DBT-BET-JRF 2021 QUESTION PAPER

Section - A

1. The time period of a simple pendulum will _____(approximately) when it is shifted to a place which has 1% higher gravity:
   (a) Decrease by 0.5%,
   (b) Decrease by 1%,
   (c) Increase by 0.5%,
   (d) Increase by 1%,

2. A mutation that generates a termination codon is known as:
   (a) Missense mutation,
   (b) Nonsense mutation,
   (c) Reverse mutation,
   (d) Silent mutation,

3. Which one of the following is an achiral amino acid?
   (a) Alanine,
   (b) Glycine,
   (c) Phenylene
   (d) Proline

4. In an enzymatic reaction following Michaelis-Menten kinetics, doubling the substrate concentration from So to $2S_0$ resulted in an increase in the rate of reaction by 2 percent. Which of the following statements is TRUE?
   (a) $k_{m >}$
   (b) $S_o < K > 2S_o$
   (c) $\frac{So}{2}$ $K_{m < So}$
   (d) $K_m << \frac{So}{2}$

5. If the row-wise and column-wise sums in the figure below are same for all rows and columns, x + y + z =

Z	9	X
8	y	6
12	5	10

   (a) 24,
   (b) 27,
   (c) 31,
   (d) 34,

6. You are preparing 100 ml of a solution containing: 100 mM Tris HCl (pH 7.5); 5 mM $MgCl_2$; 1 mM DTT. If the stock solutions provided are: 1 M Tris-HCl (pH 7.5); 100 mM MgCl2; 50 mM DTT, the amount of each component would be:
   (a) 1M Tris HCl (pH 7.5) : 05 ml ; 100 mM MgCl2 : 10 ml; 50 mM DIT : 2.5 ml.
   (b) 1M Tris HCI (pH 7.5) : 10 ml ; 100 mM MgCl2: 5.0 ml ; 50 mM DTT : 2 ml.
   (c) 1M Tris HCl (pH 7.5): 10 ml ; 100 mM MgCl2: 7.5 ml ; 50 mM DTT: 10 ml.
   (d) 1M Tris HCl (pH 7.5): 20 ml ; 100 mM MgCl2: 2.5 ml ; 50 mM DIT: 5 ml.

7. For sequencing DNA by Sanger's method, the chain elongation is terminated by:
   (a) 1', 4' dideoxy nucleotides,
   (b) 2, 3' dideoxy nucleotides,
   (c) 2, 4' dideoxy nucleotides,
   (d) 4, 3' dideoxy nucleotides,

8. Match the components of list I with those in list II

	List I		List II
A	Methylation of Lys	i	Collagen structure
B	Hydroxylation of proline	ii	Activates genes by modifying histones in chromatin
C	Phosphorylation of tyr	iii	Targets a protein for degradation
D	Poly- ubiquitination of Lys	iv	Cell signalling

(a) A - i, B - ii, C-iii, D-iv
(b) A - i, B - iii, C-iv, D –ii
(c) A - ii, B-i, C- iii, D-iv
(d) A - ii, B-i, C-iv, D-iii

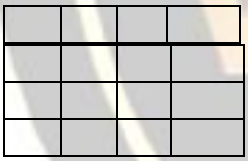
9. In a donor-acceptor pair, the one with the strongest tendency to donate electrons (e) has the:
(a) Most negative redox potentials and the strongest affinity for,e.
(b) Most negative redox potentials and the weakest affinity for e-.
(c) Most positive redox potentials and the strongest affinity for e-.
(d) Most positive redox potentials and the weakest affinity for e.

10. Match the components of list I with those in list II under physiological conditions.

	List I		List II
A	Leucine	i	Negatively charged
B	Lysine	ii	Non polar
C	Glutamic acid	iii	Uncharged polar
D	Glutamine	iv	Positively charged

Choose the CORRECT answer from the options given below:
(a) A - ii, B-i, C-iv, D –iii
(b) A - ii, B - iv, C-i, D-iii
(c) A - iii, B - ii, C-i, D-iv
(d) A - iv, B - ii, C-i, D-iii

11. How many squares are there in the following figures?



(a) 25
(b) 28
(c) 30
(d) 34

12. Treatment of glyceraldehyde with HIO4 produces one among the following:
(a) One molecule of formic acid and one molecule of formaldehyde.
(b) One molecule of formic acid and two molecules of formaldehyde.
(c) One molecule of formic acid, one molecule of CO_2 and one molecule of formaldehyde.
(d) Two molecules of formic acid and one molecule of formaldehyde.

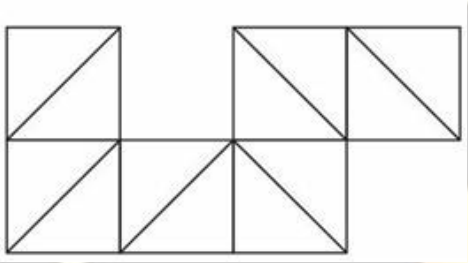
13. Which one of the following statements is CORRECT about the reactions catalyzed by serine hydrolases?
(a) A nucleophilic serine residue attacks the carboxyl carbon of aspartic acid.
(b) An aspartate residue abstracts a proton from a histidine.
(c) An aspartate residue abstracts a proton from a serine.
(d) An aspartate residue attacks the carboxyl carbon of the ester to be hydrolysed.

14. The ratio of the perimeters of a circle and a square having the same area is:
(a) π: 4
(b) $\sqrt{\pi}$: 2

(c) π: 2
(d) π: $\sqrt{2}$

15. Four coins are tossed simultaneously. You bet that it will come up as 2 heads & 2 tails but your friend says it will be either 3 heads & 1 tail or 1 head & 3 tails. In terms of probability:
(a) Both of you have equal chance of winning.
(b) The chances of both of you losing is > 50%.
(c) You have a higher chance of winning.
(d) Your friend has a higher chance of winning.

16. How many rectangles are there in the following diagram?



(a) 10
(b) 12
(c) 6
(d) 8

17. 100 mL of 0.1 N HCl solution was diluted with 50 mL of 0.05 N HCl solution. The normality of the final solution is:
(a) 0.067 N
(b) 0.083 N
(c) 0.125 N
(d) 0.25 N

18. Match the components of list I with those in list II:

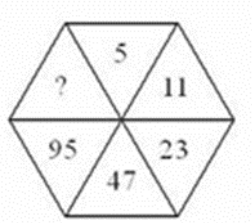
	List I		List II
A	Isomerization	i	Transfer of a functional group from one molecule to another
B	Redox reaction	ii	Electron transfer from one species to another
C	Group transfer	iii	Cleavage of bonds by addition of water
D	Hydrolysis	iv	Rearrangement of atoms to form isomers

Choose the CORRECT answer from the option given below:
(a) A –I, B –ii, C –iv, D –iii
(b) A –iv, B –ii, C –I,D –iii
(c) A-iv, B –ii, C –iii, D –i
(d) A–iv,B-iii, C-I, D-ii

19. Which one of the following **CANNOT** be used for differential gene expression analysis?
(a) EST data analysis
(b) Microarray data analysis
(c) mRNA sequencing data analysis
(d) Whole genome sequencing data analysis

20. If the codons for translation of mRNAs to proteins were 4 letters long instead of 3what would be the maximum number of hypothetical amino acids that could uniquely be recognized by the tRNA sassuming only one codon as stop codon?
(a) 1295
(b) 255
(c) 63
(d) 728

21. The missing number in the diagram is:



(a) 140
(b) 19
(c) 2
(d) Either 2 or 191

22. Beta-lactam ring is presentin:
Options:-
(a) Chloramphenicol
(b) Erythromycin
(c) Penicillin
(d) Tetracycline

23. Which one of the following amino acids has a strong tendency to disrupt α-helices and ß- strands?
(a) Alanine
(b) Glutamate
(c) Proline
(d) Tyrosine

24. Which one of the following is **NOT** a characteristic of a collagen fibre?
(a) Each of the strand is independently stable due to the presence hydrogen bonds.
(b) It is a fibrous protein with alpha-helical coiled-coil structure.
(c) It is the main component of skinbonestendons and teeth.
(d) The core of the triple-stranded helix is populated with glycine residues.

25. If 3 oranges and 2 apples cost Rs. 100while 2 oranges and 3 apples cost Rs. 120how much will 6 oranges and 2 apples cost?
(a) 124
(b) 136
(c) 180
(d) 200

26. Match the components of list 1 with those in list II

	List I		List II
A	Neutrophils	i	Make antibodies
B	Platelets	ii	Phagocytose and destroy bacteria
C	B- cells	iii	Kill virus- infected cells
D	T-cells	iv	Initiate blood clotting

Choose the CORRECT answer from the option given below:
(a) A-ii, B-iv, C-I, D-iii
(b) A-ii, B-iv, C-iii, D-i
(c) A-iv, B-ii, C-I, D-iii,
(d) A-iv, B-ii, C-iii, D-i

27. Sachin's average run score jumped from 50 to 51 when he scored 151 in his last match. How many matches has Sachin played in total?
(a) 100
(b) 101

(c) 50
(d) 51

28. Breeding of Aa and AA genotype resulted in five offspring. What is the probability that exactly four offspring will have AA genotype?
(a) $\frac{1}{16}$
(b) $\frac{1}{32}$
(c) $\frac{5}{16}$
(d) $\frac{5}{32}$

29. A took 10 hours to complete a task. B could finish only two-thirds of the task alone by that time. How much time will it take if they worked together to finish the task?
(a) 4hours
(b) 5hours
(c) 6hours
(d) 8 hours

30. During a fed batch processcells grew from a cell density of 1 ×106 cells/mL to 16 × 106 cells/mL over 12 days. Simultaneouslythe average cell diameter also increased from 12 microns to 18 microns over the same period. Total fold increase in cell volume per mL over the entire process is:
(a) 24
(b) 36
(c) 54
(d) 81

31. A biased coin with probability of getting head being 0.4 was tossed for four times. What is the probability of getting head at least once?
(a) 0.36
(b) 0.4
(c) 0.6
(d) 0.87

32. If x/y = 3/2find the value of (4x + 5y)/(2x − y)
(a) 11/2
(b) 2/11
(c) 2/20
(d) 20/2

33. Which one of the following molecules causes catabolite repression of lac operon?
(a) Arabinose
(b) Galactose
(c) Glucose
(d) Lactose

34. Which nuclease of bacteria is responsible for degrading the genome of the invading lambda phage?
(a) Exonuclease
(b) Phagodegradase
(c) Restriction endonuclease
(d) Topoisomerase

35. DNA fingerprinting for forensic investigation is based on:
(a) Exon sequences
(b) Intron sequences
(c) Promoter sequences
(d) Repetitive sequences

36. At which phase of the growth curve are bacteria more sensitive to ampicillin?
Options:-
(a) Declining phase
(b) Lag phase
(c) Log phase
(d) Stationary

37. You are performing a PCR reaction in which you need to use 20 pmoles of each primer. If both the primers are 20 nucleotides long and the average molecular weight of each nucleotide is 300 Dathe amount of each primer required for 100 µl reaction is:
(a) 1.2 ng
(b) 12 ng
(c) 120 ng
(d) 1200 ng

38. The blood volume of an individual is 5 litres. The person was injected with 500 mg of a drug that has molecular weight of 100 Da. If the drug is metabolized so that half of the drug remains in the bloodstream after every passing hourthe concentration of the drug four hours after injection is:
(a) 0.0625 mM
(b) 0.125 mM
(c) 0.25 mM
(d) 0.5 mM

39. In the electron transport chainwhich one of the following can be a two-electron carrier?
(a)Cupro proteins
(b)Cytochrome
(c)Flavin
(d)Iron-sulphur proteins (Fe-S cluster)

40. The E. coli cell has a volume of 1 µm3 and the volume of a single base pair is 1 nm3. If the E. coli DNA has 5 × 106 base pairs then the volume occupied by the genome in the cell is:
(a) 0.01%
(b) 0.05%
(c) 0.50%
(d) 5%

41. If a random year is selectedthe probability that it will have both 53 Mondays and 53 Tuesdays is:

(a) 0
(b) 1/4
(c) 1/7
(d) 1/8

42. In an equilateral triangle the mid points of each side is joined to form a smaller equilateral triangle inside the larger triangle. The ratio of their perimeters is:
Options:-
(a) 1:√3
(b) 1:2
(c) 1:3
(d) 1:4

43. Which one among the following can be effectively transmitted from person to person due to coughing?
(a) AIDS & Tuberculosis
(b) Dengue & COVID-19

(c) Malaria & Typhoid
(d) Swine Flu & Adenovirus

44. A highly sensitive instrument with large fluctuations measures the trace amount of impurity in a sample and the two readings are 10−7 mg and 10−9 mgrespectively. The best estimate of the impurity level which can be found by taking the arithmetic mean of these two data points is approximately?
(a) 10−7mg
(b) 10−8mg
(c) 5 × 10−7 mg
(d) 5 × 10−8 mg

45. During replicationDNA polymerase-:
(a) Can initiate DNA synthesis de novo.
(b) Cannot initiate DNA synthesis de novo .
(c) Synthesizes DNA in 3′ to 5′ direction .
(d) Unwinds DNA in a 5′ to 3′ direction.

46. Conversion of L-pyruvate to L-lactate is an example of:
(a) Isomerisation
(b) Oxidation
(c) Reduction
(d) Transesterificat on

47. Conversion of UDP-Galactose to UDP-Glucose occurs by:
(a) Dehydration and hydration
(b) Oxidation and reduction
(c) Oxidative addition
(d) Reductive elimination

48. A 2 Kb insert has to be ligated to a 8 Kb plasmid in a ligation mix where we want to keep the vector insert molar ratio as 1: 2. If 1 µg of vector is usedthe amount of insert to be used is?
(a) 0.25 µg
(b) 0.5µg
(c) 1µg
(d) 2µg

49. The shortest land route has to be determined from Mumbai to a city X in Mexico at the same latitude. The route will be:
(a) A line curving so that it touches higher latitudes.
(b) A line curving so that it touches lower latitudes.
(c) A line passing through the North Pole.
(d) The latitude line connecting Mumbai and X.

50. During translation which one of the following aminoacyl-tRNA binds first to the P site of bacterial ribosomes?
(a) fMet-tRNAfMet
(b) fMet-tRNAMet
(c) Met-tRNAfMet
(d) Met-tRNAMet

51. DNA replication requires DNA-Topoisomerase to remove the supercoiling of DNA that accumulates at the end of a growing replication fork. You wish to perform a PCR amplification of a gene that has been provided to you in a 6 kb plasmid vector. Why will you **NOT** use topoisomerase in your PCR reaction mix?
(a) Denaturation step in the PCR protocol precludes formation of supercoils.

(b) Reaction buffer has a pH that denatures DNA and avoids supercoiling.
(c) Taq-polymerase has innate topoisomerase activity.
(d) The 5´3´exonuclease activity of Taq-polymerase does not allow supercoiling.

52. Enzyme-linked immunospot (ELISPOT) assay measures:
(a) Cytokine concentration in culture supernatant .
(b) Expression of cytokine gene.
(c) Intracellular cytokine concentration.
(d) Number of cytokine releasing cells at single cell level.

53. Which one of the Immunoglobulins (Ig) cause type-I hypersensitive immune reaction?
(a) IgA
(b) IgE
(c) IgG
(d) IgM

Section B

54. You have recently observed a mutation in gene X in patients with lung cancer. You have sequenced the gene X in these patients and have observed that (i) both the copies of gene X are mutated, and (ii) the mutation leads to absence of the protein X in the patients. The gene is most likely:
(a) A metastasis inducer
(b) A stem cell associated gene
(c) A tumor suppressor
(d) An oncogene
Answer Given By Candidate:- A tumor suppressor

55. Which one of the following strategies do viruses employ to evade the human immune system?
(a) Virus binds to TCR and blocks activation of T-cells.
(b) Virus infected cells show increased expression of pro-inflammatory cytokines.
(c) Virus infected cells show reduced expression of surface MHC Class I molecules.
(d) Viruses bind to surface Ig on B-cells and neutralize them.

56. A protein cargo X is destined for lysosomal degradation in cells under specific conditions. This can be tracked by red fluorescence emitted by the tag when it reaches lysosomes. What will happen when you treat the cells with NH
(a) No red fluorescence will be emitted .
(b) Red fluorescence will be emitted in dotted structures in the cytoplasm.
(c) Red fluorescence will be emitted only at the periphery of the cell.
(d) Red fluorescence will be emitted throughout the cell .

57. In induced pluripotent stem cells:
(a) Germ cells are transformed and passaged continuously in culture to maintain a state conducive to future pluripotent cell formation.
(b) Oncogenes are added to embryonic stem cells to help them retain stemness for prolonged cultures.
(c) Somatic cells are continuously cultured to generate a cell line that is mutagenized to produce pluripotent cells when required.
(d) Somatic cells are transduced with viral vectors coding for transcription factors that induce a pluripotent state in the recipient cells.

58. A protein X is active when phosphorylated on Thr residue. You wish to mimic this phosphorylation by mutating Thr to another residue. Which one of these residues will you mutate Thr into?
(a) Glu
(b) Gly
(c) His
(d) Tyr

59. You have isolated a hypothetical protein X. When X is run on a gel filtration column, the apparent size of the protein is 80 kDa. When X is run on an SDS-PAGE with 2- mercaptoethanol present in the loading bufferthe size is around 40 kDa.
(a) X is a dimer of two units held together by disulfide bond(s) with a molecular weight of 40 kDa per monomeric unit.
(b) X is a dimer of two units of X held together by electrostatic interactions with a molecular weight of 80 kDa per monomeric unit.
(c) X is a monomer with at least one disulfide bond and a molecular weight of 40 kDa.
(d) X is a monomer with at least one disulfide bond and a molecular weight of 80 kDa.

60. In the following table, List I has different nucleic acids and List II has certain base modifications. Match the components from the List I with those in the List II:

	List I		List II
A	DNA	i	7- methylguanosine (m 7G)
B	tRNA	ii	5-methylcytosine (m5C)
C	mRNA	iii	Pseudouridine (Ψ)

Choose the CORRECT answer from the options given below:
(a) A-i,B-ii, C-iii
(b) A –ii, B -i,C – iii
(c) A-ii, B-iii, C-i
(d) A-iii, B-ii, C-i

61. If a single-stranded DNA sequence of 250 nucleotides consists of 30% thymine, the number of Adenine, Guanine, Thymine and Cytosine nucleotides present in it are:
(a) 50, 50, 75, 75
(b) 75, 50, 75, 50
(c) 75, 75, 50, 50
(d) Cannot be calculated

62. Pyruvate decarboxylase catalyses the decarboxylation of pyruvic acid to acetaldehyde and carbon dioxide. Its action depends on cofactors thiamine pyrophosphate (TPP) and magnesium. In this process, the role of TPP in the initial step is to act as a:
(a) Electron donor ,
(b) Carbanion
(c) Carbocation
(d) Thiolate anion

63. Baeyer-Villiger monooxygenases (BVMOs) are flavin-dependent enzymes that catalyze oxidations. Which one of the following oxidation is **NOT** carried out by BVMOs?
(a) Aldehydes to carboxylic acids.
(b) Ketones and cyclic ketones to esters and lactones.
(c) N-oxidations (amines to N-oxides).
(d) Sulfoxidations (conversion of sulphides to sulphoxides.

64. Which one of the following is a malnutrition disease?
(a) Ketosis
(b) Arthritis
(c) Hepatitis
(d) Marasmus

65. The fragments obtained from a Sanger sequencing experiment are as follows: 5′ – GAATTA – 3′
5′ – GAATTAT – 3′
5′ – GAATTATC – 3′
5′ – GAATTATCA – 3′
5′ – GAATTATCAC – 3′
Please identify the template sequence from the above given data:
Options:-
(a) 3′ – CTTAATAGTG – 5′,
(b) 3′ – GAATTATCAC – 5′,
(c) 5′ – CACTATTAAG – 3′ ,
(d) 5′ – GAATTATCAC – 3′,

66. Which one of the following is **NOT** TRUE for local alignment of protein sequences?
(a) Gap penalty is not used for insertions and deletions.
(b) It is generally used for analyzing distantly related sequences.
(c) It looks for regions/blocks of high similarity between the two sequences.
(d) Smith-Waterman algorithm is used to locally align the two sequences.

67. Following is a table in which the List I contains names of various steps of gene expression and in those List II are the enzymes associated with those. Match the components of:
List I with those in List II.

	List I		List II
A	Epigenetic regulation	i	Endonuclease
B	DNA repair	ii	Histone methyltransferase
C	Transcription	iii	eIF2 Kinase
D	Translation	iv	RNA polymerase

Choose the CORRECT answer from the options given below:
Options:-
(a) A –ii, B –i, C-iv, D-iii
(b) A -ii, B-iv, C – i, D- iii
(c) A –iii, B –ii, C –iv, D –i
(d) A-iv, B-iii, C-ii, D-i

68. What is the pH of a mixture of 0.042 M NaH?
(a) 4.86,
(b) 5.86,
(c) 6.86,
(d) 7.86,

69. Cellulose is a polymer of glucose which is made by _____glycosidic bond?
(a) $(1 \rightarrow 2)$ linkage,
(b) $(1 \rightarrow 4)$ linkage,
(c) $(1 \rightarrow 6)$ linkage,
(d) $\alpha(1 \rightarrow 4)$ linkage

70. Which one of the following defines the angle in the protein backbone?
(a) $N - Ca - C - N$,
(b) $Ca - C - N - C$
(c) $C - N - Ca - C$,
(d) $N - Ca - C - O$

71. Which one of the following is used to validate the secondary structure of proteins?
(a) Dot plot,
(b) Neural network,
(c) Ramachandran plot,
(d) Sigma plot,

72. Genes that are related through gene duplication events are:
(a) Analogs,
(b) Homologs,
(c) Orthologs,
(d) Paralogs,

73. A geneticist interested in immune function induces random mutations in a number of specific genes in mice and then determines which of the resulting mutant mice have impaired immune function. This approach is an example of:
(a) Both forward and reverse genetics
(b) Forward genetics
(c) Neither forward nor reverse genetics
(d) Reverse genetics

74. A scientist chose Nickel – NTA affinity chromatography to purify a recombinant protein. Which one of the following tag was present in his recombinant protein?
(a) Flag,

(c) Glutathione-S-transferase,
(a) Hexa-histidine,
(b) Maltose binding protein,

75. During eukaryotic replication, _____degrades the RNA primer by 5' – 3' exonuclease activity. Options:-
(a) DNA polymerase V,
(b) FEN-1,
(c) RNAseH1,
(d) Topoisomerase IIB,

76. The presence of Cardiolipin is a characteristic of the membrane of:
(a) Endoplasmic reticulum,
(b) Lysosomes,
(c) Mitochondria,
(d) Myelin sheets,

77. The enzyme used to prevent unwanted self-ligation of DNA molecules during cloning experiments is:
(a) Alkaline phosphatase,
(b) Reverse transcriptase,
(c) Terminal peroxidase,
(d) Terminal phosphatase,

78. In genomics, a contig means:
(a) A set of fragments generated through digestion with restriction enzymes.
(b) A set of molecular markers used in genetic mapping.
(c) A set of overlapping fragments that form a continuous stretch of DNA.
(d) A small DNA fragment used in next-generation sequencing.

79. The hypochromic effect is used to estimate the melting temperature for double- stranded DNA. It arises because:
(a) Double stranded DNA absorbs more UV light than single stranded DNA.
(b) Double stranded DNA is less colourful than single stranded DNA.
(c) Double stranded DNA is more colourful than single stranded DNA.
(d) Stacked bases in double stranded DNA absorb less UV light than unstacked base in single stranded DNA.

80. Gel filtration chromatography separates proteins on the basis of:
(a) Affinity tag
(b) Charge
(c) Hydrodynamic volume
(d) Hydrophobicity

81. Fake medicines are a nuisance that shatter the faith of patients in medicine and enhance the emergence of drug resistance. A medicine is likely to be fake if:
(a) HPLC retention time (RT) of standard and test sample is same.
(b) Melting point of standard and test are same.
(c) Rf of standard and test sample on TLC is same.
(d) Same peak intensity and same retention time are not observed on injection of equal amount of the test and standard sample on HPLC.

82. Chip-on-chip, a technique that combines chromatin immune precipitation with microarrays, is used to identify:
(a) micro-RNA coding genes.
(b) Protein motifs involved in protein-protein interaction.
(c) Protein-coding regions in the genome.
(d) Transcription factor binding regions in the promoters.

83. You have an assay method that can estimate compound A up to level 10 mg/ml. If you need to modify it so that you can estimate 0.1 mg/ml, you need to improve upon the:
(a) Accuracy
(b) Reactivity
(c) Sensitivity
(d) Specificity

84. A 20-mer peptide composed of all 20 coded standard amino acids was hydrolyzed with 6N HCl. However, only 17 amino acids were detected when the hydrolysate was analyzed by chromatography. The three missing amino acids will be:
    (a) Gln, Asn, Trp
    (b) Glu, Asp, Trp
    (c) Glu, Asp, Tyr
    (d) Tyr, Trp, Phe

85. Which one of the following is the most effective reducing agent of disulfide bonds in proteins?
    (a) 2-mercaptoethanol
    (b) Dithiothreitol
    (c) Ethanethiol
    (d) Ethanol

86. Digitalis is used for the treatment of congestive heart failure because:
    (a) It can dissolve clots to release congestion .
    (b) It can increase the force of contraction of heart muscle .
    (c) It can increase the volume of the heart chambers .
    (d) It clears the lungs to release congestion.

87. Peroxisomes are different from mitochondria and chloroplast mainly because they are:
    (a) Not the major sites of oxygen utilization.
    (b) Surrounded by double membrane.
    (c) Surrounded by single membrane and contain genome.
    (d) Surrounded by single membrane.

88. Copy number variation (CNV) signifies:
    (a) A short (1- 4 nucleotide) highly polymorphic DNA sequence, widely distributed in the genome.
    (b) DNA segments > 1 Kb repeated multiple times in the genome .
    (c) Increase in the number of some of the chromosomes.
    (d) Series of short tandem repeat sequences (10 – 100 nucleotides) occurring frequently in the genome.

89. Which one among the following is **NOT** a characteristic of an "Enhancer"?
    (a) It is conserved in evolution .
    (b) It is transcribed to form enhancer RNA .
    (c) Its function is independent of its location in the genome .
    (d) Its function is independent of its orientation in genome .

90. The enzyme that plays a key role in glucose homeostasis is:
    (a) Fructokinase
    (b) Galactokinase
    (c) Glucokinase
    (d) Hexokinase

91. Prokaryotic ribosomes bind to which one of the following:
    (a) Kozak sequence
    (b) Ori sequence
    (c) Promoter sequence
    (d) Shine-Dalgarno sequence

92. Which one of the following components of an enveloped virus particle is **NOT** encoded by the viral genome?
    (a) Capsid proteins
    (b) Envelope lipids
    (c) Non- structural proteins

(d) Structural proteins

93. A student clones a gene of interest within the ampicillin resistance gene of pBR322 vector for transformant selection, the student will use:
(a) Ampicillin plates .
(b) Both Ampicillin plates and Tetracycline plates .
(c) Neither Ampicillin plates nor Tetracycline plates .
(d) Tetracycline plates .

94. The consequences of a DNA base change in a mutation are maximum, if the base change is located in the:
(a) First or second position of a codon
(b) Middle of an intron
(c) Repetitive DNA elements
(d) Third position of a codon

95. The Telomerase enzyme is a:
(a) DNA–dependent DNA Polymerase
(b) DNA–dependent RNA Polymerase
(c) Reverse Transcriptase
(d) RNA–dependent RNA Polymerase

96. Though DNA and RNA are nucleic acids, isolating RNA in the laboratory requires extreme precautions and pre-preparations than isolating DNA. This could be because:
(a) RNA is more prone to hydrolysis than DNA.
(b) RNA is smaller in size than DNA.
(c) RNA molecules tend to form RNA-RNA hybrids.
(d) There is lesser RNA content per cell than DNA.

97. Type IIP restriction endonucleases will always:
(a) Bind to double strand RNA.
(b) Cleave outside the recognition sequence.
(c) Generate blunt ends.
(d) Recognize palindromic sequence.

98. Given below are two statements: one is labelled as Assertion A and the other is labelledas Reason R.
Assertion A: Ionizing radiation can cause damage to the DNA Reason R:
Ionizing radiation generates free radicals
In light of the above statements, choose the most appropriate answer from the options given below:
(a) A is false but R is true.
(b) A is true but R is false.
(c) Both A and R are true and R is the correct explanation of A.
(d) Both A and R are true but R is NOT the correct explanation of A.

99. Lysosomal lumen is maintained at an acidic pH by:
(a) De novo generation of H+ ions in the lysosomes.
(b) H+ ATPase that pumps H+ ions into lysosomes.
(c) H+ ATPase that pumps H+ out of lysosomes.
(d) Specialized luminal proteins that lower the pH.

100. Which one among the following is a nuclease?
(a) DNase I
(b) Helicase
(c) Ligase
(d) Polymerase

101. Which one of the following statements is **NOT** common between oxidativephosphorylation and photophosphorylation?

(a) Generation of ATP
(b) Involvement of a kinase
(c) Involvement of electron transport
(d) Involvement of oxygen

102. Which one of the following combinations signify similar function?
(a) Cryptochrome and flurochrome
(b) Cryptochrome and phytochrome
(c) Cytochrome and cryptochrome
(d) Fluorochrome and cytochrome

103. When the critical night length in winters is disrupted by a pulse of red light followed bya pulse of far red light:
(a) Both long-day and short day plants will flower.
(b) Long-day plants will flower and short-day plants will not flower.
(c) None of the plants will flower.
(d) Short-day plants will flower and long-day plants will not flower.

104. A plant species nearing its extinction due to viral infection has been chosen formicropropagation by tissue culture. Which explants will be the most appropriate to produce virus-free plants?
(a) Shoot apical meristem
(b) Stem
(c) Leaf disc
(d) Root tip.
Choose the most appropriate answer from the options given below:
(a) A and C
(b) A only
(c) B and D
(d) C only

105. The rice blast fungus Magnaporthegrisea, invades rice plants in a manner typical of many foliar pathogens by producing specialized infection structures called:
(a) Appressoria
(b) Infection tube
(c) Mycota
(d) Sporangia

106. The first alkaloid to be isolated and characterized from plants is:
(a) Caffeine
(b) Cocaine
(c) Morphine
(d) Quinine

107. Seeds of Arabidopsis thaliana placed on Murashige and Skoog (MS) media without anyhormones germinates faster than in the medium that contains:
(a) Abscisic acid
(b) Auxin
(c) Cytokinin
(d) Jasmonic acid

108. Which one of the following is a non-climacteric fruit?
(a) Jackfruit (Artocarpusheterophyllus)
(b) Tomato (Solanumlycopersicum)
(c) Wild banana (Musa balbisiana)
(d) Wild strawberry (Fragariavesca)

109. Which one of the following statements are TRUE for gibberellins?
(a) Gibberellins promote seed germination.
(b) Gibberellins cannot stimulate leaf growth.
(c) Gibberellins cannot stimulate stem growth.
(d) Gibberellins can be exogenously used to increase plant growth.

110. Which one of the following is **NOT** a secondary metabolite?
(a) Acetyl-CoA
(b) Coumarins
(c) Flavonoids
(d) Squalene

111. Which one of the following classes of compounds is generally accumulated as an antiherbivore response in plants?
(a) Alkaloids
(b) Glucose
(c) Sucrose
(d) Tannins

112. Which one of these polysaccharides is induced after a pathogen or microbial attack?
(a) Arabinoxylan
(b) Callose
(c) Cellulose
(d) Pectin

113. The GA2oxidase gene from bean is overexpressed in a wheat plant by geneticengineering. Which one of the following phenotypes CORRECTLY describes the resultanttransgenic plant?
(a) The height of the plant will not be affected.
(b) The plant will be shorter than the wild type.
(c) The plant will be taller than the wild type.
(d) The plant will not survive.

114. The TDNA of Agrobacterium must be cut out from its circular plasmid for its transferinto plant cells. Which one of the following Vir proteins are involved in this process?
(a) Vir A / Vir C
(b) Vir B6 / Vir B7
(c) Vir D1 / Vir D2
(d) Vir E2 / Vir G

115. Lateral roots initiate from:
(a) Endodermis
(b) Pericycle
(c) Root apical meristem
(d) Root epidermis

116. Which one of the following is **NOT** a characteristic feature of skotomorphogenicdevelopment?
(a) Apical hook
(b) Closed cotyledons
(c) Expanded leaves
(d) Long hypocotyls

117. Which one of the following can be used as a selection marker for developing transgenicplants?
(a) □galactosidase
(b) □glucoronidase
(c) Green fluorescent protein
(d) Hygromycin phosphotransferase

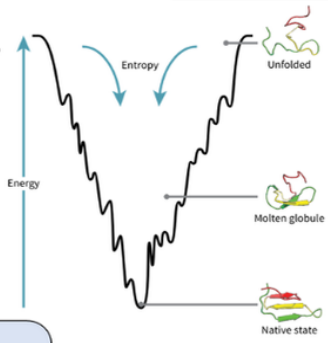
118. Which one of the following treatments is required for flowering in a winter annual typeof Arabidopsis plants?
(a) A short pulse of cold temperature.
(b) A short pulse of high temperature.
(c) High expression of Flowering Locus C (FLC) gene

VEDEMY'S CAPSULE (VEDEMY'S SPECIAL NOTES)

Amino acid Classes

Essential	**M**y **V**ery **T**alented **F**riend **I**s **W**aiting **F**or **K**ajo**L**
Semi-essential	**R**ahu**L**
Non-Polar	**GAV** के लोग **PILW** लेकर **FM** सुन रहे थे
Polar Uncharged	**CN**(कार्टून नेटवर्क) pe **STY**(सत्य) **Q**ues पूछते है
Negative charged	Ye **DE**kh
Positive charged	**R**a**H**u**L** bola
Gluco-ketogenic	**I**tni **T**alented **WYF** (wife)
Ketogenic	**K**ajo**L**

Protein Folding Curve



Energy profile-

High

- **U**- Unstructured
- **M**- molten globule
- **D**- discrete structure
- **N**- native
- **A**- amorphous
- **A**- amyloid

Low

Urmila Matoldkar ka DNA Achha hai

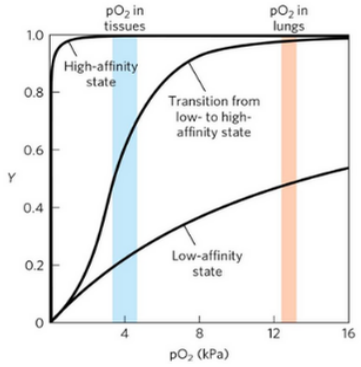
Hemoglobin

State of Hb – MOLD

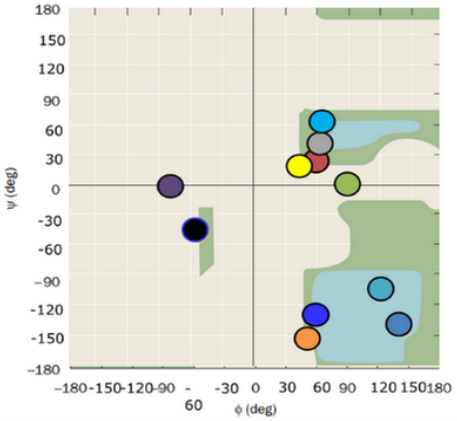
- **O**xy Hb
- **L**ess acidic (Tensed state)
- **D**eoxy Hb
- **M**ore acidic (Relaxed state)

Affinity of Curve – DRIL

- H+, Temp. BPG, CO_2
- **I**ncrease
- **L**eft shift
- **D**ecrease
- **R**ight shift

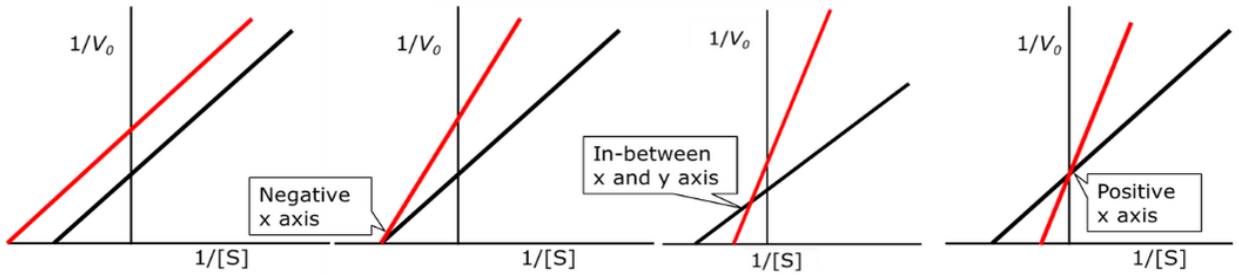


Ramachandran plot



Secondary Structure	Phi	Psi
AP β Sheet	+140⁰	-135⁰
P β Sheet	+120⁰	-115⁰
CTH	+50⁰	-150⁰
L-α-H	-60⁰	-50⁰
R-α-H	+60⁰	+50⁰
Type-I i+1	+60⁰	+30⁰
Type-I i+2	+90⁰	0⁰
Type-II i+1	+60⁰	-120⁰
Type-II i+2	-80⁰	0⁰

Enzyme Inhibition Curve



Uncompetitive Inhibition
Decrease K_m = increased $1/K_m$
Decreased V_{max}= increased $1/V_{max}$

Noncompetitive Inhibition
Decreased V_{max}= increased $1/V_{max}$

Mixed Inhibition
K_m increase
V_{max} decrease

Competitive Inhibition
Increase K_m = decreased $1/K_m$

UP ke **NaNa** patekar **MI** ka **PC** lekar aaye

- **U**ncompetitive — **P**arallel
- **N**on-competitive — **N**egative x axis
- **M**ixed — **I**n-between x and y axis
- **P**ositive x axis — **C**ompetitive

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पता: 2nd फ्लोर , SBI बिल्डिंग, क्राइस्ट नगर, बड़ालालपुर , चांदमारी, सिंधोरा रोड, वाराणसी, 221003

(d) Hygromycin phosphotransferase.

119. Which one of the following treatments is required for flowering in a winter annual type of Arabidopsis plants?

(a) A short pulse of cold temperature.

(b) A short pulse of high temperature.

(c) High expression of Flowering Locus C (FLC) gene.

(d) Prolonged cold period.

120. Which one of the following statements are TRUE regarding specialized embryonic structures peculiar to the grass family?

A. Thecotyledon has been modified by evolution to form an absorptive organ called coleoptile

B. Scutellum forms the interphase between the embryo and the starchy endosperm tissue

C. Coleoptile covers and protect the first leaves while buried beneath the soil

D. The base of the hypocotyl has elongated to form a protective sheath around the radicle called the scutellum

Choose the most appropriate answer from the options given below:

(a) A and C only

(b) A and D only

(c) B and C only

(d) C and D only

121. Two immobilized enzyme columns with equal enzyme loading and same column volumeare run at the same feed rate and same inlet substrate concentration. It is observedthat the taller and thinner column gives better conversion. This demonstrates that:

(a) Column packing efficiency is not good

(b) Enzyme deactivation is taking place .

(c) Immobilized enzyme has external diffusion which reduces the enzymatic conversionrate .

(d) Immobilized enzyme has internal pore diffusion which reduces the enzymaticconversion rate.

122. In a two stage CSTR in series, the first reactor runs at a dilution rate D1 <μmax and the inletsubstrate concentration (S0) is two times greater than Ks, then:

(a) Washout will never takes place .

(b) Washout will take place when D2>μmax in the second reactor .

(c) Washout will take place when D2<μmax in the second reactor .

(d) Washout will take place when D2 = μmax in the second reactor.

123. To have an extended late log/ stationary phase so that secondary metabolites may beproduced, you will prefer to use:

(a) Batch reactor

(b) Fed batch reactor

(c) Fluidized bed reactor

(d) Plug flow reactor

124. Given the pseudoplastic rheology of fungal fermentation broth, we can expect that:

(a) The viscosity of the fungal broth to be uniformly high in the culture .

(b) The viscosity of the fungal broth to be uniformly low in the culture .

(c) The viscosity to be higher near the impeller but low near the walls of the bioreactor .

(d) The viscosity to be low near the impeller but high near the walls of the reactor.

125. Given below are two statements: one is labelled as Assertion A and the other is labelledas Reason R

Assertion A: In a plate & frame filter operated under constant pressure, the filtrate flowrate declines with time

Reason R: In a plate & frame filter operated under constant pressure, the filtrate cakebuilds up on the filter membrane

In light of the above statements, choose the most appropriate answer from the optionsgiven below:

(a) A & R are both true and A is due to R .

(b) A & R are both true but A is NOT due to R .

(c) A is false but R is true .

(d) A is true but R is false.

126. Scaling up a reactor while keeping the power consumption per unit volume constant willlead to:

(a) Decrease in RPM of the impeller of the larger reactor.

(b) Holding the RPM of the impeller at the same value.

(c) Increase in RPM of the impeller of the larger reactor.

(d) Increasing or decreasing the RPM of the impeller depending on the type of impeller.

127. In a fed batch culture the feed rate of concentrated substrate is increased with timewhile the RPM of the impeller is kept constant. You will most likely observe one of thefollowing:

(a) A decline in the D.O. values of the culture.

(b) An increase in the D.O. values of the culture.

(c) An oscillation in the D.O. values of the culture.

(d) No change in the D.O. values of the culture.

128. In an anaerobic fermentation producing ethanol, the ethanol yield (Yp/s) .

(a) Decreases with increasing biomass yield (Yx/s) .

(b) Increases with increasing biomass yield (Yx/s) .

(c) Initially increases & then decreases with increasing biomass yield (Yx/s) .

(d) Is independent of biomass yield (Yx/s).

129. Doubling the substrate concentration in the inlet of a CSTR (with cells following Monodgrowth kinetics) will, after reaching the new steady state, lead to:

(a) Higher biomass concentration but unchanged substrate concentration in the outlet.

(b) Higher substrate & biomass concentration in the outlet.

(c) Higher substrate concentration but unchanged biomass concentration in the outlet.

(d) Unchanged substrate & biomass concentration in the outlet.

130. If 180 gm of glucose is consumed during cell growth and 132 gm of carbon dioxide is produced, then the fractional carbon flux towardsbiomass (assuming no product is formed and glucose is the sole carbon source) is:

(a) 0.5

(b) 132/180

(c) 2 /15

(d) 48/180

131. S. cerevisiae produces ethanol at a yield of 0.5 g/g glucose. The strain ferments 20g/lglucose in 24 hours. Calculate productivity of ethanol in this fermentation:

(a) 0.416 g/l/h

(b) 0.833 g/l/h

(c) 108 g/l

(d) 20 g/l

132. E. coli was grown aerobically in batch fermentation. The initial concentration of cells was 1x 103/ml and it reached 1x106/ml in 10 hours. Calculate specific growth rate:

(a) 0.3 h-1

(b) 0.69 h-1

(c) 103 h-1
(d) 3 h-1

133. In a fed batch process with a non-growth product formation kinetics given by qp = β (a constant), in order to maximize productconcentration and enhance metabolic flux towards product formation, you will:
(a) Maintain a slowly declining μ
(b) Maintain a slowly increasing μ
(c) Maintain highest possible μ
(d) Maintain lowest possible μ

134. Given that Power number is constant; then increasing the RPM of the impeller 3-foldwill increase the power consumption due to agitation by:
(a) 27-fold
(b) 3-fold
(c) 81-fold
(d) 9-fold

135. If the maintenance coefficient (m) is significantly high, then with reduction in specificgrowth rate:
(a) Biomass yield decreases
(b) Biomass yield increases
(c) Biomass yield remains constant
(d) Sum of biomass & product yield remain constant

136. Increasing the agitation in a reactor increases oxygen transfer primarily because:
(a) Gas hold up decreases
(b) Good mixing takes place
(c) Microbial cells move more energetically coming closer to gas bubbles
(d) 0.67

137. In a continuous culture of Saccharomyces cerevisiae, the cell density is 30 gL1 (DCW),the dilution rate (D) is 0.4 h1 and substrate uptake rate (q) is 18 gL1 h1. The cell yieldcoefficient Yx/s will be:
(a) 0.32
(b) 0.45
(c) 0.50
(d) 0.67

138. Aqueous two phase partitioning (ATPS) is used for the recovery of an enzyme from the cell free culture filtrate on addition of PEG2000 and dextran. The mixture separatesinto two phases with a partition coefficient for the enzyme = 4.2. The maximumpossible enzyme recovery, when the volume ratio of the upper to lower phases is 5.0will be:
(a) 68%
(b) 76%
(c) 85%
(d) 95%

139. A fermentation medium is being cooled from 70 to 32 in a double pipe heat exchanger.Cooling fluid flowing counter-currently with this stream is heated from 20 to 46. Thelog mean temperature difference (in) for the two streams is:
(a) 12.6
(b) 17.3
(c) 4.8
(d) 8.5

140. For reactions catalysed by an enzyme following MichaelisMenten Kinetics, the elasticityof the reaction velocity with respect to substrate:
(a) Decreases with increase in substrate concentration.

(b) Increases and then declines with increase in substrate concentration.
(c) Increases with increase in substrate concentration.
(d) Remains unchanged on change in substrate concentration.

141. Given below are two statements: one is labelled as Assertion A and the other is labelledas Reason R
Assertion A: Gene Sequences are aligned using identity matrices instead of substitutionmatrices Reason R: The four bases in DNA **CANNOT** be replaced with each other
In light of the above statement, choose the CORRECT answer from the options givenbelow:
(a) A is false but R is true.
(b) A is true but R is false.
(c) Both A and R are true and R is the correct explanation of A.
(d) Both A and R are true but R is not the correct explanation of A.

142. Match the components of List I with List II

	List I		List II
A	Sequence alignment	i	PUBMED
B	Structural alignment	ii	BLAST
C	Fold prediction	iii	ROSETTA
D	Review of literature	iv	DALI

Choose the CORRECT answer from the options given below:
(a) A-i, B-iv, C-iii, D-ii
(b) A-ii, B-iii, C-iv, D-i
(c) A-ii, B-iii, C-iv, D-i
(d) A-ii, B-iv, C-iii, D-i

143. Which one of the statements relating to properties and structures of two proteins is most appropriate?
(a) Two proteins with very similar secondary structures will have similar stability.
(b) Two proteins with very similar secondary structures will have similar tertiary structures.
(c) Two proteins with very similar tertiary structures will be localized to similar compartments inside the cell.
(d) Two proteins with very simple tertiary structures will have very similar secondary structures.

144. Trp florescence can be used to study protein folding and unfolding. Which properties of Trp are critical in ensuring that this can be used for studying the process?
(a) Trp in the only amino acid present in most of the proteins.
(b) Trp is a better hydrogen bond acceptor than most other amino acids.
(c) Trp is a positively charged amino acid.
(d) Trp is an environment sensitive fluorophore which is typically buried in a folded protein.

145. Given below are two statements:
Statement I: The peptide bond is a planar bond
Statement II: The Ramachandran Plot describes Omega Torsion Angles in proteins In light of the above statements, choose the most appropriate answer from the optionsgiven below
(a) Both Statement I and Statement II are correct.
(b) Both Statement I and Statement II are incorrect.
(c) Statement I is correct and Statement II is incorrect.
(d) Statement II is correct and Statement I is incorrect.

146. Protein folding is highly cooperative. Which one of the following statement define thiscooperativity?
(a) If one protein unfolds, it forces a nearby protein to unfold too.
(b) If one proteins chain folds, it facilitates the folding of a nearby chain.
(c) Many molecules of polypeptides come together to fold at the same time.
(d) The protein chain completely unfolds if key interactions are broken in an "all or none"manner.

147. Given below are two statements: Statement I: Serine is part of a catalytic triad in proteases that also includes histidine and aspartic acid.

Statement II: Catalytic triads are responsible for peptide hydrolysis. In light of the above statements, choose the most appropriate answer from the options given below
(a) Both statement I and statement II are correct.
(b) Both statement I and statement II are incorrect.
(c) Statement I is correct and statement II is incorrect.
(d) Statement II is correct and statement I is incorrect.

148. If two sequences are 1 PAM apart, then they will be:
(a) 1% identical amino acid residues.
(a) 1% similar nucleotide bases.
(b) 99% identical amino acid residues.
(c) 99% similar nucleotide bases.

149. Contact map distance matrix of a protein provides a two-dimensional view of a three-dimensional structure of a protein. How can you obtain a proper three-dimensionalstructure from the contact map?
(a) Directly from the contact map by mapping the distance on the sequence,
(b) The contact map and secondary structure prediction tools are simultaneously used to generate the 3D structure,
(c) Using contact map along with computational modelling techniques like simulated annealing,
(d) Using the contact map to generate Ramachandran plot for the protein which will provide the 3D structure.

150. Which one of the following is TRUE about Phylograms and Cladograms?
(a) Branches of cladograms are proportional to evolutionary time.
(b) Cladograms show common ancestry but not time.
(c) Phylograms show common ancestry but not time.
(d) There is no difference between cladograms and phylograms.

151. Two sequences PLAVAV and PLLV were aligned using Needliman-Wunsch algorithm with the scores, match = 1, mismatch = -1, gap initiation = -1, gap elongation = -2. The alignment with the best score according to this algorithm will be:
(a) PLAVAV
PLLV--
(b) PLAVAV
PLL--V
(c) PLAVAV
PL-LV-
(d) PLAVAV
PL-L-V

152. CASP judges one of the following:
(a) Experimental techniques of structure determination.
(b) Quality of protein structures.
(c) Suitability of drug .
(d) Techniques of protein structure prediction .

153. A protein sequence was isolated from a novel source. During an initial sequencesimilarity search through BLAST, no homologous sequence was identified. A furtherBLAST search should be run by changing the scoring matrix to:
(a) BLOSUM62
(b) BLOSUM80
(c) PAM250
(d) PSSM

154. The in vitro ADMET analysis **CANNOT** provide information about:
(a) Cytochrome P450 inhibition
(b) Adverse reaction to the drug
(c) Blood-brain barrier penetrability
(d) Metabolic Stability

155. K-tuple method is associated with:
(a) Dot matrix ,
(b) Dynamic programming ,
(c) Multiple sequence alignment,
(d) Sequence similarity,

156. The motif D-[TS]-x-(2)-{GH}-L motif will have sequence:
(a) DRRRRL
(b) DSARRL
(c) DSRRGL
(d) DTRRHL

157. How many atomic positions are required to measure a dihedral angle?
(a) Five
(b) Four
(c) Three
(d) Two

158. Which one of the following will be used to assess structural similarity of biomolecules?
(a) E-value
(b) P-Value
(c) Root mean square deviation
(d) Standard deviation

159. A profile can be generated from a multiple sequence alignment by obtaining positionspecific preference (or probability) of each amino acid. This can be used to identifyhomologs. However, the key difference between a profile alignment like this and HiddenMarkov Model (HMM) is:
(a) HMM can find more remote homologs using PSI-BLAST.
(b) HMM does not generate a profile of position specific probabilities.
(c) HMM has the option to introduce gaps with position specific gap penalties.
(d) HMM is independent of a multiple sequence alignment.

160. You have purified a protein X and observed the following:
A. When run on a native PAGE, it gives rise to a single band.
B. When run on a non-reducing SDS-PAGE, you obtain two bands-corresponding to40kDa and 60kDa.
C. When run on a reducing SDS page you get three bands- corresponding to 60kDa,30kDa, and 10kDa.
What can you conclude about the purified protein X?
(a) X contains 2 polypeptide chains that form a complex
(b) X contains at least 3 polypeptide chains that from a complex
(c) X has 3 polypeptide that have intramolecular disulfide bonds
(d) X is a complex of 3 polypeptide chains all of which are linked to each other y disulfide bonds,

161. What types of bonds generally stabilize the antigen-antibody interaction?
(a) Covalent bonds and hydrogen bonds.
(b) Disulphide bonds.
(c) Glycosidic bonds.
(d) Weak hydrogen bonds and Van der Waal forces.

162. Tay-Sachs disease is a:
(a) Autosomal recessive genetic disorder.
(b) Sex-linked inherited disorder.
(c) Transposition disorder.
(d) Trinuceotide repeat disorder.

163. "Dysbiosis" is a term associated with:
(a) Genome
(b) Metabolome
(c) Microbiome
(d) Proteome

164. Single chain variable fragment (ScFV) are fusion proteins composed of:
(a) FC region
(b) V_H + V_LGjoined by a flexible linker)
(c) V_H only
(d) V_L only

165. Human embryonic stem cells (hESCs) can be obtained from:

(a) Inner cell mass of blastocyst
(b) Morula stage
(c) Teratoma
(d) Trophoblast of blastocyst

166. Witch gene is often been inserted in an adenoviral vector to treat cancer by suicidegene therapy?
(a) GM-CSF
(b) HSV-TK
(c) IL-2
(d) VSV-G

167. Which one of the following is the most common adjuvant composed of water in oil emulsion with Mycobacterium tuberculosis components?
(a) Alum
(b) Complete Freund's adjuvant
(c) Incomplete Freund's adjuvant
(d) Montanide

168. Karyogram of an individual shows presence of 45 chromosomes (44+x) and one sexchromosome is missing. The individual has a female appearance and dwarfism. Whichof the following is the most probable condition associated with this individual?
(a) Down's syndrome
(b) Edward's syndrome
(c) Klienfelter's syndrome
(d) Turner's syndrome

169. Match the components of List I with those in the List II.

	List I		List II
A	Idiopathic thrombocytopenic purpura (ITP)	i	Thyroid
B	Hashimoto's Disease	ii	Gut
C	Celiac Disease	iii	Brain
D	Huntington Disease	iv	Platelets

(a) A-i, B-iii, C-ii, D-iv
(b) A-ii, B-i, C-iv, D-iii
(c) A-iii, B-iv, C-ii, D-i
(d) A-iv, B-i, C-ii, D-iii

170. Which family does HIV belong to?
(a) Paramyxoviridae
(b) Retrovirie
(c) Rhabdovie
(d) Togaviridae

171. Kuru disease in human is caused by:
(a) Bacteria
(b) Mycoplasma
(c) Prions
(d) Virus

172. Which statement is TRUE for pathogenicity islands?
(a) These are large segments of bacterial genome encoding virulence factors.
(b) They coordinate gene expression to make the biofilm.
(c) They generate signals that activate global response regulators.
(d) They interfere with the antibody response of the host.

173. Which one of the following diseases can be treated with dopamine producing neuronsgenerated from stem cells?
(a) Alzheimer's disease
(b) Amyotrophic lateral sclerosis
(c) Brain tumor
(d) Parkinson's disease

174. Protein A, which has strong affinity for Fc region of immunoglobulin, is extracted from?
(a) Saccharomyces cerevisae
(b) Staphlyococcu spyogenes
(c) Staphylococcus aureus
(d) Staphylococcus sanjuis

175. Which one of the following diseases in caused due to a point mutation in the coding region of The associated gene?
(a) Hemolyticanemia
(b) Sickle cell anemia
(c) α-thalassemia
(d) a-thalassemia

176. Double pain sensation that is occasionally felt following painful stimulation of the skin isdue to:
(a) Application of two painful stimuli simultaneously at two different sites,
(b) Perception of pain at two different higher centers,
(c) Presence of dual pain pathways,
(d) Repetition of the painful stimulus,

177. Interneurons:
(a) Influence the rate of discharge from the alpha motor neurons,
(b) Participate in ascending sensory pathways,
(c) Provide communication between dendrites of the efferent neurons,
(d) Provide communication between the central ends of afferent neurons,

178. The hypothalamus protects the body against hypoglycemia by:
(a) Increasing epinephrine release,
(b) Increasing glucagon release,
(c) Increasing thyroxin release,
(d) Inhibiting insulin release,

179. Chemical transmitters in basal ganglia include all the following, EXCEPT:
(a) Dopamine,
(b) GABA,
(c) Glutamate
(d) Glycine,

180. Which one of the statements is TRUE regarding chemical synapses in the nervoussystem?
(a) Allow diffusion of chemical substances form the presynaptic neuron into thepostsynaptic
(b) neuron,
(c) Allow transmission of potential changes in one direction only; from the presynaptic to the postsynaptic neurons,
(d) Are more numerous in the peripheral nervous system than the central nervoussystem,
(e) Have potential-gated ionic channels,

181. Given below are two statements:
Statement I: Tissues that are non-regenerative, such as neurons in the brain, do havestem cells.
Statement II: Tissue localization does not necessarily mean lineage commitment andreduced potency, as liver stem cells can generate neurons.
In light of the above statements, choose the most appropriate answer from the optionsgiven below:
(a) Both statement I and II are correct.
(b) Both statement I and II are incorrect.
(c) Statement I is correct but statement II is incorrect.
(d) Statement I is incorrect but statement II is correct.

182. Given below are two statements: one is labelled as Assertion A and another one islabelled as Reason R
Assertion A: It is essential that the animal cell cultures be maintained in antibiotic freeconditions otherwise cryptic contaminations will persist
Reason R: The constant use of antibiotics favours development of chroniccontamination. Many organisms are inhibited but not killed by antibiotics, which mayresurface when conditions are

favourable.
In light of the above statements, choose the CORRECT answer from the options below:
(a) A is false but R is true.
(b) A is true but R is false .
(c) Both A and R is true and R is NOT the correct explanation of A.
(d) Both A and R is true and R is the correct explanation of A.

183. Match the components of List I with List II.

	List I (Inducers of cell diffrerent		List II (Cell type)
A	Hydrocortisone	i	Neuroblastoma
B	Retinoids	ii	Endothelium
C	Prolactin	iii	Glia, glioma
D	Interfgeron – γ	iv	mammary epithelium

(a) A-i, B-ii, C-iii, D-iv
(b) A-ii, B-i, C-iv, D-iii
(c) A-iii, B-ii, C-iv, D-i
(d) A-i, B-iii, C-ii, D-iv

184. Match the components of List I with List II.

	List I (Techniques)		List II(Used in)
A	Mosaic Spheroids	i	3D aggregate of cells
B	Microcarrier matrix	ii	Microgravity cell growth environment
C	Organioids	iii	Bystander effects
D	Rotatory cell culture system	iv	3D growth environment

(a) A-iii, B-iv, C-i, D-ii
(b) A-iv, B-iii, C-ii, D-i
(c) A-ii, B-ii, C-iii, D-iv
(d) A-i, B-ii, C-i, D-III

185. What is the role of macrophage activating factor (MAF) in an animal cell culture media?
(a) Antiviral .
(b) Epithelial cell mitogen .
(c) Inhibits differentiation of embryonic stem cells.
(d) Support growth of activated T cells.

186. Common indicators of water pollution with enteropathogens are following EXCEPT-:
(a) Bacillus spp.
(b) Clostridium spp.
(c) coli
(d) Streptococcus spp.

187. The first U.S patent for a GM organism was awarded to Dr. A. M. Chakrabarty for his work on one of the following:
(a) E. coli engineered to produce insulin,
(b) Pseudomonas engineered to degrade petroleum,
(c) Pseudomonas engineered to produce petrol ,
(d) Yeast engineered to produce Hepatitis B vaccine,

188. The suitable method for treatment of municipal waste water and aqueous hazardous waste which have less than 1% of suspended solids is:
(a) Activated sludge process
(b) Bioreactors
(c) Lagoons & ponds
(d) Trickling filter

189. Nitrification during nitrogen cycle is the production of:
(a) Ammonium

(b) Nitrates
(c) Nitric oxide
(d) Nitrogen ,

190. Match the components of List I with List II.

	List I		List II
A	Legume	i	Frankia
B	Azolla	ii	Azorhizobium
C	Sugarcane	iii	Anabaena
D	Actinorhizal	iv	Acetobacter

(a) A-i, B-iii, C-ii, D-iv
(b) A-ii, B-iii, C-i, D-iv
(c) A-ii, B-iii, C-iv, D-i
(d) A-ii, B-iv, C-i, D-iii

191. Match the components of List I with List II.

	List I (Marine Enzymes)		List II (Source)
A	Chitinolytic enzymes	i	Digestive tracts of fish, shellfish, squid liver, octopus saliva
B	Gastric proteases	ii	Pyloric ceca, pancreatic tissues, intestines of sardine, cod & salmon
C	Polyphenol oxidases	iii	Fish viscera from fishery sources
D	Serine and cycteine proteases	iv	Crustaceans

(a) A-i, B-ii, C-iii, D-iv
(b) A-i, B-iii, C-iv, D-ii
(c) A-ii, B-iii, C-iv, D-i
(d) A-iv, B-iii, C-ii, D-i

192. Given below are two statements:
Statement I: Humans mainly obtain DHA and EPA by consuming fish whereas fish in turn obtain PUFAs from microalgae.
Statement II: Microalgae derived DHA and EPA can be used as a supplement for people who do not consume fish and seafood.
In light of the above statementschoose the most appropriate answer from the options given below:

(a) Both Statement I and II are correct
(b) Both Statement I and II are incorrect
(c) Statement I is correct but statement II is incorrect
(d) Statement I is incorrect but statement II is correct

193. Given below are two statements:
Statement I: Xenobiotic pollutants are biomagnified and accumulate in marine organisms.
Statement II: Pollutants can be quantified in tissue samples from key marine animals living in the environment where pollution monitoring is in place.
In light of the above statements choose the most appropriate answer from the options given below:
(a) Both Statement I and II are correct
(b) Both Statement I and II are incorrect
(c) Statement I is correct but statement II is incorrect
(d) Statement I is incorrect but statement II is correct

194. Brine shrimp assay involves one of the following:
(a) Testing effect of changing salinity on nutritional content of shrimp.
(b) Testing effect of decreasing salinity on growth of shrimp.
(c) Testing effect of increasing salinity on survival of shrimp.
(d) Testing the toxicity of anticancer molecules using eggs of brine shrimp.

195. Strong adhesives can be prepared using the constituents of one of the following:
(a) Base of sea anemone

(b) Byssus generated by sea mussel
(c) Platform generated by sea urchin
(d) Tentacles of hydra

196. Match the components List I with List II

	List I		List II
A	Rhodopsin	i	Vitamin –C
B	Tocopheral	ii	Vitamin –A
C	Idoflaconoids	iii	Vitamin -A
D	Ascorbic acid	iv	Soybean

(a) A-I,B-ii,C-iv,D-iii
(b) A-ii,B-I,C-iv,D-iii
(c) A-ii,B-iii,C-iv,D-i
(d) A-iv,B-iii,C-ii,D-i

197. Which one of the following is **NOT** a fermented food? Options: -
(a)Milk cream
(b)Cheese
(c)Salami
(d)Sauerkraut

198. Given below are two statements: one is labelled as Assertion A and another one is labelled as Reason R
Assertion A: Within a few hours after an animal is killedrigor mortis sets in with a contraction of muscle fibres and an increasing toughness of the meat.
Reason R: The loss of glycogen and disappearance of ATP from the muscles are observed in freshly killed animals
In light of the above statementschoose the CORRECT answer from the options below:
(a) A is false but R is true.
(b) A is true but R is false.
(c) Both A and R is true and R is NOT the correct explanation of A.
(d) Both A and R is true and R is the correct explanation of A.

199. Which one of the following methods of controlling microbial contamination is the least preferred in food processing?
(a) Autoclaving
(b) Dry heat
(c) Pasteurization
(d) Preservatives

200. Spirulina is considered as a super food for human consumption because it contains:
(a) All dietary phytochemicals .
(b) All essential amino acids vitamins and fatty acids .
(c) All known proteins, carbohydrates and lipids .
(d) No heavy metals or anti-nutritive compounds .

DBT-BET-JRF 2021 ANSWER KEY

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
a	b	b	d	c	b	b	d	b	b	c	d	b	b	d	b	b	b	d	b
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
d	c	c	a	b	a	b	b	c	c	d	a	c	c	d	c	c	a	c	c
41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
d	b	d	d	b	c	b	b	a	a	a	d	b	c	c	a	d	a	a	c
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
d	b	a	d	a	a	a	d	b	a	c	d	d	c	b	c	a	c	d	c
81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
d	d	c	a	b	b	d	b	a	c	d	b	d	a	c	a	d	c	b	a
101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
b	b	b	b	a	c	a	d	c	a	a	b	b	c	b	c	d	d	d	c
121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140
c	a	b	d	a	a	a	a	a	d	a	b	d	a	a	d	d	d	b	a
141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160
c	d	d	d	c	d	a	c	c	b	b	d	c	b	b	b	b	c	c	b
161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180
d	a	c	b	a	b	b	d	d	b	c	a	d	c	b	c	a	a	d	b
181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200
a	d	c	a	a	a	b	a	b	c	b	a	a	d	b	c	a	d	b	b