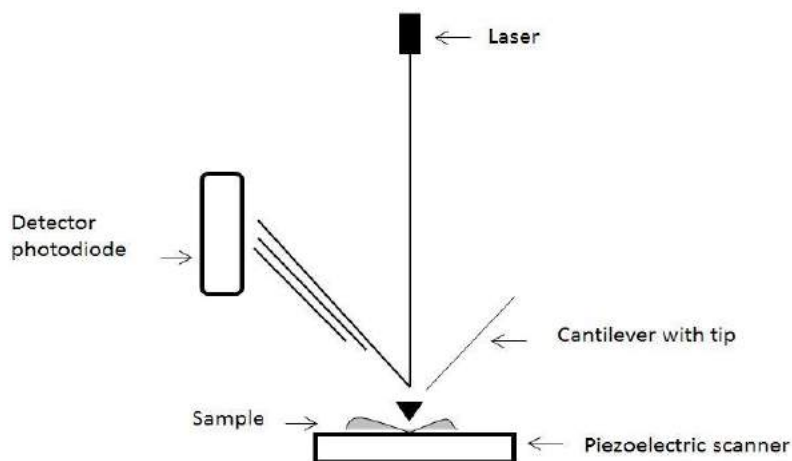
Question 86 :

A recombinant plasmid is introduced with adenovirus to specifically label liver cells with GFP. Which gene promoter will be most optimal for specific expression of GFP?

Answers :

1. Catalase
2.  $\alpha$ -Mannosidase
3. Cytochrome-P<sub>450</sub>
4. Amylase

Question 87 :



The schematic represents the basic structural components of a

Answers :

1. Cryo electron microscope
2. Confocal microscope
3. Atomic force microscope
4. Dark field microscope

Question 88 :

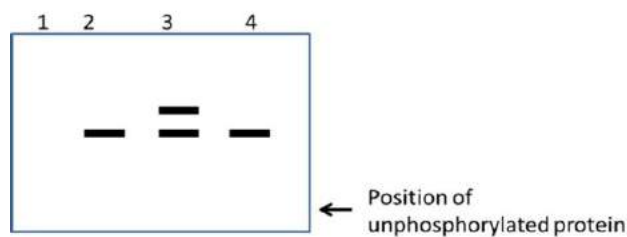
An *in vitro* translation system containing microsomes was used to translate an mRNA encoding a secretory protein lacking the stop codon. Which one of the following outcomes can be expected?

Answers :

1. The protein will not be translated
2. The protein translation will start but stop after some time
3. The protein will be fully synthesized but not incorporated into the microsomal membrane
4. The protein will be synthesized and incorporated into the microsomes but will not be released from the ribosomes

Question 89 :

The result of an *in vitro* phosphorylation assay of a protein using  $\gamma$ - $^{32}\text{P}$  ATP in the presence of various kinases is shown below. The bands represent phosphorylated proteins detected.



1. Lane 1: No kinase
2. Lane 2: Kinase 2
3. Lane 3: Kinase 2 followed by inactivation of kinase 2 and subsequent addition of kinase 3
4. Lane 4: Kinase 3 followed by inactivation of kinase 3 and subsequent addition of kinase 2

Based on the autoradiograph shown above it can be concluded that:

Answers :

1. The protein cannot be phosphorylated by any kinase
2. Kinase 3 phosphorylates two sites on the protein
3. Kinase 2 can phosphorylate the protein independent of kinase 3
4. Kinase 3 can phosphorylate the protein independent of kinase 2

Question 90 :

During subcellular fractionation, a protein is recovered in the membrane fraction. However, upon washing the membrane fraction with high salt, the protein is obtained in the soluble fraction. The mode of association of the protein with the membrane is via:

Answers :

1. A transmembrane domain
2. A covalent bond
3. Noncovalent bond
4. A lipid anchor

Question 91 :

Effective oral rehydration therapy requires the presence of both  $\text{Na}^+$  and glucose because the intestinal epithelial cells express a:

Answers :

1.  $\text{Na}^+$ -glucose symporter on their basolateral membrane
2.  $\text{Na}^+$ -glucose antiporter on their basolateral membrane
3.  $\text{Na}^+$ -glucose symporter on their apical membrane
4.  $\text{Na}^+$ -glucose antiporter on their apical membrane

Question 92 :

The Warburg effect in cancers refers to their ability to:

Answers :

1. Perform aerobic glycolysis
2. Perform anaerobic glycolysis
3. Promote angiogenesis
4. Promote angiogenesis and metastasis

Question 93 :

In a migrating cell the relative position of the \_\_\_\_\_ and the \_\_\_\_\_ determines the polarity of the cell.

Answers :

1. Nucleus, Golgi
2. Golgi, centriole
3. Nucleus, mitochondria
4. Golgi, mitochondria

Question 94 :

During apoptosis, lipid asymmetry is lost permitting Annexin V to bind to \_\_\_\_\_ in the outer leaflet of the plasma membrane.

Answers :

1. phosphatidylserine
2. phosphatidylcholine
3. Phosphatidylinositol
4. phosphatidylethanolamine

Question 95 :

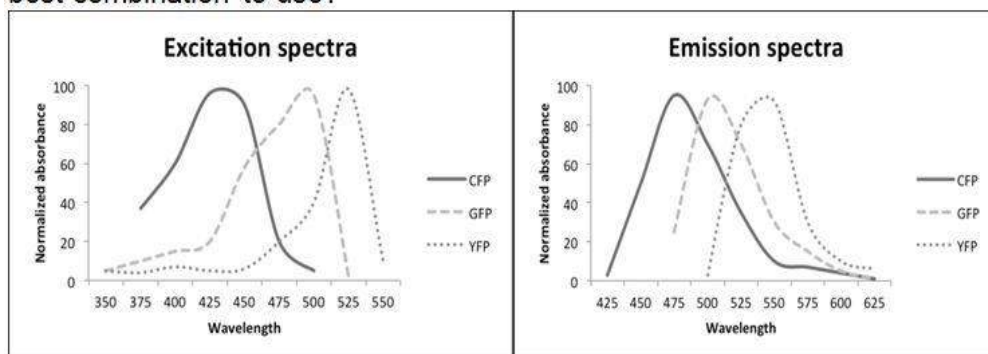
A cargo has to be delivered from the center of the cell to the cell periphery using the microtubule network. To which protein does it need to be associated with?

Answers :

1. Dynein
2. Kinesin
3. Microtubule associated protein 4
4. Myosin

Question 96 :

The graph below shows the excitation and emission spectra of three fluorophores: CFP, GFP and YFP. If you were to design an experiment to image two fluorescently labelled proteins inside the same cell, which is the best combination to use?



Answers :

1. CFP-GFP as they have overlapping excitation and emission spectra
2. CFP-YFP as they have maximally separate excitation and emission spectra
3. GFP-YFP as they have overlapping excitation and emission spectra
4. Any combination of CFP-GFP-YFP is suitable for imaging two proteins

Question 97 :

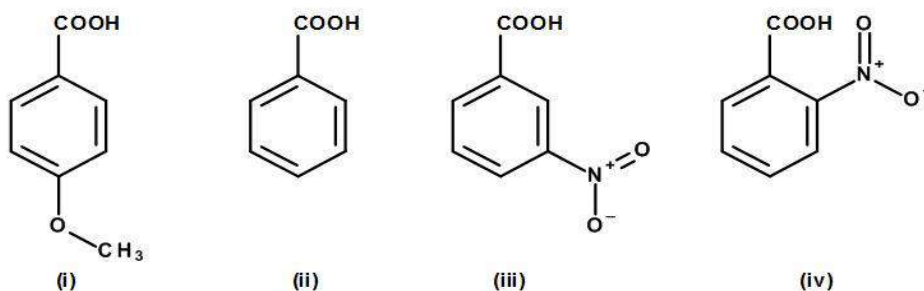
Deamination of which of the following bases will NOT be recognized by the DNA damage repair machinery?

Answers :

1. Cytosine
2. 5-Methyl cytosine
3. Adenine
4. Guanine

Question 98 :

Arrange the following compounds based on increasing order of acid strength:

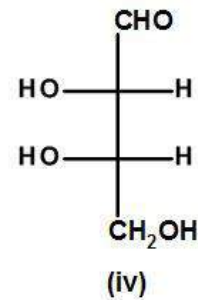
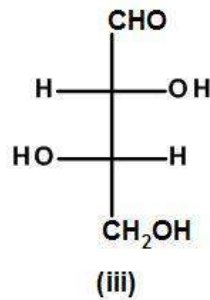
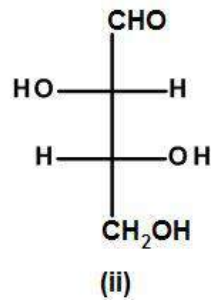
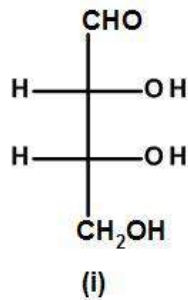


Answers :

1. (i) < (ii) < (iii) < (iv)
2. (i) < (ii) < (iv) < (iii)
3. (ii) < (i) < (iv) < (iii)
4. (iv) < (iii) < (ii) < (i)

Question 99 :

Which of the following compound(s) on oxidation gets converted into optically active tartaric acids?



Answers :

1. (ii) and (iii)
2. (i) and (iv)
3. (i), (ii) and (iv)
4. (i), (ii) and (iii)

Question 100 :

Normal bilirubin (4Z, 15Z isomer) undergoes structural isomerisation on absorption of blue-green light (460 – 490 nm). For this reaction, which one of the following statements is **TRUE**?

Answers :

1. It is fast and reversible
2. It is slow but reversible
3. It is fast but irreversible
4. It is slow and irreversible

Question 101 :

SCID mice lack T-cells owing to the:

Answers :

1. Absence of thymus
2. Defect in recombinase genes
3. Defect in expression of pre-TCR
4. Absence of terminal deoxynucleotide transferase

Question 102 :

Anti-human  $\mu$  chain antibody is specific for epitopes present in the:



Answers :

1. Constant region of the Ig molecule
2. Variable region of the Ig molecule
3. CDR region of the Ig molecule
4. Framework region of the Ig molecule

Question 103 :

Hapten-carrier hypothesis was useful in the designing of the vaccine for:

Answers :

1. *Polio myelitis*
2. *Vibrio cholerae*
3. *Haemophilus influenzae B*
4. *Corynebacterium diphtheriae*

Question 104 :

Tetanus toxoid is a protein that has been chemically treated to retain its:

Answers :

1. Toxicity and antigenicity
2. Toxicity and immunogenicity
3. Immunogenicity and not its toxicity
4. Antigenicity and not its toxicity

Question 105 :

Haemolytic disease of the new born called erythroblastosis fetalis commonly develops in mothers with repeated pregnancies owing to the activation of:

Answers :

1. IgG- secreting memory cells
2. IgE- secreting memory cells
3. Cytotoxic T-cells
4. Natural killer cells

Question 106 :

Human olfactory receptors are:

Answers :

1. Ionotropic receptors
2. G-protein coupled receptors
3. Thermoreceptors
4. Fc receptors

Question 107 :

Primary neurotransmitter that plays a role in sleep, appetite, arousal and mood is:

Answers :

1. Serotonin

2. Acetylcholine
3. Octopamine
4. Glutamate

Question 108 :

For some people it is a popular herb added in food for flavour, but for others it tastes like soap due to a mutation in OR6A2 receptor. The herb is:

Answers :

1. Basil
2. Mint
3. Cilantro
4. Parsley

Question 109 :

Chromosome complement of river vs swamp domestic water buffalo is:

Answers :

1. 50 vs 48
2. 52 vs 50
3. 60 vs 58
4. 48 vs 46

Question 110 :

Which one of the following animal diseases was officially declared eradicated by FAO in the year 2011?

Answers :

1. CBPP
2. Dourine
3. African horse sickness
4. Rinderpest

Question 111 :

Peste des petits ruminants (PPR) also known as “goat plague”, a viral disease of goats and sheep is caused by:

Answers :

1. Morbilli virus
2. Flavi virus
3. Reo virus
4. Astro virus

Question 112 :

Which of these is used as a **preferred** inhalation anaesthetic for laboratory animals?

Answers :

1. Isoflurane
2. Nitrous oxide
3. Anaesthetic ether
4. Methoxyflurane

Question 113 :

A1/A2 cow milk are genetic variants of the beta casein milk protein that differ by a single amino acid at position 67. The variants for A1 and A2 are:

Answers :

1. A1-Histidine vs A2-Proline
2. A1-Proline vs A2-Histidine
3. A1-Histidine vs A2-Tyrosine
4. A1-Tyrosine vs A2-Proline

Question 114 :

Dental formula of cattle older than 4 years is:

Answers :

1. 0/2, 0/0, 3/3, 3/3
2. 0/4, 0/0, 3/3, 3/3
3. 2/2, 0/0, 2/2, 4/4
4. 1/1, 0/0, 3/3, 2/2

Question 115 :

*In utero* microcephaly is caused by:

Answers :

1. Rota virus
2. HIV
3. Borna disease virus
4. Zika virus

Question 116 :

Labels on the tubes containing Fab and F(ab')<sub>2</sub> fragments of anti-SRBC were dislodged. Recommend one of the following techniques to identify the correct fragments in the tube:

Answers :

1. Agglutination with SRBC
2. Complement fixation assay with SRBC
3. Rocket electrophoresis with SRBC
4. Reducing SDS-PAGE followed by immunoblotting

Question 117 :

Two cell lines (Vero and SP2/O-Ag14) were cross contaminated. In order to confirm the homogeneity of the cell lines, which of the following approaches would you use?

Answers :

1. Comparative morphological examination of unstained or stained cells
2. Comparative assessment of chromosome number of the cell lines
3. Comparative cell-cycle analysis of the cell lines
4. Comparative flow cytometric analysis of the cell lines

Question 118 :

Match the genus listed in A with the features in B:

A	B
1. <i>Clostridium</i>	a. Nosocomial infection
2. <i>Streptococcus</i>	b. Growth in Thioglycollate broth
3. <i>Shigella</i>	c. Growth in Blood agar
4. <i>Pseudomonas</i>	d. Dysentery

Answers :

1. 1-b; 2-c; 3-d; 4-a
2. 1-a; 2-b; 3-c; 4-d
3. 1-d; 2-c; 3-a; 4-b
4. 1-c; 2-a; 3-b; 4-d

Question 119 :

Vitamin D3 formed in the skin is converted to 1,25-dihydroxycholecalciferol in the:

Answers :

1. Muscle and liver
2. Liver and kidney
3. Spleen and kidney
4. Bone and pancreas

Question 120 :

Recently US FDA approved CAR-T treatment is a

Answers :

1. Monoclonal antibody therapy
2. Cell therapy
3. Small molecule therapy
4. Photoactive agent based therapy

Question 121 :

$\beta$ - Glucans protect aquaculture organisms from various pathogenic strains because they:

Answers :

1. resemble aminoglycoside antibiotics and cause misreading of pathogenic mRNA.
2. enhance immune response and promote growth of prebiotic gut bacteria in aquaculture organisms.
3. adsorb phosphorous and nitrogen from water hampering further proliferation of pathogen strain.
4. are degraded by pathogenic strains to form toxic intermediates.

Question 122 :

Which one of the following is used for culturing *Perna viridis*?

Answers :

1. Raft culture with hanging ropes.
2. Offshore cages and Pens.
3. Irrigated or flow through tanks.
4. Multitrophic recirculatory canal culture cage.

Question 123 :

From the table below, match the pelagic zones with their respective depths and choose the correct option:

	<u>Ocean Zone</u>	<u>Depth</u>
I)	Mesopelagic	w) > 4000 to <6000m
II)	Bathypelagic	x) > 6000 m
III)	Abyssopelagic	y) >200 to <1000m
IV)	Hadopelagic	z) >1000 to <4000m

Answers :

1. I-x; II-w; III-y; IV-z
2. I-w; II-x; III-z; IV-y
3. I-z; II-y; III-x; IV-w
4. I-y; II-z; III-w; IV-x.

Question 124 :

Dead zones in oceans refer to:

Answers :

1. Mariana trench, the deepest part of ocean where living organisms have not been found.
2. hydrothermal vents that have extreme temperatures.
3. neritic zone at the extreme end of continental shelf that is devoid of sunlight.
4. oceanic regions that are extremely hypoxic due to substantial eutrophication.

Question 125 :

Gynogenesis in fishes is achieved by:

Answers :

1. Heat shock treatment at 42°C for 5 min after normal fertilization.
2. Cold shock treatment at 5°C for 10 min after normal fertilization.
3. Fertilization of egg with UV-irradiated sperm followed by heat shock treatment.
4. Treatment of fertilized eggs with cytochalasin.

Question 126 :

A wastewater sample has COD of 1 g/L of which 80% is the BOD. During partial aerobic oxidation only 200 mg of COD was converted to CO<sub>2</sub> and H<sub>2</sub>O. The remaining BOD (mg/L) is:

Answers :

1. 800
2. 200
3. 600
4. 1000

Question 127 :

A microbial community has grown on starch anaerobically and it produced a mixture of metabolites with the following composition: glucose, disaccharides, acetate, butyric acid, butanol and carbon dioxide. This microbial community is comprised of:

Answers :

1. *E. coli*, *Clostridium*, *Methanosarcina*
2. *E. coli*, *Bacillus*, *Saccharomyces*
3. *Acetobacter*, *Bacillus*, *Methanosarcina*
4. *Methanosarcina*, *Methanococcus*, *E. coli*

Question 128 :

In an air sample, 12% particulate matter is of around 25 nm size, 35% around 10 nm, 30% around 5 nm and remaining are 2.5 nm or smaller. The respiratory particulate matter in this sample is:

Answers :

1. 53%
2. 65%
3. 47%
4. 23%

Question 129 :

A mixture of food waste on inorganic analysis was found to contain Cl<sup>-</sup>, SO<sub>4</sub><sup>-</sup>, NO<sub>3</sub><sup>-</sup>, NH<sub>4</sub><sup>+</sup> ion. Successful anaerobic digestion by a mixed microbial community will result in biogas having the following gases:

Answers :

1. N<sub>2</sub>, CO<sub>2</sub>, O<sub>2</sub>, H<sub>2</sub>
2. CH<sub>4</sub>, CO<sub>2</sub>, N<sub>2</sub>, H<sub>2</sub>S
3. CH<sub>4</sub>, CO<sub>2</sub>, N<sub>2</sub>, H<sub>2</sub>S, H<sub>2</sub>
4. H<sub>2</sub>, CO<sub>2</sub>, N<sub>2</sub>, H<sub>2</sub>S, Cl<sub>2</sub>

Question 130 :

A bioremediation mesocosm experiment has been carried out on a plot with 250 ppm aromatic molecules as contaminants. After 15 days the level of aromatic molecules came down to 100 ppm at a temperature of 48 ± 2°C. The electrical conductance of this site has increased over time because of the

Answers :

1. Accumulation of NaCl
2. Evaporation of aromatics
3. Increase in organic acids
4. Production of CO<sub>2</sub>

Question 131 :

Internal coordinates for representation of the three-dimensional structure of a protein consists of:

Answers :

1. bond lengths, bond angles and dihedral angles
2. Cartesian coordinates X, Y and Z for all the atoms
3. spherical polar coordinates R,  $\theta$ ,  $\Phi$  for all atoms
4. all possible inter atomic distances

Question 132 :

*Cis*-peptide unit corresponds to the O-C-N-H dihedral angle (degrees) of:

Answers :

1. 0
2. -60
3. 120
4. 180

Question 133 :

Which of the following corresponds to the amino acid pair having maximum and minimum number of allowed conformations in the Ramachandran plot?

Answers :

1. Max: Gly, Min: Pro
2. Max: Pro, Min: Gly
3. Max: Ala, Min: Lys
4. Max: Lys, Min: Ala

Question 134 :

If the energy of a protein structure is calculated using molecular mechanics forcefield, which of the following energy components **CANNOT** have a negative value?

Answers :

1. Bond energy
2. Dihedral energy
3. van der Waals energy
4. Electrostatic energy

Question 135 :

X, Y and Z correspond to three different conformers of an 18-residue peptide, where X:  $\alpha$  helix, Y:  $\beta$  strand and Z:  $3_{10}$  helix. Which of the following correspond to the conformers in the decreasing order of end to end distance?

Answers :

1. Y, Z, X
2. X, Y, Z
3. Z, X, Y
4. Y, X, Z

Question 136 :

Which one of the following protein structure prediction methods is based on the principle of locating lowest energy minimum in the conformation space of a protein?

Answers :

1. *Ab initio* structure prediction
2. Threading
3. Fold prediction
4. Homology modeling

Question 137 :

Which one of the following can be used to measure the extent of similarity between the predicted structure of a protein and its experimentally determined structure?

Answers :

1. Root mean square deviation (RMSD)
2. Radius of gyration
3. Solvent accessibility of amino acids
4. Tanimoto coefficient

Question 138 :

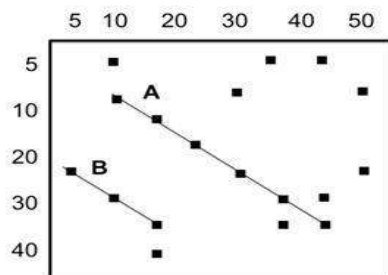
The PROSITE pattern representing the conserved sequence motif for a new family of AMP binding protein is [LIVMFY]-X(2)-[STG]-[STAG]-G-[ST]. You are given a sequence of a 15-amino acid stretch starting from the first residue of the motif. Which one of the following proteins is likely to have AMP binding function?

Answers :

1. LIVMFYNGSTGSTAG
2. MAGTAGSEGYIRHHC
3. LIVMFYSTGSTAGGS
4. LSSTAYTTSALKAAA

Question 139 :

Dot matrix analysis of the amino acid sequences of lambda phage cI (horizontal sequence) and phage P22 c2 (vertical sequence) repressors is shown below. Which one of the following is correct?





Answers :

1. Line A indicates similar sequences and Line B indicates repeat sequences
2. Line B indicates similar sequences and Line A indicates repeat sequences.
3. Line A indicates similar sequences and Line B indicates inverted repeat sequences
4. Line B indicates similar sequences and Line A indicates inverted repeat sequences.

Question 140 :

An alignment of two protein sequences showing matches, mismatches and gaps ( $\Delta$ ) is given below:

```
Sequence A    A G  $\Delta$   $\Delta$  C D E V I G
Sequence B    A G E Y C D  $\Delta$  V I G
```

The similarity score (%) for the above alignment will be:

Answers :

1. 14
2. 86
3. 70
4. 100

Question 141 :

Which one of the following is a depiction of the GenBank sequence entry format?

Answers :

1. 

```
>YCZ2_YEAST protein in HMR 3' region
MKAVVIEDGKAVVKEGVPIPELEEGFV
GNPTDWAHIDYKVG PQSILG CDAAGQG*
BASE COUNT 215 A 224 G 263 G 250 T
ORIGIN
Filename, Length of sequence, Date,...
1 GAATTCGATA AATCTCTGGT TTATTGTGCA
51 CTTTGCTGTA AGCATAACTG CAGGGGGCGG
```
2. 

```
>P1; ILEC
lexA repressor - Escherichia coli
MKALTARQQEVFDLIRDHISQTGMPPTRAE
IAQRLGFRSPNAAEEHLKALARKGVIEIVS
```
- 3.

```

LOCUS      name of locus, length and type of sequence.
           classification of organism, data of entry
DEFINITION description of entry
KEYWORDS   key words for cross referencing this entry
SOURCE     ...
ORGANISM   ...
REFERENCE  ...
COMMENT    ...
FEATURES   ...
BASE COUNT ...
ORIGIN     text indicating start of sequence
1  GAATTCGATA AATCTCTGGT TTATTGTGCA
51 CTTTGCTGTA AGCATAACTG CAGGGGGCGG
//

```

4.

Question 142 :

Two sequences of comparable length have several regions that align locally, but are separated by other regions that align poorly. Which algorithm can be used to find the highest-scoring alignment between the two sequences?

Answers :

1. Smith-Waterman algorithm
2. Needleman-Wunch algorithm
3. BLAST
4. PHI-BLAST

Question 143 :

A sample genetic code is given below:

Amino Acid	Pro	Val	Gly	His	Asp	Tyr	Thr	Lys
Codon	CCN	GUN	GGN	CAY	GAY	UAY	CAN	AAR

If an amino acid substitution matrix based on genetic code is derived for sequence alignment and analysis from evolutionary studies, which one of the following is **TRUE**?

Answers :

1. Pro is most similar to His
2. Pro is most similar to Thr
3. Gly is most similar to Lys
4. Asp is most similar to Thr

Question 144 :

Which one of the following tools can reliably establish an evolutionary link between two proteins and align them even if they share very low degree of sequence similarity?

Answers :

1. BLAST
2. PSI-BLAST
3. ClustalW
4. FASTA

Question 145 :

Of the two databases A and B, the database A is larger in size than database B. In a BLAST search, a sequence has a highly significant match with the same entry in both the databases. Which of the following is **TRUE**?

Answers :

1. Match in Database A will have lower E-value when compared to Database B
2. Match in Database B will have lower E-value when compared to Database A
3. The E-value will be same for both the matches
4. The E-value cannot be compared for such a search

Question 146 :

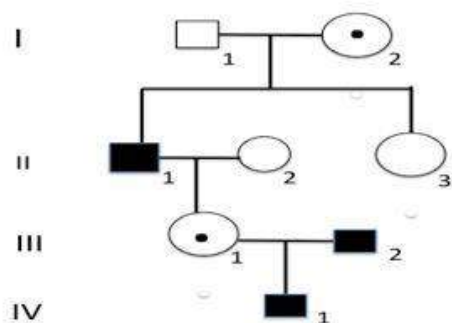
Parents who appear normal have a child with sickle cell anemia, which is an autosomal recessive trait. The woman becomes pregnant again and is told that she is carrying fraternal twins. What is the probability that both the twins will develop sickle cell anemia?

Answers :

1. 1/16
2. 1/4
3. 1/2
4. 9/16

Question 147 :

The following pedigree shows the inheritance of a human disease. What is the most likely mode of inheritance for this trait and what is the probability that a son of III 1 would be affected by the disease, if III 1 is known to be a carrier.



Answers :

1. Sex-linked recessive; 0.75
2. Autosomal recessive; 0.5
3. Autosomal dominant; 0.75
4. Sex-linked recessive; 0.5

Question 148 :

A 30 Kb candidate gene linked to prostate cancer from a patient was digested with *Xho*I. Following Southern hybridization of the digested products with the full-length gene probe, three bands of 15,

10 and 5 Kb sizes were obtained. However, an identical experiment in normal individuals gave a 15 Kb fragment. This could be due to:

Answers :

1. Presence of SNP in the candidate gene
2. Deletion of a fragment of DNA from the candidate gene
3. The probe could not identify the 10 and 5 Kb fragments
4. The probe could only identify the 15 Kb fragment

Question 149 :

In a given population, 1 out of 400 individuals has cancer caused by a recessive allele ' $p$ '. Assuming the population is in Hardy-Weinberg equilibrium, what is the expected proportion of individuals who carry the ' $p$ ' allele but do not develop cancer?

Answers :

1. 1/400
2. 19/400
3. 20/200
4. 38/400

Question 150 :

Color blindness in human beings is an X-linked trait. A color-blind man has a 45, X daughter who is also color-blind. The nondisjunction that leads to the 45, X daughter occurred in which parent and in which meiotic division?

Answers :

1. Father; First meiotic division
2. Brother, father and mother; first meiotic division
3. Mother; first meiotic division
4. Father; second meiotic division

Question 151 :

A marker present outside the targeted QTL used to check the crossing over is called:

Answers :

1. Peak marker
2. Background marker
3. Recombinant marker
4. Foreground marker

Question 152 :

Linkage disequilibrium (LD) decay is:

Answers :

1. Much rapid in out-crossing than in selfing species
2. Much rapid in selfing than in out-crossing species
3. Equal in selfing and out-crossing species

4. Not dependent on selfing or out-crossing

Question 153 :

'Gene for gene' hypothesis states that:

Answers :

1. For each resistance gene in the host there is a corresponding gene for virulence in the pathogen conferring host resistance
2. For each resistance gene in the host there is a corresponding gene for avirulence in the pathogen conferring host resistance
3. For each resistance gene in the host there is a corresponding gene for aggressiveness in the pathogen conferring host resistance
4. For each resistance gene in the host there is a corresponding gene for non-aggressiveness in the pathogen conferring host resistance

Question 154 :

In an ordered tetrad analysis, if the two genes are not linked, the ..... will be almost equal.

Answers :

1. Parental ditype and non-parental ditype
2. Parental ditype and tetratype
3. Tetratype and non-parental ditype
4. Parental ditype, non-parental ditype and tetratype

Question 155 :

Assume that a marker M1 is present 5 cM away on one side of a gene "X" (a desirable allele of the gene), while marker M2 is present 10 cM away on the other side of the gene. The donor's genotype is M1M1XXM2M2, while the recipient has m1m1xxm2m2 genotype. A cross was made between these two individuals. The F<sub>1</sub> is crossed to recipient. The progeny of this cross had 1000 plants. How many plants from this progeny will have both the markers (M1 & M2) present while the desired gene is absent? (Assume no interference)

Answers :

1. 0
2. 5
3. 10
4. 15

Question 156 :

Maize transgenic for bacterial *CspA* (a RNA chaperone) imparts tolerance to:

Answers :

1. Water stress
2. High temperature stress
3. Salt stress
4. Nutrient stress

Question 157 :

Assume gene "A" is dominant over "a" and "B<sup>1</sup>" is codominant over "B<sup>2</sup>" in petunia. A cross is made between two individuals – AAB<sup>1</sup>B<sup>2</sup> x aaB<sup>1</sup>B<sup>2</sup>. Assuming that there is no gene interaction, the progeny will segregate in a phenotypic ratio of:

Answers :

1. 9:3:3:1
2. 1:1:1:1
3. 1:2:1
4. 3:1

Question 158 :

A multiline variety is:

Answers :

1. a mixture of isogenic lines that usually confer resistance to a specific disease
2. a single genotype with stacked multiple genes conferring resistance to a specific disease
3. a mixture of pure lines having different traits
4. a collection of germplasm lines

Question 159 :

A variety "X" is a donor for resistance to blast, but it has an undesirable gene for lodging susceptibility that is tightly linked to the blast resistant gene. The best breeding method which has high probability of breaking this linkage is:

Answers :

1. Pedigree method
2. Bulk method
3. Single seed decent method
4. Backcross method

Question 160 :

Upon application of the inhibitor, DBMIB (Dibromothymoquinone) which one of the following events in the chloroplast electron transport chain will **NOT** take place?

Answers :

1. Reduction of reaction centre Q<sub>A</sub>
2. Reduction of Plastocyanine (PC)
3. Reduction of Cyt<sub>b</sub><sub>6</sub>f
4. PQ will remain oxidized

Question 161 :

The reduction phase of Calvin-Benson cycle in *Arabidopsis* is inhibited. This can be attributed to the inactivation of:

Answers :

1. Aldolase
2. Triose phosphate isomerase
3. Fructose-1,6-bisphosphatase

4. 3-Phosphoglycerate kinase

Question 162 :

Sucrose-phosphate synthase (SPS) is inhibited by SPS-kinase and activated by SPS-phosphatase. It is known that a high ratio of Glucose-6-phosphate to inorganic phosphate maintains SPS in its active form. Which one of the following statements is true?

Answers :

1. Glucose-6-phosphate inhibits SPS-phosphatase
2. Inorganic phosphate activates SPS-kinase
3. Glucose-6-phosphate inhibits SPS-kinase
4. Inorganic phosphate activates SPS-phosphatase

Question 163 :

The bacterial flagellin activates a typical MAPK cascade consisting of MEKK1-MKK4-MPK6 leading to the activation of ACS6 enzyme involved in ethylene biosynthesis in plants. Which one of the following events will be true in a transgenic *Arabidopsis* plant overexpressing the constitutively active form of MKK4?

Answers :

1. Ethylene responsible genes will be less transcribed in the presence of flagellin stimuli
2. MPK6 will not get activated in the absence of flagellin
3. Flagellin stimuli are not required for the activation of ACS6
4. Flagellin stimuli will be required for ethylene biosynthesis

Question 164 :

Which one of the following statements is correct during gibberellic acid (GA) signal transduction in plants?

Answers :

1. DELLA protein stimulates GA response
2. GID1 does not make complex with DELLA protein
3. Degradation of DELLA protein by 26S proteasomal pathway
4. GID1 proteins get degraded by 26S proteasomal pathway

Question 165 :

In *CLAVATA* (*clv*) mutant of *Arabidopsis*, Shoot Apical Meristem (SAM) size and expression of *WUSCHEL* (*WUS*) is increased. SAM size is reduced in *wus* mutant plants. Choose the correct statement regarding the function of these two genes:

Answers :

1. CLV positively regulate WUS expression and negatively regulate SAM size
2. CLV negatively regulate WUS expression and WUS positively regulate SAM size
3. WUS negatively regulate SAM size and CLV expression
4. WUS and CLV independently regulate SAM size

Question 166 :

Any DNA fragment can be used as a STS marker provided it fulfills one of the following conditions:

Answers :

1. Multilocus nature
2. Single copy
3. Present in repeat regions
4. Telomeric region

Question 167 :

Which one of the following conditions eliminates the possibility of horizontal gene transfer from a transgenic plant?

Answers :

1. Single copy nuclear events
2. Multicopy nuclear events
3. Plastid transformation events
4. Marker free events

Question 168 :

Which one of the following transposition events would increase the DNA content in a given cell?

Answers :

1. *Ac/Ds* elements
2. *Mu* elements
3. *P* elements
4. LINEs

Question 169 :

Flower development in plants is regulated by the ABC model of gene regulation. Members of this gene family are characterized by which one of the following domains?

Answers :

1. C box
2. MADS box
3. WRKY
4. NAC

Question 170 :

In which one of the following PCR assays only one primer is used for amplification?

Answers :

1. SSR
2. SCAR
3. ISSR
4. CAPS

Question 171 :

Gaps in certain regions of the genome have been observed upon sequencing of a xerohalophyte. Which one of the following databases will **NOT** be of any use in filling up these gaps?



Answers :

1. EST database
2. Full length cDNA database
3. RefSeq database
4. QTL database

Question 172 :

One of the most popular genes used for developing rice tolerant to flooding stress is:

Answers :

1. Sub1A
2. LEA
3. HSP70
4. DREB1A

Question 173 :

“Refugia” is a practice commonly employed to control

Answers :

1. Diptera
2. Coleoptera
3. Development of resistance in insects
4. *Bacillus thuringiensis*

Question 174 :

Oat seeds will usually **NOT** germinate when exposed to Red (R) and Far red (FR) light in the following order:

Answers :

1. R → FR → R
2. FR → R → FR
3. R → FR → R → FR → R
4. FR → R → FR → R

Question 175 :

*Vir* genes are necessary for the transfer of the T-DNA into the host genome. The product of which one of the following genes is tightly associated with the 5' end of the T-strand and helps in nuclear targeting?

Answers :

1. *Vir A*
2. *Vir G*
3. *Vir E*
4. *VirD2*

Question 176 :

A microorganism following Monod kinetics is grown in a chemostat with working volume of 5 L and inlet substrate concentration of 1g/L. If the  $\mu_{\max}$  and  $K_s$  of the organism are  $0.5 \text{ h}^{-1}$  and  $0.25\text{g/L}$  respectively, washout occurs when the flow rate ( $\text{L}\cdot\text{h}^{-1}$ ) exceeds

Answers :

1. 0.5
2. 1
3. 2
4. 2.5

Question 177 :

How does the rate of a typical chemical reaction vary as a function of temperature?

Answers :

1.  $k = A.e^{-\Delta E/RT}$
2.  $k = A.\ln(\Delta E/RT)$
3.  $k = A.e^{-RT/\Delta E}$
4.  $k = A.(\Delta E/RT)$

Question 178 :

An enzyme follows Michaelis-Menten kinetics with the following parameters:  $V_{max} = 5$  mM/s and  $K_m = 2.5$  mM. The reaction velocity would be:

Answers :

1. 2.5 mM/s at all substrate concentration
2. equal to  $V_{max}$  at all substrate concentration
3. 1.67 mM/s at a substrate concentration of 1.25 mM
4. 5 mM/s at a substrate concentration of 2.5 mM

Question 179 :

A high cell density fermentation produces recombinant protein product which is 20% of the total cellular protein. The final cell density is 80 OD (1 OD = 0.4g of dry cell wt/L of which 50% is total cellular protein). Then the product concentration (g/L) is:

Answers :

1. 2.4 g/l
2. 3.2 g/l
3. 4.8 g/l
4. 6 g/l

Question 180 :

In a plug flow bioreactor running at steady state, 12.5% cells are recycled back to the inlet. If the cells grow at  $\mu_{max} = 1$  h<sup>-1</sup> throughout the length of the reactor (L=124 cm), then the flow velocity should be

Answers :

1. 0.5 cm/min
2. 1cm/min
3. 1.5 cm/min
4. 2cm/min

Question 181 :

In a CSTR, first order reaction takes place converting A to B. If at a dilution rate  $(D) = 0.5 \text{ h}^{-1}$ , 50% of A gets converted to B, then the rate constant 'k' of the reaction is:

Answers :

1.  $0.5 \text{ h}^{-1}$
2.  $1.0 \text{ h}^{-1}$
3.  $0.25 \text{ h}^{-1}$
4.  $2.0 \text{ h}^{-1}$

Question 182 :

In a continuous crystallizer, 100 g of a saturated solution of sugar at 85% (w/w) enters the crystallizer and leaves the crystallizer at 70% (w/w). The weight of input solids converted to crystals (g) in the crystallizer is

Answers :

1. 30
2. 50
3. 70
4. 85

Question 183 :

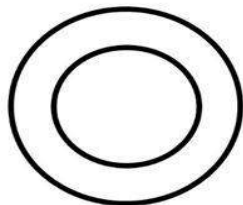
We wish to produce a metabolite 'X' whose biosynthetic pathway is feedback inhibited in the wild type strain. A mutation, which leads to overproduction of X, is discovered in the gene coding for a homodimeric enzyme which catalyses the first step in the biosynthetic pathway of 'X'. This mutation is most likely to occur at:

Answers :

1. the catalytic active site
2. the regulatory site
3. the point of contact between the two monomers
4. in the random coil structure of the protein

Question 184 :

A new spherical resin (of radius  $300 \mu\text{m}$ ) has been developed in which only the outer layer is activated to a depth of  $100 \mu\text{m}$  (as shown in figure). The fraction of the activated volume is:



Answers :

1.  $1/3$
2.  $4/9$
3.  $8/9$

4. 19/27

Question 185 :

In a fed batch cultivation, a specific growth rate of 0.2/h needs to be maintained. At the start of fed-batch cultivation, 200 mL/h of media is fed to 1000 mL of working volume. Quasi steady state shall be obtained if:

Answers :

1. flow rate/volume is kept constant at 0.2/h
2. flow rate/volume increases exponentially with time
3. flow rate increases linearly with time
4. flow rate is kept constant

Question 186 :

A recombinant protein is produced in *Escherichia coli* by two stage continuous cultivation at steady state. Upon induction of the culture in stage II, the specific growth rate of the culture decreased considerably. For an input flow rate in stage I of 100mL/h, a steady rate of product formation can only be obtained

Answers :

1. when stage I is larger than stage II
2. when stage I is smaller than stage II
3. when both the stages are of the same size
4. for all possible ratios of the sizes of the two stages

Question 187 :

Consider the scale up of a fermentation from a 10 L to 10,000 L while maintaining geometric similarity. Agitation speed was maintained at 500 rpm in the 10 L fermenter. If scale up is done based on constant tip speed, then the agitation speed in the larger reactor should be .....rpm

Answers :

1. 5000
2. 500
3. 50
4. 5

Question 188 :

A culture can grow independently in two carbon sources, glucose and hexadecane. Identify which one of the following statements is **TRUE**?

Answers :

1. The biomass growth yield is more in hexadecane than in glucose
2. The biomass growth yield is lower in hexadecane than in glucose
3. The oxygen consumed is higher for glucose when compared to hexadecane
4. The CO<sub>2</sub> produced will be more in glucose than in hexadecane

Question 189 :

In mammalian cell culture based monoclonal antibody production, perfusion culture is preferred over continuous stirred tank culture, because the process results in:

Answers :

1. high volumetric productivity
2. high specific productivity per unit biomass
3. maintaining cells in active phase of production
4. retaining the product of interest in the reactor so that higher product concentration is obtained at the end of the process.

Question 190 :

A liquid stream is cooled from 80°C to 30°C in a double pipe heat exchanger as illustrated below:



Fluid flowing counter currently with this stream is heated from 15°C to 30°C. Calculate the log mean temperature difference.

Answers :

1. 18.1° C
2. 29.1° C
3. 19.6° C
4. 32.5° C

Question 191 :

In a typical fermentation process the volumetric oxygen transfer coefficient ( $K_La$ ) of the system was found to increase after the addition of antifoam agent. The most probable reason for this is:

Answers :

1. the mass transfer coefficient of oxygen ( $K_L$ ) was increased
2. the interfacial area per unit volume ( $a$ ) was decreased
3. The increase in the value of oxygen transfer coefficient more than compensated the decrease in the interfacial area per unit volume so that the overall value of  $K_La$  was increased
4. The increase in the interfacial area per unit volume more than compensated the decrease in oxygen transfer coefficient so that overall value of  $K_La$  was increased

Question 192 :

In a batch microbial fermentation process the dissolved oxygen concentration (DOC) remains almost zero during growth. Which of the following methods will you use for the estimation of oxygen transfer rate while the fermentation is in progress?

Answers :

1. Static gassing out method
2. Dynamic gassing out method
3. Oxygen balance method
4. Sulfide oxidation method

Question 193 :

Two columns of 1 m and 2 m height and of equal diameter are packed with beads containing immobilized enzyme. Substrate was fed to these two columns at flow rates of 10 mL/min (1 m column) and 20 mL/min (2 m column) and the corresponding conversion efficiencies obtained were 30% and 40% respectively. This demonstrates that the reaction is:

Answers :

1. controlled by external mass transfer
2. controlled by internal mass transfer
3. a first order enzymatic reaction
4. a zero order enzymatic reaction

Question 194 :

A food package label displays composition of the food product in g/100g as: protein = 8g, fat= 20g, carbohydrate= 60g (of which sugar is 20g). The calorific value of this product before and after complete replacement of sugar (w/w) by a non-calorific sweetener would be:

Answers :

1. 352 Cal/100g, 272 Cal/100g
2. 452 Cal/100g, 212 Cal/100g
3. 432 Cal/100g, 352 Cal/100g
4. 452 Cal/100g, 372 Cal/100g

Question 195 :

Two sucrose solutions 'A'= 30g/100g and 'B'= 60 g/100 g have to be mixed to prepare 1 kg of 50g/100g sugar syrup. The amounts of 'A' and 'B' solutions to be mixed would be:

Answers :

1. 333 g A + 667 g B
2. 667 g A + 333 g B
3. 500 g A + 500 g B
4. 400 g A + 600 g B

Question 196 :

A food product having water activity of 0.6 is exposed to conditions of 30°C and 70% R.H. This product will tend to \_\_\_\_\_

Answers :

1. Gain moisture
2. Lose moisture
3. Neither gain, nor lose moisture
4. Initially lose, then gain moisture

Question 197 :

The driving force for mass transfer by molecular diffusion is the difference in

Answers :

1. Potential energy
2. Vapour pressure

3. Gibbs free energy
4. Chemical potential

Question 198 :

Sedimentation efficiency depends on the relative strength of :

Answers :

1. Drag versus centrifugal force
2. Drag versus gravitational force
3. Gravitational versus centrifugal force
4. Gravitational versus electrostatic force

Question 199 :

In anaerobic lactic acid fermentation by bacteria, glucose is partially oxidised to pyruvate followed by reduction to lactate:

Answers :

1. for maintaining proton motive force
2. for cofactor balancing
3. to decrease pH
4. to generate more ATP

Question 200 :

Which one of the following is NOT used for partition based bio-separation?

Answers :

1. Solvent extraction
2. Electrodialysis
3. Salting out
4. Adsorption chromatography

**Answer Key for Biotechnology Eligibility Test (BET)– 2018**

Question Number	Correct Answer
1	3
2	2
3	3
4	3
5	4
6	4
7	3
8	2
9	2
10	2
11	3
12	3
13	2
14	3
15	2
16	3
17	4
18	2
19	1
20	3
21	1
22	1
23	1
24	1
25	2
26	1
27	2
28	4
29	1
30	4
31	1
32	1
33	3
34	2
35	4
36	4
37	3
38	2
39	2

40	2
41	1
42	3
43	4
44	3
45	4
46	1
47	4
48	2
49	4
50	2
51	2
52	2
53	3
54	3
55	3
56	4
57	1
58	4
59	4
60	4
61	1
62	3
63	3
64	2
65	1
66	2
67	3
68	4
69	4
70	2
71	3
72	3
73	2
74	3
75	3
76	3
77	2
78	3
79	1
80	4



81	3
82	3
83	3
84	3
85	4
86	3
87	3
88	4
89	3
90	3
91	3
92	1
93	1
94	1
95	2
96	2
97	2
98	1
99	1
100	4
101	2
102	1
103	3
104	3
105	1
106	2
107	1
108	3
109	1
110	4
111	1
112	1
113	1
114	2
115	4
116	1
117	2
118	1
119	2
120	2
121	2
122	1

123	4
124	4
125	3
126	3
127	1
128	4
129	3
130	3
131	1
132	1
133	1
134	1
135	1
136	1
137	1
138	2
139	1
140	3
141	4
142	2
143	2
144	2
145	2
146	1
147	4
148	1
149	4
150	3
151	3
152	1
153	2
154	1
155	2
156	1
157	3
158	1
159	4
160	3
161	4
162	3
163	3
164	3

165	2
166	2
167	3
168	4
169	2
170	3
171	4
172	1
173	3
174	2
175	4
176	3
177	1
178	3
179	2
180	2
181	1
182	2

183	2
184	4
185	1
186	2
187	3
188	1
189	1
190	2
191	4
192	3
193	1
194	4
195	1
196	1
197	4
198	2
199	2
200	2

The Bionics

**PART A**

1. The major difference between hormones that have intracellular receptors and those that have cell membrane receptors is that the former is usually:

- a. Charged
- b. Hydrophilic
- c. Glycosylated
- d. Hydrophobic

*Ans. d*

2. A patient suffering from allergy has been advised to take anti-histamine drugs. Which one of the following biological processes is most likely to be the reason for the allergy?

- a. Mast cell degranulation
- b. Thymocyte maturation
- c. Somatic hypermutation
- d. Bystander lysis

*Ans. a*

3. Which one of the following statements is **NOT TRUE** for an enhancer element?

- a. it can be downstream of the gene it regulates
- b. it can only regulate a nearby gene
- c. it can be upstream of the gene it regulates
- d. it can be within the intron of the gene

*Ans. b*

4. Which one of the following statements about alleles is **NOT TRUE**?

- a. They may occupy different loci in the same chromosome
- b. There may be several at one locus
- c. One may be dominant over another
- d. They may show co-dominance

*Ans. a*

5. Allele 'A' is dominant over allele 'a' and results in dark skin pigmentation. In a mating of Aa with Aa, if 6 offspring are produced, the probability of all having dark pigment is:

- a. 0.18
- b. 0.75
- c. 0.24
- d. 0.12

*Ans. a*

6. A bacterial culture grown in a medium containing radioactive sulphur would incorporate the radiolabel in the tetra-peptide:

- a. serine-cysteine-tyrosine-methionine.
- b. threonine-lysine-aspartic acid-glutamic acid.
- c. alanine-proline-histidine-glycine.
- d. tryptophan-phenylalanine-valine-isoleucine

*Ans. a*

7. Of the dsDNA sequences given below, the sequence that is expected to have a higher melting temperature is:

- a. ATGACATTATTACATTAGTG
- b. GCGCGTGCATGCCCGATGCC
- c. ATTATTATACGTATTTATAT
- d. CGCGATCGGGATTACGAGC

*Ans. b*

8. A peptide of sequence -SHELRL- is isolated from bacteria. Which one of the following options lists the possible phosphorylation site in this peptide?

- a. H
- b. L
- c. R
- d. E

*Ans. a*

9. Competitive inhibition of an enzyme can be reduced by:
- Reducing the amount of the substrate
  - Increasing the amount of the substrate
  - Decreasing the amount of the enzyme
  - Diluting the reaction mixture
- Ans. b*
10. The sequence of first strand of DNA obtained after reverse transcription of a bacterial mRNA is the same as:
- Anti-sense DNA strand
  - Sense DNA strand
  - mRNA
  - Anti-sense RNA
- Ans. a*
11. Statins inhibit biosynthesis of:
- Prostaglandins
  - Leukotrienes
  - Serotonin
  - Cholesterol
- Ans. d*
12. A fetus with which one of the following karyotypes will **NOT** survive at birth?
- 45, Y
  - 47, XY+13
  - 45, X
  - 47, XY+21
- Ans. a*
13. If a cell carries 21 pairs of chromosomes just after completion of mitotic telophase, how many chromatids will be there in metaphase?
- 21
  - 42
  - 84
  - 168
- Ans. c*
14. Molecular mass of a protein **CANNOT** be determined by:
- MALDI-TOF
  - Gel filtration Chromatography
  - Chromatofocusing
  - SDS-PAGE
- Ans. c*
15. Lack of reactivity to self HLA is known as?
- Autoimmunity
  - Complement fixation
  - Clonal selection
  - Tolerance
- Ans. d*
16. The frequency of two alleles in a population is 0.19 (*B*) and 0.81(*b*). If the population is in Hardy-Weinberg equilibrium, what will be the percentage of heterozygous individuals in the population?
- 62%
  - 38%
  - 31%
  - 19%
- Ans. c*

17. Which one of the following intermediate filament proteins is present in the nucleus?
- Vinculin
  - Lamin
  - Nestin
  - Laminin
- Ans. b*
18. All the DNA strands of a cell containing 4 chromosomes are labelled. After one division how many chromosomes in the daughter cell will have labelled DNA?
- 1
  - 2
  - 4
  - 8
- Ans. c*
19. Which one of the following statements is **INCORRECT** about facilitated diffusion?
- Its rate is higher than simple diffusion.
  - The partition coefficient of the solute is irrelevant for it.
  - It can be saturated at high concentration of the solute.
  - It works against the concentration gradient.
- Ans. d*
20. Variable number of tandem repeats (VNTR) in DNA molecule are highly useful in:
- Fingerprinting
  - Footprinting
  - Gene annotation
  - DNA repair
- Ans. a*
21. Bovine spongiform encephalopathy is a disease caused by:
- Fungus
  - Bacteria
  - Prions
  - Viroids
- Ans. c*
22. Which one of the following is used to study the structural details of biological tissues using freeze-fracture technique?
- Scanning electron microscopy
  - Transmission electron microscopy
  - Atomic force microscopy
  - Phase contrast microscopy
- Ans. b*
23. Which one of the following assures prevention of polyspermy in an egg?
- Activation of PI3 kinase
  - Cortical reaction
  - Acrosome reaction
  - Cross-linking between ZP1 and ZP3
- Ans. b*
24. Cytotoxic T cells generally recognize antigen in association with:
- class II MHC determinants
  - class I MHC determinants
  - class III MHC determinants
  - HLA-DR determinants
- Ans. b*
25. With reference to protein precipitation by organic solvents, which one of the following statements is correct?
- It is not influenced by pH.
  - It is dependent on the change in dielectric constant.
  - It is unaffected by ionic strength.
  - It is independent of the molecular size of the protein.
- Ans. a*

26. An organism exhibits Monod growth with the following growth parameters,  $\mu_m = 0.6 \text{ h}^{-1}$  &  $K_s = 4 \text{ g/l}$ . The specific growth rate,  $\mu$ , of the organism at a substrate concentration of  $2 \text{ g/l}$  would be:
- $0.2 \text{ h}^{-1}$
  - $0.3 \text{ h}^{-1}$
  - $0.4 \text{ h}^{-1}$
  - $1.2 \text{ h}^{-1}$
- Ans. a*
27. What is  $10! / 8!$
- $2!$
  - $1.25!$
  - $90$
  - $1.25$
- Ans. c*
28. A cricketer has an average of 62 runs after playing 25 innings. How many runs should he score in the next innings so as to increase his average to 65 runs?
- 147
  - 122
  - 140
  - 180
- c*
29. The next number in the series 1, 1, 2, 3, 5, 8, 13, 21 is:
- 27
  - 29
  - 32
  - 34
- Ans. d*
30. A TE buffer contains 200 mM Tris and 50 mM EDTA. Given the stock solutions – 0.5 M Tris and 0.5 M EDTA, volumes of stock solutions required to make 1 liter of buffer solution are respectively:
- 400 ml, 100 ml
  - 200 ml, 50 ml
  - 500 ml, 125 ml
  - 100 ml, 25 ml
- Ans. a*
31. The pH of a 0.001 molar HCl solution in  $\text{H}_2\text{O}$  is:
- 1
  - 2
  - 3
  - 4
- Ans. c*
32. To make 2 liters of 0.4 M HCl, how many ml of 28% w/w HCl (specific gravity = 1.15) is required?
- 80.7
  - 90.7
  - 100.7
  - 110.7
- Ans. b*
33. Two sides of a triangle measure 4 cm and 7 cm. Which one of the following **CANNOT** be a measure of the third side?
- 4 cm
  - 5 cm
  - 8 cm
  - 11 cm
- Ans. d*
34. A boy appears for a test and scores 35% but fails by 10 marks. If he had scored 46%, he would have passed by 12 marks. What is the pass mark?

- a. 70
- b. 74
- c. 80
- d. 86

*Ans. c*

35. If a student runs at 1.5 times his usual speed, he reaches his school 20 minutes early. If he runs at 0.5 times his usual speed, how late will he reach his school?

- a. 60 min
- b. 30 min
- c. 45 min
- d. 15 min

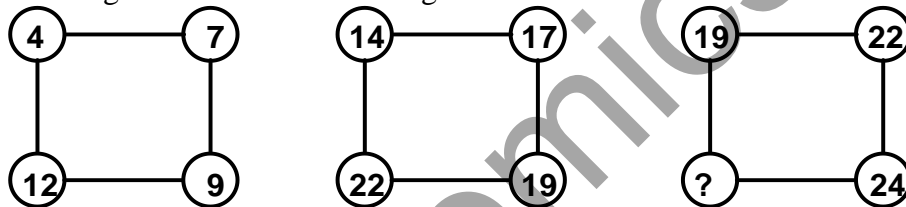
*Ans. a*

36. A stationary car is accelerated at the rate of  $5 \text{ m/s}^2$ . The distance covered by the car till it reaches a speed of  $40 \text{ m/s}$  is:

- a. 100 m
- b. 120 m
- c. 160 m
- d. 200 m

*Ans. c*

37. Find the missing number in the following series:



- a. 27
- b. 25
- c. 29
- d. 32

*Ans. a*

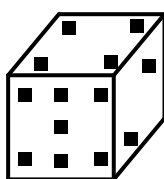
38. Identify the next figure in the series



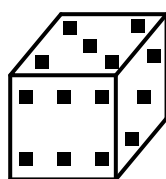
- a)
- b)
- c)
- d)

*Ans. a*

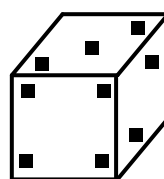
39. If the total number of dots on opposite faces of a cubical block is always 9 and no number is repeated, which of the following figure represents the block:



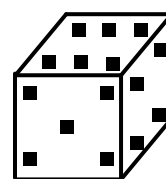
(i)



(ii)



(iii)



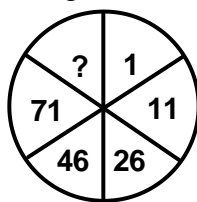
(iv)

- a. (i)
- b. (iii)
- c. (ii)

*Ans. b*

d. (iv)

40. Find the missing number in the following series:



- a. 96
- b. 91
- c. 101
- d. 121

*Ans. c*

41. If MONEY is to CARROM, MILITARY is to CHESS, COURT is to CRICKET then, WORLD WIDE WEB is to which of the following?

- a. Kho Kho
- b. Kabaddi
- c. Boxing
- d. Badminton

*Ans. d*

42. Which one of the following enzymes can hydrolyze both ester and amide bonds?

- a. Methionine racemase
- b. Thrombin
- c. Chymotrypsin
- d. Peroxidase

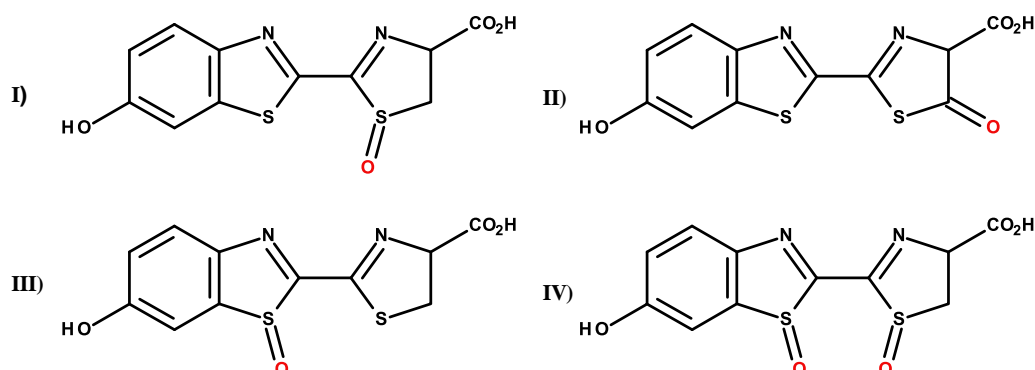
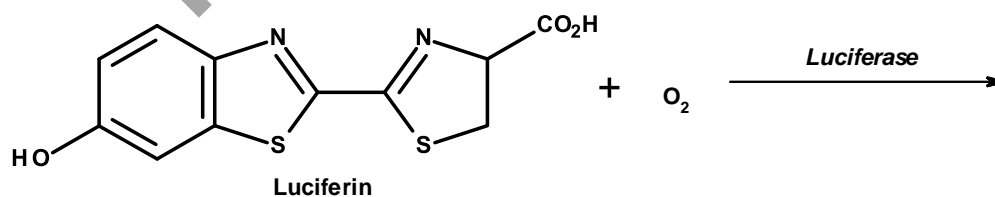
*Ans. c*

43. In the citric acid cycle operating under aerobic conditions, which one of the following is not directly involved?

- a)  $\text{NAD}^+$
- b) FAD
- c) Molecular oxygen
- d) Succinate

*Ans. c*

44. Identify the product(s) obtained when luciferin undergoes the following reaction:



*Ans. a*



- a) Only I
- b) I and II
- c) Only IV
- d) I, II and III

45. In the DNA methylation reaction mediated by S-adenosylmethionine (SAM) methyltransferase, the nucleophilic species involved is:

- a. an alcohol
- b. an amine
- c. a thiol
- d. a carboxylate

*Ans. b*

46. Correlation coefficient is a number between:

- a. +1 and +2
- b. 0 and +1
- c. -1 and 0
- d. -1 and +1

*Ans. d*

47. While making 100 ml of 2M NaCl solution, a student left the solution on a heating platform reducing the volume by 50 ml. This solution was diluted 1:100 for use. What is the final concentration of NaCl in this solution?

- a. 20 mM
- b. 80 mM
- c. 40 mM
- d. 400 mM

*Ans. c*

48. The pKa of acetic acid is 4.76. At what pH would the concentration of acetic acid and acetate ion be the same?

- a. pH = 7
- b. pH = 6.7
- c. pH = 9.8
- d. pH = 4.76

*Ans. d*

49.  $^{14}\text{C}$  has a half-life of 5760 years; 100 mg of a sample of  $^{14}\text{C}$  will completely disintegrate in:

- a. 23,040 years
- b. 1440 years
- c. 11,520 years
- d. infinite time

*Ans. d*

50. A young scientist was interested in creating a dipeptide using L-alanine and L-glycine. How many different dipeptides can be generated?

- a. One
- b. Two
- c. Three
- d. Four

*Ans. d*

## PART - B

51. A patient is suffering from an auto-immune disorder. Exome analysis has revealed a mutation in the gene 'AIRE'. Which one of the following biological processes is likely to be affected in this patient?
- Positive selection of thymocytes
  - Negative selection of thymocytes
  - Affinity maturation
  - Dendritic cell development
- Ans. b*
52. Which one of the following genes is mutated in nude mice?
- Foxn1*
  - Foxp3*
  - Foxp1*
  - Prkdc*
- Ans. a*
53. Which one of the following statements is **TRUE** for long non-coding RNAs?
- They are less than 22 base pair
  - They are processed in the nucleus by RISC complex
  - They have > 300 amino acid open reading frame
  - They may have a poly-A tail
- Ans. d*
54. Which kind of post-translationally modified protein targets are recognized by Bromodomain containing proteins?
- Acetylated protein
  - Glycosylated protein
  - Ubiquitinated protein
  - Sumoylated protein
- Ans. a*
55. When dissolved oxygen is lower than the critical concentration in mammalian cell culture systems, cell viability declines because of:
- Complete glutamine oxidation
  - Decrease in specific lactate production from glucose
  - Incomplete glutamine oxidation and increase in lactate production from glucose
  - Accumulation of ammonia
- Ans. c*
56. Combination of high temperature during processing, low temperature during storage, and increasing the acidity for prevention of food contamination is known as:
- Stumbling technology
  - Mixed preservation approach
  - High pressure food preservation
  - Hurdle technology
- Ans. d*
57. The production of ethanol rather than biomass by yeast cells at high concentration of glucose is known as:
- Warburg effect
  - Simpson's effect
  - Crabtree effect
  - Olivosky's effect
- Ans. c*

58. Anhidrotic dysplasia is a condition in which development of sweat glands is prevented. It is caused by mutation present on the X chromosome. A heterozygous female for this allele will:

- Show complete absence of sweat glands.
- Have normal phenotype
- Show mosaic pattern of presence and absence of sweat glands
- Show increased physiological activity of sweat glands

*Ans. c*

59. The combination of numbered terms that completes all of the following statement is:

- Transport through the phloem is \_\_1\_\_ while transport through Xylem is \_\_2\_\_
- Loading of sugar into the phloem is \_\_3\_\_ at the source
- Movement of water out of the phloem at the sink is -4--

- 1-bidirectional, 2-unidirectional, 3-by active transport, 4-by osmosis
- 1-by osmosis, 2-by turgor pressure, 3- by passive transport, 4-bidirectional
- 1-unidirectional, 2-bidirectional, 3-by diffusion, 4-unidirectional
- 1-by diffusion, 2-unidirectional, 3-bidirectional, 4-by osmosis

*Ans. a*

60. A plant with orange flowers was self-pollinated. In the F1 progeny, we obtained 38 plants producing red flowers, 80 plants producing orange flowers and 41 plants producing yellow flowers. The likely explanation for the above observation is that:

- the gene for flower colour shows incomplete dominance.
- flower colour is a polygenic trait controlled by 3 genes.
- the gene for flower colour is epistatic to another gene.
- the trait of flower colour is maternally inherited.

*Ans. a*

61. Based on equal probability of any base occurrence in a genome, what should be the minimum length of a probe to bind specifically on a single locus on a bacterial genome of 1 Mbp?

- 6 bases
- 15 bases
- 10 bases
- 4 bases

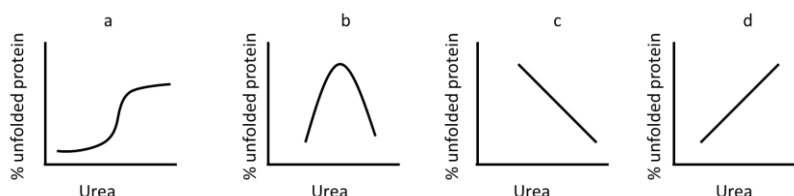
*Ans. c*

62. Which one of the following techniques can be used to study transient protein – protein interactions in a live cell?

- Pull-down assay
- Immunoprecipitation
- Surface Plasmon Resonance
- Forster Resonance Energy Transfer

*Ans. d*

63. Which one of the following graphs correctly represents unfolding of a protein in presence of increasing concentration of urea?



*Ans. a*

64. A tRNA containing an anticodon for leucine was charged with leucine. Subsequently, the attached leucine was chemically modified to arginine. This tRNA will incorporate:

- Arginine against codon of arginine in mRNA.
- Leucine against codon of arginine in mRNA.
- Arginine against codon of leucine in mRNA.
- Leucine against codon of leucine in mRNA.

*Ans. c*

65. Which one of the following statements regarding base excision DNA repair system is **FALSE**?

- a. It can be triggered by damaged DNA.
- b. The pol $\beta$  pathway facilitates replacement of a long polynucleotide stretch of DNA.
- c. The enzymes that remove bases from DNA are glycosylases and lyases.
- d. Damaged DNA that has not been repaired causes stalling of DNA polymerase III.

*Ans. b*

66. Which one of the following result is expected when a mammalian cell in S phase is fused with another in G2?

- a. G2 phase nucleus will wait for the S phase nucleus to complete the replication and both the nuclei simultaneously enter into M phase.
- b. S phase nucleus would immediately enter into G2 phase without completing the replication phase.
- c. Both the nuclei would follow their corresponding cell cycle without influencing each other.
- d. Due to influence of S phase promoting factor, G2 phase nucleus will enter into S phase.

*Ans. a*

67. Following statements are about chromatin organisation in eukaryotes:

- i. The length of DNA per nucleosome varies for individual tissue or species.
- ii. Typical nucleosomal packaging pattern is strictly maintained across the genome of an organism.
- iii. While wrapping around the histone core particle, uniform structure of DNA is maintained.
- iv. Histone tail mediated internucleosomal contact is one of the essential factors to achieve the 30 nm fibre structure.

Select the **correct** combination of statements.

- a. i and iii
- b. ii and iii
- c. i and iv
- d. iii and iv

*Ans. c*

68. Which one of the following techniques can be utilized to study both protein–peptide and protein–DNA interactions?

- a. DNA footprinting
- b. 2D-gel electrophoresis
- c. Phage display
- d. ChIP-on-chip assay

*Ans. c*

69. In genomic DNA denaturation and renaturation experiments, which one of the following regions would renature the earliest?

- a. Single-copy gene
- b. Satellite DNA**
- c. Pseudogenes
- d. Multi copy gene families

*Ans. b*

70. Which one of the following represents an autonomous retrotransposon?

- a. SINEs
- b. LINEs

- c. P-element  
d. Tn10 Ans. b
71. Thallium-208 has a half-life of 3.053 min. How long will a sample containing 120.0  $\mu\text{Ci}$  of Thallium-208 take to decay to 7.50  $\mu\text{Ci}$ ?
- a. 6.11 min.  
b. 9.36 min.  
c. 12.21 min. Ans. c  
d. 18.46 min.
72. Injection of *nanos* transcripts at the anterior end of a fertilized *Drosophila* egg is expected to develop in an embryo with:
- a. Two heads at both the ends.  
b. Two tails at both the ends.  
c. A tail in middle and two heads at both the ends. Ans. b  
d. A head in middle and two tails at both the ends.
73. If nondisjunction of a chromosome occurs in meiosis II, what will be the product at the completion of meiosis?
- a. All the gametes will be diploid  
b. Two gametes will be  $n + 1$ , and two will be  $n - 1$   
c. One gamete will be  $n + 1$ , one will be  $n - 1$ , and two will be  $n$  Ans. c  
d. Two of the four gametes will be haploid, and two will be diploid
74. Which one of the following changes occurs in a directionally migrating eukaryotic cell?
- a. The ER is fragmented.  
b. The mitochondrial membrane potential drops.  
c. The nucleus moves towards the back and behind the Golgi. Ans. c  
d. The Golgi is fragmented.
75. Underwinding or overwinding of circular dsDNA generates supercoils only when it does **NOT** have any of the following:
- a. Nicks  
b. repeat sequences  
c. G:C rich regions Ans. a  
d. A:T rich regions
76. CRISPR/Cas9 is an example of bacterial adaptive immunity. The transcription of *CRISPR* loci generates small crispin-RNAs (crRNA) to specifically target viral DNA, but not *CRISPR* loci, by forming complex with guide RNA and Cas9 nuclease. This prevention of autoimmunity is due to the:
- a. absence of protospacer adjacent motif sequence in *CRISPR* loci.  
b. absence of DNA sequence complementary to crRNA in *CRISPR* loci.  
c. absence of DNA sequence complementary to guide RNA in *CRISPR* loci.  
d. methylation of *CRISPR* loci. Ans. a
77. The type of transport that does **NOT** reach  $V_{\text{max}}$  is:
- a. Simple diffusion across lipid bilayer  
b. Facilitated diffusion via uniporters  
c. Movement of ions through ion channels Ans. a  
d. Primary active transport via ATP powered pumps
78. What is the **minimum** number of tRNAs required to recognize all six codons of serine (UCU, UCA, UCG, UCC, AGU and AGC)?
- a. 2

- b. 3
- c. 4
- d. 6

*Ans. b*

79. Which one of the following statements about signal recognition particles (SRPs) is **INCORRECT**?

An SRP:

- a. contains RNA and protein.
- b. is an integral membrane protein.
- c. docks with a receptor on the surface of the ER membrane.
- d. binds to localization signal at the N-terminus of the emerging polypeptide chain.

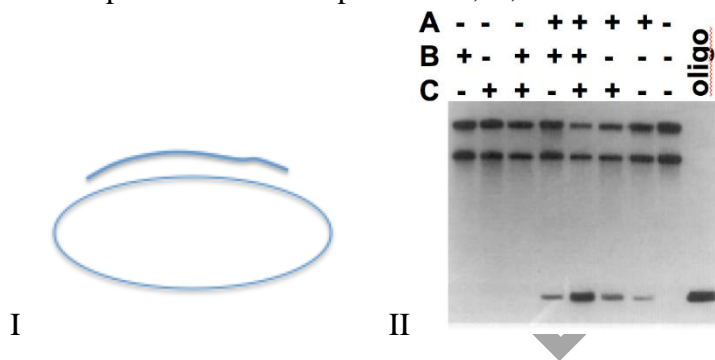
*Ans. b*

80. Which one of the following materials is a bioplastic?

- a. Polypropylene
- b. Alginate
- c. Polyhydroxybutyrate
- d. Dextran

*Ans. c*

81. Labeled circular single stranded DNA and linear short DNA (oligo) were annealed to form a product shown in figure I. Helicase assay was performed using the annealed product and three proteins A, B, C. Below is the gel profile of the results (figure II).

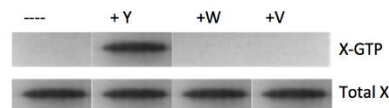


Based on the results identify the protein with helicase activity?

- a. protein A
- b. protein B
- c. Protein C
- d. Both Protein A and C

*Ans. a*

82. Protein X exists in both GTP-bound and GDP-bound forms. When this protein was purified, it was always GDP-bound. Proteins Y, W and V were added separately in an experiment along with GTP. The results of the experiment are depicted in the following figure:



Which one of the following could be the right conclusion of the results?

- a. Protein Y is GAP for protein X
- b. Protein Y is GEF for protein X
- c. Protein W is GEF for protein X
- d. Protein V is GEF for protein X

*Ans. b*

83. In a class, students were divided into 3 different groups and each group was given different DNA sample to find the melting temperature ( $T_m$ ). All the groups observed same  $T_m$  for their samples. This is because:

- a. They got different DNA samples from the same organism with different lengths and same GC content.  
 b. They got different DNA samples with same lengths and different GC contents.  
 c. They got different DNA samples with same length and same GC content.  
 d. They got different DNA samples from different organisms with different length and same GC content. **Ans. c**
84. For efficient translation of certain eukaryotic mRNAs under many physiological and pathological stress conditions, the small subunit of ribosome binds to the mRNA at the:  
 a. 5' Cap.  
 b. Internal ribosome entry sites.  
 c. Secondary structure at 3' UTR. **Ans. b**  
 d. Initiation codon.
85. For identifying the distribution of a specific protein in a tissue, which one of the following types of immunofluorescence microscopic methods has attained the highest level of resolution?  
 a. Indirect immunofluorescence microscopy  
 b. Confocal microscopy  
 c. Confocal microscopy with deconvolution **Ans. c**  
 d. Wide angle microscopy with deconvolution
86. Which one of the following sets of protein factors, named as Yamanaka factors, can be used to convert mammalian somatic cells into induced pluripotent stem cells?  
 a. Oct3/4, Sox2, Klf4, c-Myc  
 b. c-fos, nestin, TGF $\beta$ , c-jun  
 c. Oct3, snail, FGF, nanos **Ans. a**  
 d. Hstf, vimentin, ets, ras
87. Hayflick limit of mammalian cells refers to which one of the following?  
 a. Cells in primary cell culture undergo senescence after 50-60 passages.  
 b. Primary cells cultured in vitro do not cross the limit of cell transformation.  
 c. Cell lines when cultured in vitro have a limit for their surface to volume ratio.  
 d. Malignant cell lines undergo senescence after 50-60 passages. **Ans. a**
88. Midblastula transition is a phenomenon that occurs during early development in certain organisms. It refers to:  
 a. Transition from maternal to zygotic gene expression  
 b. Transition of morphology during midblastula stage  
 c. Transition from two germ layer embryo to three germ layer embryo **Ans. a**  
 d. Transition of blastula to gastrula
89. Under which of the following circumstances do T cells develop anergy?  
 a. With the expression of CD69 on T cells.  
 b. When the CD4/ CD8 molecules present on T cell surfaces do not recognize self MHC II/MHC I molecules.  
 c. When the MHCII molecules present on antigen presenting cells bind to the peptides with less avidity. **Ans. d**  
 d. When co-stimulatory molecules present on the antigen presenting cells fail to interact with T cells.
90. A chemist synthesized a new chemical X which is highly mutagenic. He also tested the capacity of mutation induced by X to be reversed by other known mutagens and obtained the following results:

Mutation produced by	Reversed by		
	Nitrous acid	Hydroxylamine	Acridine orange
X	Yes	Some	No

Which one of the following conclusions is appropriate?

- a. X causes transversion
- b. X causes transition
- c. X causes single-base insertion
- d. X causes single-base deletion

Ans. b

91. What would be the best assay to detect and quantify a small and low abundant peptide in a biological sample?

- a. Lowry's assay
- b. Immuno-diffusion
- c. Radioimmunoassay
- d. Immunoblot

Ans. c

92. A mutation in the coding region of a mammalian gene leads to the loss of a single amino acid at the N-terminus of the nascent polypeptide. This is possible when:

- A. The mutation occurs at 3'-end of coding strand.
- B. The mutation leads to shift of ribosome binding site.
- C. the first two codons code for methionine.
- D. the mutation leads to the introduction of premature stop codon.

Ans. c

93. A scientist performs a series of experiments to determine the recombination frequencies between the following genes. He acquires the following data:

P – Q: 3%; Q – R: 2%; R – S: 13%; P – S: 8%

Which one of the following represents the correct order of genes?

- a. PQRS
- b. QPSR
- c. SPQR
- d. PRSQ

Ans. c

94. You have two tubes containing bacteriophage labelled with radioactive phosphorous (tube A) and radioactive Sulphur (tube B) that are devoid of bacteria. You use these bacteriophage to infect separate *E. coli* cultures. After infection you separate bacteria from the virus and check them for radioactivity. You will find:

- a. Radioactivity in both bacterial samples.
- b. Radioactivity in none of them as bacteria have been totally separated from the viruses.
- c. Radioactivity in bacteria infected with viruses from tube A.
- d. Radioactivity in bacteria infected with viruses from tube B.

Ans. c

95. Colour blindness (B) in human follows sex-linked recessive mode of inheritance. If a couple with normal colour vision have a colour-blind son. What will be the genotypes of the parents?

- a.  $X^bX^b$  and  $X^bY$
- b.  $X^BX^b$  and  $X^BY$
- c.  $X^bX^b$  and  $X^BY$
- d.  $X^BX^B$  and  $X^bY$

Ans. b

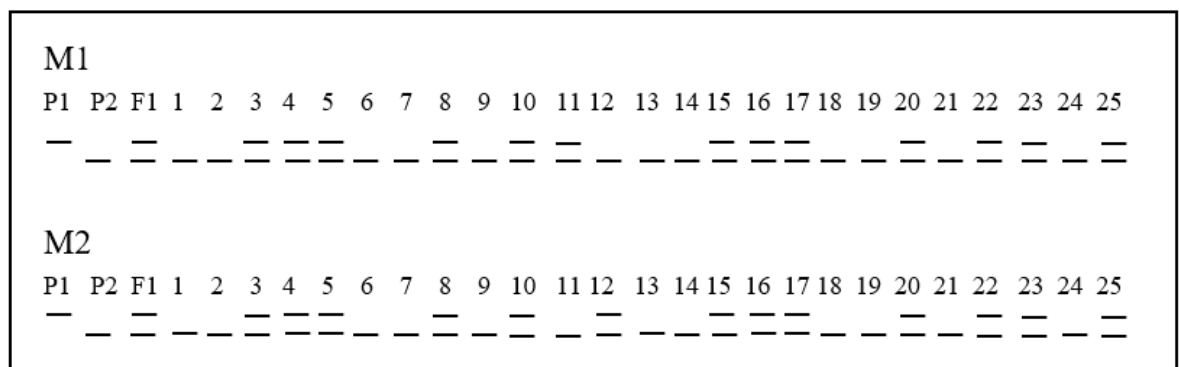
96. If the allele A is incompletely dominant over allele a, what is expected in a progeny of two heterozygous parents?

- a. Same phenotypic and genotypic ratios
- b. 2:1 phenotypic ratio
- c. 3:1 phenotypic ratio
- d. 2:1 ratio of homozygous dominant and intermediate phenotypes

Ans. a



97. An experiment involves formation of RNA-DNA hybrid. Which one of the following enzymes could be utilized to degrade only the RNA strand from the RNA-DNA hybrid?
- Micrococcal nuclease
  - S1 nuclease
  - RNase H
  - RNase P
- Ans. c*
98. If the intracellular pH of a cell becomes basic, which one of the following will help reduce the pH?
- Export of  $\text{Cl}^-$  and import of  $\text{HCO}_3^-$
  - Import of  $\text{Cl}^-$  and export of  $\text{HCO}_3^-$
  - Import of  $\text{Na}^+$  and  $\text{HCO}_3^-$  and export of  $\text{Cl}^-$
  - Export of  $\text{Na}^+$  and  $\text{Cl}^-$
- Ans. b*
99. Proteins can act as excellent buffers because of:
- The wide range of  $\text{pK}_a$  values of side chains found within the proteins.
  - The ability of the terminal regions of the protein to accept or donate  $\text{H}^+$  ions.
  - Their hydrogen-bonding capabilities in forming secondary & tertiary structures.
  - The ease with which  $\text{H}^+$  &  $\text{OH}^-$  ions can be absorbed once the protein is hydrolyzed.
- Ans. a*
100. Which one of the following statements is INCORRECT in relation to reverse phase chromatography?
- The solutes elute with decreasing order of polarity.
  - The stationary phase surface covering the silica particles involves non-polar functional groups.
  - The solutes elute with increasing order of molecular weight.
  - The pH of the mobile phase has a profound influence on retention, selectivity and separation.
- c*
101. The DNA gel picture shown below depicts the PCR banding pattern of two markers (M1 and M2).



The linkage distance between the two markers from a test cross population is:

- 4 cM
- 6 cM
- 8 cM
- 10 cM

*Ans. c*

102. For metabolic engineering in plants having improved tolerance to osmotic stress, mannitol is overproduced because it:
- lowers the water potential in the plant cell
  - increases the water potential in the plant cell
  - lowers membrane potential in the plant cell
  - increases membrane potential in the plant cell

*Ans. a*

103. For engineering virus resistance in plants, which one of the following viral components is commonly targeted?
- coat protein
  - replication protein
  - satellite RNA
  - movement protein

*Ans. a*

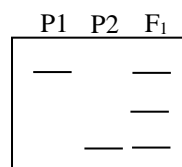
104. The Bt protein employed for raising insect-resistant plants is not toxic to humans because:
- it is inactive under acidic pH
  - it is inactive under basic pH
  - it is inactive at 37°C
  - it is rendered inactive by inhibitors

*Ans. a*

105. In rice, while pyramiding three genes for a trait, two donors were used. One donor carries two desirable genes, which are present on chromosome #2 and #4, while other donor has one desirable gene present on chromosome #3. Both the donors were crossed to produce a biparental F<sub>2</sub> population. The theoretical expectations of an individual carrying all the desirable allele in homozygous condition is one out of:
- 4
  - 16
  - 64
  - 256

*Ans. c*

106. An isoenzyme may be a monomer, dimer or multimer with identical or distinct subunits. Following picture depicts a native PAGE profile of the isoenzyme from a diploid plant (P1 – Parent 1, P2 – Parent 2, F<sub>1</sub> – Progeny).



This isoenzyme is a:

- monomer
  - homodimer
  - homotrimer
  - homopentamer
107. Which one of the following sets is an example of specific sequence-based PCR analysis in marker assisted selection?
- RAPD, DAF, AP-PCR

*Ans. b*

- b. SCAR, SSR, COS
- c. SCAR, SSR, DAF
- d. RAPD, SSR, COS

**Ans. b**

108. *Opaque2* gene in maize and *Wx* gene in rice affects the ..... and ..... content, respectively.

- a. protein quality, amylose
- b. oil, wax
- c. protein quality, wax
- d. oil, starch

**Ans. a**

109. Which one of the following is associated with RNA-induced gene silencing in plants?

- a. DNA methylation
- b. DNA acetylation
- c. DNA degradation
- d. DNA restriction

**Ans. a**

110. The oxidative photosynthetic carbon cycle salvages:

- a. C3 carbon
- b. C4 carbon
- c. CO<sub>2</sub>
- d. C2 carbon

**Ans. d**

111. The term 'co-suppression' was coined by Richard Jorgensen to explain:

- a. Patchy flower colour in petunia.
- b. Resistance to viral infection in tobacco.
- c. Production of white flowers in Ipomea.
- d. Silencing of actin gene in *C. elegans*.

**Ans. a**

112. Which one of the following plants exhibits both C3 and C4 pathways?

- a. *Zea mays*
- b. *Oryza sativa*
- c. *Mesembryanthemum crystallinum*
- d. *Arabidopsis thaliana*

**Ans. a**

113. 'Dichogamy' refers to a phenomenon in which anther dehiscence and stigma receptivity are:

- a. temporally separated

- b. spatially separated
- c. temporally coinciding
- d. spatially coinciding

*Ans. a*

114. Light compensation point is the irradiance at which:

- a. net photosynthetic photon flux is zero.
- b. there is no photosynthesis.
- c. net CO<sub>2</sub> exchange is zero.
- d. quantum yield of photosynthesis is 1.

*Ans. c*

115. Fusicoccin promotes cotyledon growth by promoting:

- a. cell division
- b. cell wall biosynthesis
- c. tonoplast acidification
- d. cell wall acidification

*Ans. d*

116. Plants take up water from the soil predominantly by the apoplastic and symplastic modes of transport. Which one of the following statements is true?

- a. Apoplastic transport is ATP-dependent, symplastic is ATP-independent.
- b. Symplastic transport is ATP- dependent, apoplastic is ATP-independent.
- c. Both apoplastic and symplastic transport are ATP-dependent.
- d. Both apoplastic and symplastic transport are ATP-independent.

*Ans. d*

117. Which one of the following is a Mo-Fe containing protein?

- a. Nitrate reductase
- b. Nitrogenase
- c. Nitrite reductase
- d. Leghemoglobin

*Ans. b*

118. TIR1, an auxin receptor, is a:

- a. F-box protein
- b. MAP kinase
- c. His kinase
- d. Ser/Thr kinase

*Ans. a*

119. Phytochromes A and B maximally absorb light at wavelength range:

- a. 150-300 nm
- b. 300-450 nm
- c. 450-550 nm
- d. 600-750 nm

*Ans. d*

120. A researcher wants to ectopically express protein X exclusively in the seeds of Arabidopsis. Which one of the following promoters is most suitable for this purpose?

- a. CaMV 35S
- b. Maize ubiquitin
- c. Napin

d. rd22

Ans. c

121. Given below are the names of different phytohormones in the left column. Match them with their corresponding precursor molecules in the right column.

Phytohormone	Precursor molecule
(A) Auxin	I. Methionine
(B) Jasmonic acid	II. L-Tryptophan
(C) Ethylene	III. alpha-linolenic acid
(D) Brassinolide	IV. Campesterol

Select the correct combination:

- a. A-I, B-II, C-III, D-IV
- b. A-II, B-III, C-I, D-IV
- c. A-IV, B-III, C-II, D-I
- d. A-II, B-III, C-IV, D-I

Ans. b

122. Which one of the following is a sulphur containing secondary metabolite in mustard plant derived from glucose and an amino acid?

- a. Glucosinolates
- b. Phytoalexins
- c. Ecdysones
- d. Cyanogenic glycosides

Ans. a

123. Disarmed Ti plasmid of *Agrobacterium tumefaciens* does not result in crown gall phenotype since it does not possess:

- a. *ipt* and *iaaH* genes
- b. *Vir D* gene
- c. *Vir A* gene
- d. *Vir G* gene

Ans. a

124. A plant that survives a local pathogen infection, often develops increased resistance to a subsequent attack by a mechanism called:

- a. Systemic Acquired Resistance
- b. DAMP-triggered immunity
- c. Hypersensitive response
- d. Heat Shock Response

Ans. a

125. In genetically modified Dhara Mustard Hybrid – 11, male sterility is conferred by ....., while ..... restores fertility.

- a. barnase, barstar
- b. barstar, barnase
- c. bar, barnase
- d. barnase, bar

Ans. a

126. Glycosylation of a monoclonal antibody **DOES NOT** affect:

- a. *in vivo* stability of antibody
- b. mediation of phagocytosis and cytotoxicity of antibody
- c. efficacy of monoclonal antibody
- d. **fluorescence spectrum of antibody**

*Ans. d*

127. Match the common antibody origin with appropriate generic name/brand name of the antibody

a	Mouse	(i)	Binatumomab
b	Chimeric	(ii)	Herceptin
c	Humanized	(iii)	Pantimumab
d	Human	(iv)	Retuxan

*Ans. c*

- a. a-ii, b-i, c-iv, d-iii
- b. a-i, b-iv, c-iii, d-ii
- c. **a-i, b-iv, c-ii, d-iii**
- d. a-iv, b-i, c-ii, d-iii

128. A recombinant therapeutic protein is intracellularly produced in soluble form using *E. coli*. Which one of the following sequences of chromatographic separation methods is preferable for obtaining clinical grade protein?

- a. Hydrophobic interaction followed by ion-exchange
- b. Dye-ligand followed by ion-exchange
- c. Ion-exchange followed by gel-filtration
- d. Gel-filtration followed by metal-affinity

*Ans. a*

129. What property is involved in the separation of a mixture of analytes using gas chromatography?

- a. Partitioning
- b. Conductivity
- c. Mass
- d. Polarity

*Ans. a*

130. Which organization in India approves and gives regulatory clearance of biologicals?

- a. Central Drugs Standard Control Organization (CDSCO)
- b. National Institute of Biologicals (NIB)
- c. Indian Pharmacopoeia Commission (IPC)
- d. Department of Biotechnology (DBT)

*Ans.a*

131. In a crossflow filtration process, if the volumetric flow rate of the feed is 10 times that of the retentate, the concentration factor is:

- a. 9
- b. 9/10
- c. 1/10
- d. 10

*Ans. d*

132. In a bioprocess, assume that only cell mass is formed. Due to a variation in process conditions, if the microbial cell yield has halved, what would be the rate of substrate consumption to maintain the same rate of cell mass production?
- It would be doubled
  - It would be halved
  - It would be unchanged
  - It would increase four folds
- Ans. a*
133. In a chemostat, which one of the following would increase the exit cell concentration?
- Increase in inlet substrate concentration
  - Increase in dilution rate
  - Increase in inoculum size
  - Increase in impeller size
- Ans. a*
134. The ratio of gassed to ungassed powder (Pg/P) in a bioreactor will be in the range of:
- 0.4 – 0.9
  - 1.0 – 2.0
  - 1.2 – 2.4
  - 4.0 – 8.0
- Ans. a*
135. Scale up of a fermenter is done based on constant impeller tip speed. If the diameter of the impeller is increased by 10 fold, the agitator speed will:
- decrease by 10 fold
  - decrease by 100 fold
  - increase by 10 fold
  - increase by 100 fold
- Ans. a*
136. For an enzyme catalyzed reaction in a batch bioreactor, which one of the following is true under quasi-steady state conditions:
- Enzyme-substrate complex concentration remains nearly constant
  - Substrate concentration remains nearly constant
  - Product concentration remains nearly constant
  - Both substrate and product concentration remain nearly constant
- Ans. a*
137. In a batch reactor, which one of the following is true regarding specific growth rate?
- It remains constant with time.
  - It continuously increases with time.
  - It continuously decreases with time.
  - It reaches a maximum in the exponential phase.
- Ans. d*
138. For a Rushton turbine impeller (Reynold's number greater than 10,000) when RPM is doubled, the power absorption increases by:
- 2 fold
  - 4 fold
  - 8 fold
  - 32 fold
- Ans. c*

139. Reynold's number is ratio of:
- viscous force to inertial force.
  - inertial force to viscous force.
  - gravitation force to inertial force.
  - inertial force to gravitational force.
- Ans. b*
140. In developing a structured model for microbial cell growth, we:
- separate the population by age.
  - compartmentalize the cell into different components.
  - separate the cells by age and also compartmentalize it.
  - treat cells to be composed of a single component only.
- Ans. b*
141. Glycerol is a:
- Newtonian fluid
  - Pseudoplastic fluid
  - Thixotropic fluid
  - Dilatant fluid
- Ans. a*
142. A catalyst:
- Reduces the free energy change of the reaction
  - Increases the free energy change of the reaction
  - Reduces the activation energy of the reaction
  - Reduces the heat of reaction
- Ans. c*
143. If the pulse input response curve for a CSTR shows a long tail, it means:
- Strong internal circulation in the reactor
  - Dead space in the reactor
  - Short circuiting in the reactor
  - Parallel flow in the reactor
- Ans. b*
144. During mixed acid fermentation by *E. coli*, which one of the following is **NOT** produced?
- Lactic acid
  - Ethanol
  - Succinic acid
  - Citric acid
- Ans. d*
145. The maximum yield for microbial conversion of Glucose ( $C_6H_{12}O_6$ ) to ethanol ( $C_2H_5OH$ ) on a mol/mol basis is approximately:
- 1
  - 2
  - 3
  - 0.5
- Ans. b*
146. A substrate is consumed in a zero order reaction such that the concentration falls from 40 g/l to 20 g/l in 4 h. How long will it take the substrate to fall from 20 g/l to 2 g/l:
- 2.5 h
  - 1.8 h
  - 3.6 h
  - 4.8 h
- Ans. c*



147. The least used heat transfer-design in bioreactor is:

- a. Jacket
- b. Limpet coil
- c. Internal cooling coil
- d. External heat exchanger

*Ans. d*

148. The major drawback in using wild type *S. cerevisiae* for producing ethanol from biomass hydrolysate is:

- a. Low biomass yield of hexose sugars
- b. Presence of solid residues
- c. Low concentration of sugars
- d. Non utilization of Pentose sugars

*Ans. d*

149. Match the physical/chemical property with the corresponding unit operations used for separation:

a) Density difference	(i) Distillation
b) Partition coefficient	(ii) Filtration
c) Relative volatility	(iii) Liquid-liquid extraction
d) Particle size	(iv) Centrifugation

- a. a-iii b-iv c-i d-ii
- b. a-i b-iii c-ii d-iv
- c. a-iv b-ii c-iii d-i
- d. a-iv b-iii c-i d-ii

*Ans. d*

150. One microgram of a pure enzyme (MW: 92,000) catalyzed a reaction at a rate of 0.50  $\mu\text{moles/min}$  under optimum conditions. The specific activity of the enzyme [ $\mu\text{moles/min}/\text{mg protein}$ ] is:

- a. 0.5
- b. 5.0
- c. 500
- d. 5000

*Ans. c*

151. The ion transport that will be the most affected following mutation in Cystic fibrosis transmembrane conductance regulator (CFTR) gene is:

- a. Sodium
- b. Potassium
- c. Chloride
- d. Calcium

*Ans. c*

152. The organism in which the luciferase gene is termed as “*lux*” gene is:

- a. Algae
- b. Insects
- c. Bacteria
- d. Jelly fishes

*Ans. c*

153. The first humanized monoclonal antibody approved by the US-FDA for targeted treatment of breast cancer was:

- a. Trastuzumab

- b. Palivizumab
- c. Gemtuzumab
- d. Natalizumab

*Ans. a*

154. Which one of the following statements is **INCORRECT** with regard to DNA vaccines?

- a. No risk of infection
- b. Proteins produced are likely to be correctly post translationally modified
- c. It can persist for an extended time period in the cell
- d. Introduced DNA stimulates a protective immune response

*Ans. d*

155. Antibiotic bleomycin is secreted by:

- a. *Bacillus sp.*
- b. *Aspergillus sp.*
- c. *Streptomyces sp.*
- d. *Acremonium sp.*

*Ans. c*

156. Zinc deficiency among children primarily results in the atrophy of:

- a. Thymus
- b. Spleen
- c. Lymph nodes
- d. Peyer's patches

*Ans. a*

157. Antigen activated B cells differentiate into antibody producing plasma cells in:

- a. Lymphoid follicles
- b. Hassall's corpuscles
- c. Lamina propria
- d. Phagosome

*Ans. a*

158. Allergenicity of a protein refers to its capacity to activate:

- a. Mast cells
- b. B cells
- c. Dendritic cells
- d. M cells

*Ans. a*

159. Secondary immune response to a hapten depends on the:

- a. Hapten immunization alone
- b. Carrier immunization alone
- c. Both hapten and carrier used in the primary immunization
- d. Hapten and is independent of the carrier used during immunization

*Ans. c*

160. Ig class specific antigenic determinants are known as:

- a. Allotypic determinants
- b. Isotypic determinants
- c. Idiotypic determinants
- d. Gm determinants

*Ans. b*

161. Isotypic determinants of the Ig molecule are located in the:

- a. HC
- b. LC
- c. Constant region of HC and LC

*Ans. c*

d. Variable region of HC and LC

162. A chimeric organism is generated when:

- a. Cells of different genetic constitution appear in the same organism
- b. Union of two different genomes occur within a cell
- c. A genome of another individual is injected into an adult organism
- d. A part of the genome is inactivated by chromosomal rearrangement

*Ans. a*

163. Metaplasia represents:

- a. Uncontrolled proliferation of cells initiated at the metaphase of cell cycle
- b. Transformation of one differentiated cell type to another
- c. Cell proliferation during metamorphosis
- d. A measure of metabolic activity in hyperplastic cells

*Ans. b*

164. The taxonomic method of identifying an organism to its species is:

- a. Genetic speciation
- b. DNA barcoding
- c. RFLP
- d. AFLP

*Ans. b*

165. In *Drosophila*, the growth of legs on the head instead of antennae during development is an example of:

- a. Homeotic transformation
- b. Epigenetic modification
- c. Chromosomal aberrations
- d. Dysgenesis

*Ans. a*

166. Ameloblasts are differentiated cells:

- a. that secrete amylase
- b. of amygdala
- c. of adrenal gland
- d. that secrete enamel

*Ans. d*

167. Which one of the following contributes to the development of the reproductive tract in a male foetus?

- a. Anti-diuretic hormone
- b. Inhibin
- c. Anti-Mullerian hormone
- d. Activin

*Ans. c*

168. Neurotransmitter at the neuromuscular junction is:

- a. Epinephrine
- b. Serotonin
- c. Acetylcholine
- d. Dopamine

*Ans. c*

169. Viral vector that is ideal for expressing therapeutic gene in non-dividing cells is:

- a. Lentiviral vector
- b. Retroviral vector

- c. Adeno-associated viral vector *a*  
d. Adenoviral vector
170. Which one of the following amino acids can be used as a diuretic because of its importance in metabolism of ammonia?  
a. Asparagine  
b. Leucine  
c. Tryptophan *Ans. a*  
d. Isoleucine
171. Paralytic shellfish poisoning is a foodborne illness that typically develops after consumption of shellfish contaminated chiefly with the heat stable and acid stable toxin:  
a. Okadaic acid.  
b. Mitotoxin.  
c. Saxitoxin. *Ans. c*  
d. Aflatoxin.
172. The antifreeze molecules that prevent intracellular ice formation in marine organisms are generally:  
a. calcium salts.  
b. glycoproteins. *Ans. b*  
c. membrane phospholipids.  
d. long chain alcohols.
173. Which one of the following transgenes expressed in transgenic fish by an appropriate inducible promoter, may be used for detecting environmental toxicants?  
a. Super oxide dismutase  
b. Green Fluorescent Protein  
c. Antimicrobial peptide *Ans. b*  
d. Aromatic hydrocarbon decarboxylase
174. Ballast water may be carried onboard by ships to maintain stability and improve maneuverability during transit. Introduction of which one of the following is regarded as the major threat in release of untreated ballast water?  
a. pathogenic microbes.  
b. terrestrial inputs of pollutants.  
c. invasive marine species. *Ans. c*  
d. algal blooms.
175. Remote sensing of ocean-atmospheric parameters carried out in the microwave channels is based on the phenomenon of:  
a. emission.  
b. reflection.  
c. scattering.  
d. diffraction. *Ans. a*

176. A starch containing wastewater sample with high BOD,  $\text{CaCl}_2$  and  $\text{NH}_4\text{NO}_3$  was subjected to aerobic oxidation using a designed bacterial consortium. The oxidised product(s) will have:

- a.  $\text{Cl}_2$ ,  $\text{N}_2$ ,  $\text{O}_2$ , and  $\text{CO}_2$
- b.  $\text{Cl}_2$ ,  $\text{N}_2$ , and  $\text{O}_2$
- c.  $\text{O}_2$  and  $\text{CO}_2$
- d.  $\text{CO}_2$

**Ans. d**

177. A wastewater has BOD of 1500 mg/L and COD of 2400 mg/L. Assuming 80% treatment efficiency in an activated sludge bioreactor, the BOD/COD ratio of treated effluent will be:

- a. 0.25
- b. 0.50
- c. 0.625
- d. 0.78

**Ans. a**

178. A slaughter house waste was subjected to anaerobic digestion. If the operation conditions are mesophilic then the biogas will have only:

- a.  $\text{H}_2\text{S}$ ,  $\text{H}_2$ ,  $\text{CH}_4$ , and  $\text{CO}_2$ .
- b.  $\text{H}_2\text{S}$ ,  $\text{CH}_4$ , and  $\text{CO}_2$ .
- c.  $\text{CH}_4$ , and  $\text{CO}_2$ .
- d.  $\text{CH}_4$ .

**Ans. a**

179. A pilot plant treating organic waste in aerobic and continuous mode was running with a constant organic load. It was observed that after three days, the Dissolved Oxygen level had increased from 3mg/L to 4.5mg/L under the same operating conditions. This suggests that:

- a. treatment system running efficiently
- b. treatment system not running efficiently
- c. treatment system not getting affected
- d. activated biomass generating oxygen

**Ans. b**

180. An anaerobic flask containing 50 ml of media with glucose as the sole carbon source was inoculated with a consortium consisting of *Methanosarcina* and *Bacillus*. After two weeks of incubation, there will be:

- a. no growth
- b. growth with methane production
- c. growth with acetate and methane production
- d. growth with  $\text{CO}_2$  production

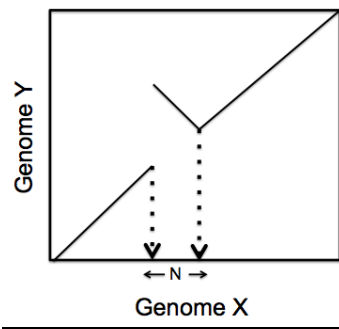
**Ans. a**

181. A representative sequence profile of a given nucleotide binding domain is to be used to mine related sequences from TrEMBL. The database to be used to extract the query corresponding to this fold is:

- a. Interpro
- b. Pfam
- c. TrEMBL
- d. Gene Ontology

**Ans. b**

182. The figure represents a dot plot comparing two genomes X and Y. The portion marked N is a/an:



- a. Translocation
- b. Inversion
- c. Repeat Sequence
- d. Insertion or deletion (Indel)

*Ans. b*

183. Which one of the following methods is most **accurate** in rescoring docked ligand-protein complexes?

- a. Molecular mechanics non-bonded energy functions
- b. Binding free energy calculations incorporating solvation models
- c. X-score – which is an independent score based on an energy function
- d. Ensemble scoring of multiple docking algorithms

*Ans. b*

184. A reference set of molecules is experimentally assayed for xenobiotic toxicity using the MTS assay which is a colorimetric measurement of cell viability. As part of the lead optimization step in drug discovery, which one of the following steps can be used to predict the toxicity of a new set of compounds?

- a. Estimation of  $\log P$  values
- b. Building a regression model of the reference compounds using molecular descriptors and toxicity measures
- c. Docking of molecules against an essential enzyme like DHFR
- d. Building a classifier without molecular descriptors of the reference compounds

*Ans. b*

185. In a *de novo* RNASeq analysis, the typical steps are (1) transcript assembly, (2) cluster sequence contigs and construct complete *de Bruijn* graphs for each cluster, and (3) separate the *de Bruijn* graph to full length alternatively spliced isoforms or transcripts from paralogous genes. Which one of the following statements is **INCORRECT** in this context?

- a. The first two steps are memory intensive
- b. The speed of the process is improved by a pre-processing step involving removal of redundant transcripts with no loss of accuracy
- c. It is not possible to distinguish between alternatively spliced and paralogous transcripts
- d. The last step can be parallelized to run on multiple processors

*Ans. c*

186. For Gene Set Enrichment Analysis (GSEA), differentially expressed genes are grouped into broader functions. A typical tool/resource used for this purpose is:
- Gene Ontology
  - BLAST against the nr database
  - Pfam database
  - PRODOM database

*Ans. a*

187. Two types of pair-wise sequence alignment of the same hypothetical protein sequence fragments are illustrated in the figure below. Vertical bars between the sequences indicate the presence of identical amino acids. \* symbols in Figure Y indicate residues not included in the alignment.

X)

```

LGPSSKQTGKGS-SRIWDN
|      |  ||  |  |
LN-ITKSAGKGAIMRLGDA
  
```

Y)

```

*****TGKG*****
      |||
*****AGKG*****
  
```

*Ans. a*

Which one of the following is correct?

- Figures X and Y are examples of *global* and *local* sequence alignment, respectively.
- Figures X and Y are examples of *local* and *global* sequence alignment, respectively.
- Figures X and Y are examples of *local* sequence alignment.
- Figures X and Y are examples of *global* sequence alignment.

188. Match the items in **Group I** with **Group II** with reference to a database search for identifying homologs of human hemoglobin.

**Group I**

- (P) Sensitivity  
(Q) 100% Sensitivity  
(R) Specificity  
(S) 100% Specificity

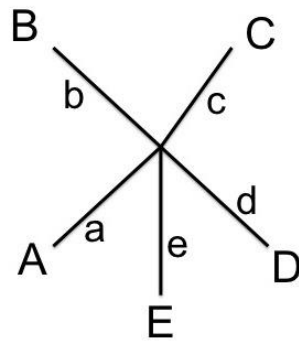
**Group II**

- (1) Measure of how many correct hits are found  
(2) Measure of how many hits found are correct  
(3) Measure indicating that all correct hits are found  
(4) Measure indicating that all hits found are correct

- P-1, Q-3, R-2, S-4
- P-2, Q-4, R-1, S-3
- P-3, Q-1, R-2, S-4
- P-4, Q-2, R-3, S-1

*Ans.a*

189. The following phylogenetic tree of five sequences (A-E) indicates:



*Ans. d*

- a. Pairing of A and B
- b. Pairing of C and D
- c. Pairing of A, E and D
- d. No pairing of sequences

190. Genes or proteins that display the same activity, but have different origins and are the product of convergent evolution, are called:

- a. Analogs
- b. Paralogs
- c. Orthologs
- d. Xenologs

*Ans. a*

191. Match the type of BLAST programs given in **Group I** to the particular type of sequence search task described in **Group II**

**Group I**

- 1 tblastn
- 2 tblastx
- 3 blastx
- 4 blastn

**Group II**

- P A nucleotide sequence is to be used as a query to search for similar proteins against a nucleotide database
- Q A nucleotide sequence is to be used as a query to search against a protein database

- a. 2-P, 3-Q
- b. 1-P, 3-Q
- c. 4-P, 3-Q
- d. 2-P, 1-Q

*Ans. a*

192. In a multiple sequence alignment of homologous protein sequences, a region of multiple insertions and deletions indicates the presence of:

- a. a secondary structure element
- b. a buried region in the protein
- c. a surface random coil region
- d. a motif

*Ans. c*

193. Two charged molecules are at a distance 'r' from each other. Which one of the following is correct regarding the electrostatic interactions between them?

- a. The interaction energy is proportional to  $r^{-1}$  and the force is proportional to  $r^{-2}$
- b. The interaction energy is proportional to  $r$  and the force is proportional to  $r^2$
- c. The interaction energy is proportional to  $r^2$  and the force is proportional to  $r^{-3}$
- d. The interaction energy is proportional to  $r^{-3}$  and the force is proportional to  $r^{-2}$

*Ans. a*



194. The structure of two molecules P and Q with three atoms (u, v, w) each, are defined by coordinates given below.

	u	v	w
P	1,4,1	4,1,1	4,4,1
Q	0,0,1	2,0,1	3,2,1

The root mean square deviation between the two structures is:

- $\sqrt{3}$
- 3
- 9
- 27

*Ans. b*

195. A novel protein from a deep sea archaeobacterium was identified and sequenced. The sequence is expected to be widely divergent from known sequences. Which scoring matrix will produce the most appropriate alignment in a search for homologs in the NCBI database?

- PAM1
- PAM250
- BLOSUM90
- BLOSUM82

*Ans. b*

196. The measured values of main chain torsion angles of a residue in a polypeptide has values ( $\Phi=+50$ ,  $\Psi=+60$ ). What type of secondary structure is it most likely to be present in?

- Left-handed  $\alpha$ -helix
- Right-handed  $\alpha$ -helix
- Type II  $\beta$ -turn
- Parallel  $\beta$ -sheet

*Ans. a*

197. Which one of the following experimental methods is **NOT** used to determine three-dimensional structures of biological macromolecules?

- Nuclear Magnetic Resonance Spectroscopy
- Fluorescence spectroscopy
- X-ray crystallography
- Cryo-Electron microscopy

*Ans. b*

198. Which one of the following is **NOT** an assumption of an evolutionary model of the PAM matrix?

- Probability of a mutation at one position of a sequence is dependent on the identity of the amino acid
- Probability of a mutation is dependent on the position of the mutation
- Probability of a mutation is independent of the previous mutation at the position
- Probability of a mutation is independent of the neighboring residues

*Ans. b*

199. Which one of the following is a valid assumption regarding the molecular clock hypothesis in evolution?

- For a given protein sequence, mutations accumulate at a constant rate in all lineages
- For a given protein sequence, mutation rates are different in different lineages

- c. All proteins evolve at the same constant rate
- d. For a given lineage, mutation rates are the same for all proteins

*Ans. a*

200. Which of the following is **NOT** true of protein folds?

- a. Proteins assume a limited number of folds
- b. Proteins with the same fold may perform different functions
- c. Proteins with different folds can carry out the same function
- d. A stable fold is a prerequisite for the function of all proteins

*Ans. d*

The Biomimics

# Preparing for CSIR?

**GET 1 FREE MOCK TEST**

**Click on the above link to  
get 1 free mock test  
or scan the below QR code**

