Section A

1. Electrons from excited chlorophyll molecules of photosystem II are accepted first by:
   (a) Ferredoxin
   (b) Cytochrome-b
   (c) Cytochrome-f
   (d) Plastoquinone

2. Sam invested Rs. 30,000 at 5% per annum on simple interest for 4 years to Shyam. Sam also invested the same amount, for same duration and same rate of interest to Mohan on compound interest. What will be the difference of interest received by him in two cases?
   (a) Rs. 300
   (b) Rs. 150
   (c) Rs. 200
   (d) Rs. 175

3. What is meant by "Trophophase"?
   (a) Production of waste materials
   (b) Production of topical products
   (c) Production of primary metabolites
   (d) Production of secondary metabolites

4. In affinity chromatography, the protein bound to the column can be eluted using a buffer containing:
   (a) mM NaCl
   (b) Acetonitrile
   (c) immobilized ligand
   (d) free ligand

5. A reservoir has two pipes, A and B. Pipe A can fill the reservoir in 12 hours. Pipe B takes 15 hours to fill the reservoir. There is another waste pipe which can empty the reservoir. When all the pipes are opened, the reservoir is full in 20 hours. How long will the waste pipe take to empty the full reservoir?
   (a) 12 hours
   (b) 9 hours
   (c) 10 hours
   (d) 15 hours

6. Acid rain is caused by:
   (a) Carbon dioxide
   (b) Hydrogen
   (c) Biomethane
   (d) Nitrogen dioxide

7. EcoRI enzyme recognizes the sequence GAATTC. A stretch of linear DNA with six GAATTC sites, upon digestion with EcoRI, will give rise to:
   (a) 8 fragments
   (b) 7 fragments
   (c) 6 fragments
   (d) 5 fragments

8. Vande-Bharat express runs at a speed of 120 km/h. It starts from a station 8 hours after a goods train leaves that station. Vande-Bharat overtakes the goods train after 4 hours. The speed of the goods train is:
   (a) 60 km/h
   (b) 40 km/h
   (c) 80 km/h
   (d) 20 km/h

9. Which of the following statements CORRECTLY depicts the Beer-Lambert law?
   (a) Absorbance is directly proportional to path length and concentration.
   (b) Absorbance is directly proportional to molar absorptivity, and inversely proportional to path length and concentration.
   (c) Absorbance is directly proportional to molar absorptivity and path length and inversely proportional to concentration.
   (d) Absorbance is directly proportional to concentration and inversely proportional to path length.

10. What is the product formed upon decarboxylation of oxalic acid with release of one molecule of CO_2?
   (a) Acetic acid
   (b) Aspartic acid
   (c) Formic acid
   (d) Butyric acid

11. Which of the following dyes **CANNOT** be used as a fluorescent probe for microscopy?
   (a) DAPI
   (b) Trypan blue
   (c) Fluorescein
   (d) Rhodamine

12. Match List I with List II

	LIST I (Indian Environmentalists)		LIST II (environmental impact awareness)
A	Sh. Sunderlal Bahuguna	i	Tehri Bachao Andola
B	Sh. Rajender Singh	ii	Conservation of Indian Birds
C	Sh. Salim Ali	iii	Water conservation
D	Mrs. Maneka Gandhi	iv	Animal Welfare

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

13. In a class, the average weight of boys is 65 Kg and average weight of girls is 55 Kg. If average weight of all students of the class is 62 Kg, find the number of girls in the class if boys are 35 in number:
   (a) 14
   (b) 15
   (c) 12
   (d) 20

14. Match List I with List II:

	LIST I		LIST II
A	Euchromatin	i	Link sister chromatids together immediately after replication
B	Condensin	ii	Partially decondensed region of chromatin with active genes regions
C	Cohesin	iii	Highly condensed region of chromatin with inactive genes
D	Heterochromatin	iv	Help in chromosome condensation to further reduces mitotic chromosomes to compact bodies.

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

15. The common precursor of neurotransmitters dopamine, epinephrine and norepinephrine is:
   (a) Glutamic acid

(b) Threonine
(c) Tyrosine
(d) Methionine

16. Match List I with List II

	LIST I		LIST II
A	RCSB	i	Nucleotide Sequence database
B	OMIM	ii	Organism specific genome database
C	DDBJ	iii	Mutation database
D	Fly base	iv	Protein Structure Database

Which of the following is the CORRECT match?
(a) A-ii, B-i, C-iii, D- iv
(b) A-i, B-iii, C-i, D-ii
(c) A-ii, B-iv, C-i, D-iii
(d) A-i, B-iii, C-ii, D- iv

17. Which of the following gene is **NOT** a constituent of T-DNA in Agrobacterium tumefaciens?
(a) Octopine synthase
(b) Isopentyl transferase
(c) Virulence Gene G
(d) Indoleacetamide hydrolase

18. Find the sum of the digits in the unit place of all 4 digit numbers formed using 3, 4, 5, and 6 without any repetition.
(a) 54
(b) 90
(c) 108
(d) 219

19. Match List I with List II

	LIST I		LIST II
A	A tumor arising from endodermal tissue.	i	Lymphoma
B	A tumor arising from mesodermal connective tissue.	ii	Leukemia
C	A tumor arising from lymphoid cells.	iii	Carcinoma
D	Cancer cells arising from hematopoietic cells that do not grow as a solid tumor	iv	Sarcoma

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

20. As per Section 4 of Patents Act 1970, which of the following is **NOT** patentable in India?
(a) Discovery of a scientific principle
(b) Discovery of a living thing
(c) Invention related to atomic energy
(d) A computer program

21. The population of a village is 1,00,000. Every year, villagers move to cities in search of jobs and the population of the village decreases at a rate of 5% per annum. How many villagers will migrate in 2 years?
(a) 9,750
(b) 9,950
(c) 9,500
(d) 10,000

22. Rehan made a single stranded DNA with the following sequence 5'GGATCT3'. With which of the following single strands will it form the weakest duplex?

(a) 3'CCTAGA5'
(b) 5'AGATCC3'
(c) 5'AGAATT3'
(d) 3'CCAAGA5'

23. Imran runs at 10 miles/hour and completes a track in 151.2 minutes. His friend Nawaz completes the same track in 210 minutes. How fast was Imran running compared to his friend?

(a) 1.2.7 miles/hour
(b) 2.2.8 miles/hour
(c) 3.2.6 miles/hour
(d) 4. 2.9 miles/hour

24. Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R.
Assertion A: The sum and difference of L.C.M and H.C.F of two numbers are 504 and 456. If the sum of the numbers is 216, then the numbers are 120 and 96.
Reason R: Product of two numbers = Product of their L.C.M and H.C.F.
In the light of the above statements, choose the most appropriate answer from the options given below:

(a) Both A and R are correct and R is the correct explanation of A.
(b) Both A and R are correct but R is NOT the correct explanation of A
(c) A is correct but R is not correct
(d) A is not correct but R is correct

25. The common metabolic precursor of amino acids such as Proline and Glutamine is:

(a) Oxaloacetate
(b) Ribose-5-Phosphate
(c) Pyruvate
(d) α-Ketoglutarate

26. The ratio of present ages of Julie and Kamala is 3:8. Kamala is 8 years younger than her brother Ram, whose age after 6 years will become 70. What is the present age of Julie's mother who is 24 years older than Kamala?

(a) 80 years
(b) 64 years
(c) 45 years
(d) 48 years

27. A large cube with surface area of 1536 sq. cm is melted and small cubes each with surface area of 24 sq. cm are obtained. Find the number of small cubes obtained:

(a) 512
(b) 256
(c) 128
(d) 64

28. Which of the following molecules are involved in the formation of ATP by substrate level phosphorylation during glycolysis?

A. 1, 3-bisphosphoglycerate
B. Glucose 6-phosphate
C. Phosphoenolpyruvate
D. Fructose 1, 6-bisphosphate

(a) A, C
(b) C, D
(c) A, D
(d) B, C

29. Regarding thermal denaturation, the Tm of a protein denotes:
    (a) Midpoint of temperature range over which denaturation occurs.
    (b) Temperature at which protein starts denaturing.
    (c) Temperature at which protein denaturation is completed.
    (d) Minimum temperature at which protein does not denature.

30. Which of the following plant organs is **NOT** a potential explant for tissue culture?
    (a) Seed
    (b) Flower
    (c) Root
    (d) Shoot tip

31. Which of the following is a marker enzyme for the Lysosome?
    (a) Acid phosphatase
    (b) Signal peptidase
    (c) Succinate dehydrogenase
    (d) Lactate dehydrogenase

32. What is the molar concentration of Dinitrophenol (DNP) in a solution made by dissolving 184.107 mg DNP in one liter of water? [Molar mass: 184.107 g/mole]
    (a) 1000 μM
    (b) 1000 mM
    (c) 1000 nM
    (d) 1000 pM

33. D-Alanine and L-Alanine are:
    (a) Anomers
    (b) Enantiomers
    (c) Epimers
    (d) Diastereomers

34. There are two numbers such that the sum of thrice the first number and twice the second number is 180 and the difference of the four times the first number and twice the second number is 100. Then the product of two numbers is:
    (a) 1000
    (b) 1200
    (c) 1800
    (d) 20

35. Which of the following enzymes is **NOT** a part of the DNA replication machinery?
    (a) DNA helicase
    (b) Primase
    (c) DNA polymerase
    (d) DNA endonuclease

36. Lichen is an example of symbiotic relationship between:
    (a) Bacteria and algae
    (b) Plant and bacteria
    (c) Algae and fungi
    (d) Plant and algae

37. The term 'biotechnology' was coined by:
    (a) Fredrick Sanger
    (b) Kary Mullis
    (c) Karl Ereky

(d) James Watson

38. The sum of the circumference of the circle and the perimeter of square is 184 cm. The diameter of the circle is 28 cm. What is the sum of the area of circle and square?
(a) 784 cm^2
(b) 576 cm^2
(c) 616 cm^2
(d) 1192 cm^2

39. Which of the following methods **CANNOT** be used for ab initio determination of the three dimensional structure of proteins?
(a) X-ray crystallography
(b) Nuclear magnetic resonance
(c) Cryo electron Microscopy
(d) Conventional Mass spectrometry

40. Which of the following enzymes is **NOT** involved in protein folding?
(a) GroEL/GroES
(b) Protein disulphide isomerase
(c) Peptidyl prolyl cis-trans isomerase
(d) Peptidoglycan transpeptidase

41. Which of these organelle sets are generally equipped with their own genomes?
(a) Endoplasmic reticulum. Nucleus, Golgi apparatus.
(b) Mitochondria, Nucleus, Centriole.
(c) Nucleus, Mitochondria, Chloroplast.
(d) Centriole. Nucleus, Peroxisome.

42. Sita and Gita can do a piece of work together in 12 days. If Gita is three times more efficient than Sita, how long will Sita take to complete the work alone?
(a) 16 days
(b) 48 days
(c) 24 days
(d) 32 days

43. How much is 10^{-23} liter equal to?
(a) $10^{-17}\ ml$
(b) $10^{-20}\ \mu l$
(c) $10^{-14}\ nl$
(d) $10^{-18}\ pl$

44. Assuming 100% reaction efficiency, how many copies of dsDNA containing the amplicon will be present in the polymerase chain reaction mixture after 25 cycles?
(a) 2^{25}
(b) 25^2
(c) 25×2
(d) 25^{25}

45. Codon optimization is essential to:
(a) Maximize protein yield in heterologous host
(b) Clone genes in heterologous host
(c) Suppress protein toxicity
(d) Increase cloning efficiency

46. The tenure of a registered trade mark in India is generally:
(a) 1 year

(b) 5 year
(c) 10 year
(d) 15 year

47. If $(\sqrt{11x}\ \sqrt{11})^{1/2} + (9)^{1/2} = (n)^3 + \sqrt{11} - 340$, find the value of n:
(a) 1 .3
(b) 2 .7
(c) 3. 11
(d) 4. 13

48. What will be the molecular weight of the peptide with sequence ELTTEK following its backbone cyclization to cyclic-(ELTTEK)? [Molecular weights- E: 147, L: 131. T: 119, K: 146]:
(a) 699
(b) 700
(c) 701
(d) 800

49. How much Albumin (Mol. Wt.67, 000 Da) must be taken to couple it with 1.8 mg Aspirin (Mol. Wt. 180 Da) in a 1:1 (mole mole) reaction between the two?
(a) 67 mg
(b) 670 mg
(c) 670 μg
(d) 670 ng

50. Which of the following amino acids has two chiral centers?
(a) Valine
(b) Glycine
(c) Isoleucine
(d) Methionine

Section B

51. During genome assembly, which of the following sequence is generally followed to obtain a good chromosome-level assembly?
(a) Reads - Contigs - Scaffolds - Chromosome
(b) Reads - Scaffolds - Contigs - Chromosome
(c) Contigs - Reads - Scaffolds - Chromosome
(d) Reads Contigs - Chromosome – Scaffolds

52. A duplex DNA sequence that reads identically on both strands is known as:
(a) Holliday junction
(b) Palindrome
(c) Inverted Repeat
(d) Direct Repeat

53. Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R
Assertion A: A Shuttle vector can be used in two different host organisms. Reason R: A Shuttle vector contains only one origin of replication.
In the light of the above statements, choose the CORRECT answer from the options given below
(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is NOT the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

54. Which of the following pigment makes some archaea to appear purple?
(a) Carotenoid

(b) Phycocyanin
(c) Sphaeroidene
(d) Bacteriorhodopsin

55. The induction of pain by a normal innocuous stimulus is usually referred to as:
(a) Chronic pain
(b) Allodynia
(c) Sensitivity
(d) Inflammation

56. Match List I with List II

	List I		List II
A	Gibberelins	i	Phytoene
B	Cytokinins	ii	Squalene
C	Abscisic	iii	Isopentenyl diphosphate
D	Brassinosteroids	iv	Geranylgeranyl diphosphate

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

57. Which of these animals have a recurrence of estrous events during their breeding season (polyestrous)?
(a) Dogs
(b) Foxes
(c) Bats
(d) Squirrels

58. The transfer of tissue between genetically identical individuals (like twins) is called:
(a) Autograft
(b) Xenograft
(c) Allograft
(d) Syngenic graft

59. Genetically male sterile plants can be developed by overexpressing:
(a) CRY
(b) BAR
(c) $BARNASE$
(d) $BARSTAR$

60. Which statistical test is used to calculate **FALSE** discovery rate?
(a) Benjamini - Hoschberg
(b) Random forest
(c) T-test
(d) ANOVA

61. In a fungal fermentation where broth rheology is pseudoplastic, aeration is:
(a) Better along the central axis
(b) Better along the sides of the reactor
(c) Better at the top compared to the bottom
(d) Uniform throughout

62. Bootstrap value in a phylogenetic tree indicates:
(a) Evolutionary distance
(b) Age of a branch

(c) Robustness
(d) Node length

63. Which one of the following cells is involved in translocation of microRNA in plants?
(a) Companion cells
(b) Parenchyma cells
(c) Phloem sieve elements
(d) Sclereids

64. Which of the following autoimmune disorders involve an attack on intestinal tissues that leads to destruction of gut epithelia and poor absorption of food?
(a) Rheumatoid Arthritis
(b) Graves' Disease
(c) Crohns Disease
(d) Lupus Erythematosus

65. What happens to entropy if a crystalline substance such as $NaCl$ dissolves?
(a) Increases
(b) Decreases
(c) Remains the same
(d) First decreases and then Increases

66. Enzymatic production of aspartame (a low calorie sweetener) involves the use of:
(a) Amino acylase
(b) Penicillin acylase
(c) Lipase
(d) Thermolysin

67. A Phred score of 30 in a DNA sequencing output refers to the probability of incorrect base call as:
(a) 1 in 100000
(b) 1 in 10000
(c) 1 in 1000
(d) 1 in 100

68. Formation of the pre-replicative complexes (pre-RC) renders the cell competent for replication, an event called as:
(a) Proof reading
(b) Nick translation
(c) Licensing
(d) Polymerization

69. Which of the following United Nations sustainable development goals (SDGs) is related to clean water and sanitation for all?
(a) $SDG2$
(b) $SDG9$
(c) $SDG6$
(d) $SDG4$

70. Which of the following fragments/regions of an antibody molecule will you use to identify the presence of a specific epitope in a biological sample?
(a) Fv
(b) Fc
(c) CH
(d) DL

71. Which of the following structures is **NOT** seen in cells of angiosperms?
(a) Centrioles
(b) Peroxisome
(c) Mitochondria
(d) Golgi Complex

72. Given below are two statements:
Statement I: In a neuron at standard resting state of -70 mV, treatment with a chemical (X) induced intracellular potential -50 mV while when treated with another chemical (Y), it showed -90 mV. Given such a condition, we can say (X) induced depolarization, while (Y) induced hyperpolarization.
Statement II: In a neuron at standard resting state of -70 mV, treatment with a chemical (X) induced intracellular potential -50 mV while when treated with another chemical (Y), it showed -90 mV. Given such a condition, we can say (Y) induced depolarization, while (X) induced hyperpolarization.
In the 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 but Statement II is incorrect
(d) Statement I is incorrect but Statement II is correct

73. Two protein sequences can be aligned with the help of a BLOSUM matrix. The BLOSUM matrixes were developed by:
(a) Aligning sequences of closely related sequences
(b) Aligning sequences of distantly related sequences
(c) Taking into consideration the Smith-Waterman alignment of sequences
(d) Taking into consideration the Needleman-Wunsch alignment of sequences

74. At a constant power number, doubling the impelling diameter, while halving the stirring speed (RPM) will:
(a) keep power consumption the same
(b) double the power consumption
(c) halve the power consumption
(d) quadruple the power consumption

75. Metagenomics refers to genome sequencing of a collection of:
(a) Flowering Plants
(b) Microorganisms
(c) Mitochondria
(d) Metabolites

76. Match List I with List II

	List I		List II
A	S-Phase of cell division	i	Quiescent phase
B	G2 Phase	ii	DNA of parent cell is replicated
C	M Phase	iii	New proteins are synthesized and the cell approximately doubles in size
D	GO Phase	iv	Two daughter cells are produced.

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

77. Match the type of chromatographic technique (List I) with the protein property (List II)

List I	List II
A. Dye affinity	I. Charge and isoelectric point
B. Chromato focussing	II. Molecular size
C. Covalent	III. Structure and hydrophobicity
D. Gel Filtration	IV. Thiol groups

Choose the CORRECT answer from the options given below:

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

78. Match the phenolic compounds (List I) with their plant source (List II)

List I	List II
A. Podophyllotoxin	I. May Apple
B. Curcumin	II. Star anise
C. Methyl-eugenol	III. Turmeric rhizome

Choose the CORRECT answer from the options given below:

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

79. Which of the following statements about Forster Resonance Energy Transfer (FRET) is **INCORRECT**?

(a) The energy of the excited molecule (the donor) passes directly to a nearby molecule (the acceptor).
(b) The energy transfer is possible only when donor and acceptor are close to each other (within 50 Å).
(c) The efficiency of FRET is inversely proportional to the sixth power of the distance between donor and acceptor.
(d) The efficiency of FRET is directly proportional to the sixth power of the distance between donor and acceptor.

80. Which of the following diseases is characterized by predominant motor dysfunction that results from the progressive degeneration of the nigrostriatal dopamine pathway?

(a) Parkinson's Disease
(b) Alzheimer's Disease
(c) Schizophrenia
(d) Huntington's Disease

81. The antigen-binding site on antibodies is formed primarily by:

(a) The hypervariable regions of both H and L chains.
(b) The hypervariable region of H chains only.
(c) The hypervariable region of L chains only.
(d) The constant region of H chains.

82. The telomerase enzyme has the following activity:

(a) DNA-dependent DNA Polymerase.
(b) RNA-dependent DNA Polymerase.
(c) DNA-dependent RNA Polymerase.
(d) RNA-dependent RNA Polymerase.

83. An alternate form of starch biosynthesis machinery in cereal endosperm involves:

(a) Plastidic ADP-glucose pyrophosphorylase.

(b) Cytosolic ADP-glucose pyrophosphorylase.
(c) Plastidic UDP-glucose pyrophosphorylase..
(d) Cytosolic UDP-glucose pyrophosphorylase.

84. Which of the following statements is most appropriate with regards to the primary and secondary antibody responses?
(a) The IgM made in the primary response is made primarily by memory $B\ cells$.
(b) The lag phase is shorter in the primary response than in the secondary response.
(c) In the primary response, memory $B - cells$ are produced, but memory $T - cells$ are not.
(d) The amount of IgG made in the secondary response is greater than the amount made in the primary response.

85. Match List I with List II

	List I (bacterial products)		List II (popular applications)
A	Nisin	i	Antioxidants
B	Superoxide dis-mutases	ii	Preservation of various foods
C	Polysaccharides	iii	Lactose digestion, control of intestinal pathogens
D	Probiotic cultures	iv	Gums and thickeners, culture viscosity stabilizers

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

86. Which one of the following organisms is most likely to be the cause of pneumonia in an immunocompetent infant?
(a) *Nocardia asteroids*
(b) *Serratia marcescens*
(c) *Mycoplasma pneumonia*
(d) *Legionella pneumophila*

87. Which of the following can be used for discovery of unknown conserved motif/s in a given set of DNA/protein sequences?
(a) BLAST
(b) PHYLIP
(c) CLUSTAL
(d) MEME

88. What is TRUE about similarity and homology between protein sequences?
(a) Similarity and homology mean the same.
(b) Similarity is a mathematical term.
(c) Homology is a mathematical term.
(d) Similarity and Homology are mathematical terms.

89. Which of the following wavelengths of light are perceived by zeitlupe photoreceptor?
(a) Only UV-B
(b) Only Blue light
(c) UV-A and Blue light
(d) Red and Far-red light

90. Which of the following processes turn-on and turn-off the alpha subunit of a heterotrimeric G- protein?
(a) Binding to GDP; exchange of bound GDP with GTP

(b) Binding to GTP: exchange of bound GTP with GDP.
(c) Binding to GTP: hydrolysis of bound GTP.
(d) Binding to GDP: phosphorylation of bound GDP.

91. Biological Oxygen demand refers to the amount of oxygen that bacteria consume during:
(a) Decomposition of inorganic matter in anaerobic condition.
(b) Decomposition of organic matter in anaerobic environment.
(c) Decomposition of organic matter in aerobic condition.
(d) Decomposition of organic matter in nitrogen environment.

92. May survive without the need for immunosuppression:
(a) Liver transplants
(b) Corneal grafts
(c) Heart transplants
(d) Kidney grafts

93. Humulones or alpha-acids are used in the making of which of the following alcoholic beverages?
(a) Rum
(b) Vodka
(c) Beer
(d) Wine

94. Which of the following is true about pair-wise alignment of protein sequences?
(a) Local pair-wise alignments may be performed using Needleman-Wunsch algorithm.
(b) Local pair-wise alignments may be performed using Smith-Waterman algorithm.
(c) Local alignments search for local regions of similarities after performing global alignments.
(d) Local pair-wise alignments cannot be obtained by dot-matrix plots.

95. Match List I with List II

	Listi II (protein)		List II (function)
A	DnaA	i	Recognizes ori sequence; opens duplex at specific sites in origin
B	DnaB	ii	Unwinds DNA
C	DnaG	iii	Synthesizes RNA primers
D	DNA gyrase	iv	Relieves torsional strain generated by DNA unwinding

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

96. Which of the following methods is used to determine the three-dimensional structure of a protein in solution?
(a) X-ray crystallography
(b) NMR Spectroscopy
(c) Far-UV CD spectroscopy
(d) Cryo-EM

97. Which one of the following combinations of cytokinins (CKs) represent only Isoprenoid CKs?
(a) Trans-Zeatin and Benzyladenine.
(b) Ortho-Topolin and meta-Topolin.

(c) Cis-Zeatin and Dihydrozeatin.
(d) Trans-Zeatin and Benzyladenine.

98. Monod's model for the bacterial cell growth describes a relationship between:
(a) Cell growth rate vs time.
(b) Specific cell growth rate vs substrate concentration.
(c) Specific cell growth rate vs product concentration.
(d) Log cell concentration vs time.

99. Which of the following have been implicated as a potential cause of red wine headaches?
(a) Biogenic amines
(b) Methanol
(c) Ethanol
(d) Red colorants

100. Which gene is generally inserted in an adenoviral vector to treat cancer by suicide gene therapy?
(a) HSV-TK
(b) IL-2
(c) GM-CSF
(d) VSV-G

101. Peppers in spicy food are "hot" because the capsaicin usually activates:
(a) Proprioceptors
(b) Thermal nociceptors
(c) Photopigments
(d) Auditory receptors

102. Which of the following proteins will have a signal peptide?
(a) Hemoglobin
(b) Myoglobin
(c) Immunoglobulin
(d) Leghaemoglobin

103. The shear stress responsible for cell death in airlift fermenters **CANNOT** be reduced by
(a) Increasing the height to diameter ratio in the vessel.
(b) Increasing the bubble size.
(c) Increasing the gas flow rate.
(d) Adding protective agents.

104. Match List I with List II

	LIST I (Marine algae)		LIST II (Type of algae)
A	Fucus serratus	i	Brown algae
B	Gelidium sp.	ii	Red algae
C	Chlorella vulgaris	iii	Green algae
D	Cyanophyceae	iv	Blue green algae

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

105. Which one of the following genetic processes involves sex pili?
(a) Conjugation
(b) Transformation
(c) Transduction
(d) Transposition

106. After sequencing the genome of a new species you have obtained 2,500,000 reads each of 100-nt in length. Following assembly, the draft genome obtained is of 5 Mb size. What is the depth of coverage of the sequencing?
(a) 200x
(b) 125x
(c) 50x
(d) 150x

107. SELEX (systematic evolution of ligands by exponential enrichment) is a useful technique for identifying a ligand-specific oligonucleotide which can be utilized for diagnosis and treatment. The molecule is termed as:
(a) miRNA
(b) shRNA
(c) Aptamer
(d) Primer

108. Which of the following is produced commercially by mammalian cell culture?
(a) Insulin
(b) Tissue plasminogen activator
(c) Rennin
(d) Shikonin

109. The following feature about A-DNA is **INCORRECT**
(a) The DNA is arranged in a left handed double helix
(b) The base pairs in A-DNA are not perfectly perpendicular to the helix axis
(c) The DNA is arranged in a right handed double helix
(d) Number of base pairs per helical turn is 11

110. A student decided to perform liquid-liquid extraction of solute A and solute B separately. Based on the table below, indicate which of the following options is CORRECT about their partition coefficient (K)?

	Solute A	Solute B
Concentration of solute in extract (g/L)	50	1
Concentration of solute in raffinate (g/L)	1	50

(a) $K_A = K_B$
(b) $K_A > K_B$
(c) $K_A < K_B$
(d) K cannot be determined with the given information

111. Siderophores are generally:
(a) Produced by bacteria only during sporulation
(b) Pore forming toxins
(c) Structurally diverse iron-chelating molecules
(d) Cytokines that kill bacteria

112. The annotation of a genome sequence is generally stored in which of the following file formats?
(a) FASTA

(b) GFF
(c) FAST5
(d) BAM

113. Which one of the following is **NOT** a type of G-protein coupled receptors?
(a) G_q
(b) G_i
(c) G_s
(d) G_p

114. Match List I with List II

	List I (precursor)		List II (fermentation product)
A	Phenylacetic-acid related compounds	i	Penicillin G
B	Phenoxy acetic acid	ii	Penicillin V
C	Cyanides	iii	Vitamin B 12
D	L-Threonine	iv	Cyclosporin C

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

115. To enhance biodegradation process efficiently it is required to vary the design and operation of activated sludge system. Which of the following variations in design and operation of this system is **NOT** CORRECT?
(a) Step aeration
(b) Contact stabilization
(c) Anaerobic fermentation
(d) Tapered aeration

116. The expression of, which one of the following types of cyclins in plants is modulated by growth factors, such as cytokinins, auxins, brassinosteroids, sucrose and gibberelins?
(a) A-Type
(b) B- Type
(c) D-Type
(d) H-Type

117. Cells are successfully pelleted in a small rotor at 10,000 rpm for 5 minutes. If we now use a bigger rotor with twice the diameter to pellet the cells (having the same fixed angle) in 5 minutes, then the RPM required is, approximately:
(a) 5,000 rpm
(b) 6,000 rpm
(c) 7,000 rpm
(d) 10,000 rpm

118. Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R
Assertion A: Heat and extremes of pH cause denaturation, or melting, of double- helical DNA Reason R: Breaking of covalent bonds of DNA causes unwinding of the double helix
In the light of the above statements, choose the most appropriate answer from the options given below
(a) Both A and R are correct and R is the correct explanation of A

(b) Both A and R are correct but R is NOT the correct explanation of A
(c) A is correct but R is not correct
(d) A is not correct but R is correct

119. Match List I with List II

	List I		List II
A	A lipid anchor for proteins attached with the membrane	i	SRP
B	Ribonucleoprotein complex to bind to the signal peptide	ii	PDI
C	Formation of correct disulphide bonds in proteins	iii	BiP
D	Chaperone in the ER lumen	iv	GPI

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

120. Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R
Assertion A: A base substitution in DNA does not always result in mutant phenotype. Reason R: Some base substitutions in codons do not change the encoded amino acid.
In the light of the above statements, choose the most appropriate answer from the options given below
(a) Both A and R are correct and R is the correct explanation of A.
(b) Both A and R are correct but R is NOT the correct explanation of A.
(c) A is correct but R is not correct.
(d) A is not correct but R is correct.

121. Given below are two statements:
Statement I: Glial cells form myelin around the axons of neurons
Statement II: Myelin enables the rapid transmission of action potentials down an axon
In the 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 but Statement II is incorrect.
(d) Statement I is incorrect but Statement II is correct.

122. Given below are two statements:
Statement I: Palindromic sequences are DNA sequences that are the same when each strand of DNA is read in the same direction.
Statement II: Palindromic sequences serve as recognition sites for many type II restriction endonucleases.
In the light of the above statements, choose the CORRECT answer from the options given below
(a) Both Statement I and Statement II are true.
(b) Both Statement I and Statement II are false.
(c) Statement I is correct but Statement II is false.
(d) Statement I is incorrect but Statement II is true.

123. Following are certain statements regarding FLOWERING LOCUS C (FLC) gene in Arabidopsis:
A. FLC is a strong repressor of flowering.
B. Higher expression of FLC induces early flowering.
C. FLC is activated by FRIGIDA (FRI).

D. Vernalisation represses FLC.

Which of the following sets of statements is CORRECT?

(a) A, B and C
(b) A, B and D
(c) B, C and D
(d) A. C and D

124. Myasthenia Gravis is primarily caused due to:
(a) degeneration of muscles.
(b) defects in adrenergic receptor system.
(c) defects in the cholinergic receptors system.
(d) kidney failure.

125. Intake of total folic acid should not exceed _____in the diet for adults
(a) 0.8 mg/day
(b) 1.6 mg/day
(c) 0.4 mg/day
(d) 4.0 mg/day

126. Cholesterol is transported in blood in the form of low-density lipoprotein (LDL) particles that contain Apolipoprotein, cholesterol, cholesteryl esters with long fatty acid chains and phospholipids. Where do you think the phospholipids are located in LDL particles?
(a) Buried in the core.
(b) On the surface.
(c) In the lipid bilayer.
(d) Interacting with hydrophilic regions of Apolipoprotein.

127. An antimalarial drug such as primaquine is believed to act by causing oxidative stress to the parasite. This drug is **NOT** suitable for treatment in individuals having deficiency in
(a) Hexokinase
(b) Glucose 6-phosphate dehydrogenase
(c) Phosphofructokinase
(d) Haemoglobin

128. Roll tube technique is used for isolation of:
(a) Aerobic bacteria
(b) Cyanobacteria
(c) Stringent anaerobic bacteria
(d) Pathogenic fungi

129. Cells primarily produce energy through mitochondrial oxidative phosphorylation. However, most cancer cells predominantly produce their energy through a high rate of glycolysis followed by lactic acid fermentation even in the presence of abundant oxygen. This phenomenon is known as:
(a) Anapleorotic effect
(b) Warburg effect
(c) Cantley effect
(d) Crabtree Effect

130. Signal propagation at a chemical synapse is characterized by:
(a) delay and bidirectional signal propagation.
(b) delay and unidirectional signal propagation.
(c) efflux of Ca^{++} ions leading to release of neurotransmitter at the pre-synaptic terminal.
(d) significant influx of Ca^{++} ions at the post-synaptic neuron leading to neurotransmitter release and

generation of action potential.

Choose the CORRECT answer from the options given below:

(a) A and C only
(b) B only
(c) B and C Only
(d) D Only

131. The group of organism in marine systems that feed on dead biomass and waste material is called:
(a) decomposers
(b) omnivores
(c) detritivores
(d) anaerobic bacteria.

132. Which one of the following laboratory tests would be the best to determine the number of CD4-positive cells in the blood of a patient infected with HIV?
(a) Agglutination
(b) Complement fixation
(c) Flow cytometry
(d) ELISPOT

133. Alpha fold is an artificial intelligence based method for
(a) Prediction of protein functions based on folding.
(b) Perform de-novo protein folding.
(c) Perform protein folding based on a model trained on existing protein structures.
(d) Perform protein folding for alpha helices.

134. Which one of the following is **NOT** considered as a secondary messenger?
(a) cAMP
(b) ATP
(c) Ca^{2+}
(d) IP_3

135. Following are certain statements regarding Gibberellin (GA) signal transduction in Arabidopsis plants:
A. DELLA is a negative regulator of growth.
B. GA is not required for the interaction of DELLA with GID1 protein.
C. GID is a receptor of GA.
D. DELLA is ubiquitinated only after GDII perceives GA and binds to DELLA.
E. Proteasomal degradation of DELLA is required for the growth of plant.

Which of the following sets of statements is CORRECT?
(a) A, B, C and D
(b) A, B, C and E
(c) A, C, D and E
(d) B, D and E

136. Match photosynthetic proteins (List I) with the respective encoding genes (List II)

	List I		List II
A	D 1	i	psbB
B	D2	ii	psbD
C	P47	iii	psbC
D	CP43	iv	psbA

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

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

137. A mechanically agitated bioreactor for an aerobic microbial process can be scaled up from pilot plant data to commercial plant on the basis of:
(a) Equal impeller size
(b) Equal inoculum size
(c) Equal power/unit volume
(d) Equal air bubble size

138. Which one of the following is a nucleic acid hybridization-based test for diagnosis of Tuberculosis?
(a) TrueNat
(b) TORCH
(c) WIDAL
(d) Tubercullin test

139. Which one of the following terms is used to describe the protection of the unimmunized individual based on immunization of a sufficient number of other members of the population?
(a) Active immunity
(b) Passive immunity
(c) Herd immunity
(d) Post-exposure immunity

140. Polyhydroxyalkanoates produced by microorganisms have application as:
(a) Furfural
(b) Bioplastic
(c) Hydroxyl Methyl Furfural
(d) Biodiesel

141. Match List I with List II

	List I		List II
A	A. Ajmalicine	i	*Illicium verum*
B	B. Anethole	ii	*Papaver somniferum*
C	C. Codeine	iii	*Rauwolfia sepentina*
D	D. Vincristine	iv	*Catharanthus roseus*

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

142. 1000 dm^3 of fermentation medium containing 1×10^4 Bacillus thuringenesis cells per cm^3 is sterilized to achieve probability of contamination of 1 in 1000. Calculate the Del factor:
(a) 33.5
(b) 29.9
(c) 23.0
(d) 13.8

143. BLOSUM scoring matrix is used for:
(a) Alignment of DNA sequences only.
(b) Alignment of DNA and protein sequences only.
(c) Alignment of protein sequences only.

(d) Homology modelling.

144. In a single stage continuous extraction system, solvent is added to cell-free culture filtrate containing the product. If the partition coefficient of the product is 5, then to extract 90% of the product, assuming ideal single stage, the flow rate of solvent should be times the flow rate of the culture filtrate:
(a) 1.5 times
(b) 1.8 times
(c) 2.1 times
(d) 2.4 times

145. For a chemostat culture operating under steady state, which of the following statements is **NOT** TRUE?
(a) At a dilution rate equal to maximum specific growth rate, the culture wash out takes place.
(b) The dilution rate equals specific growth rate.
(c) The culture experiences balanced growth.
(d) The observed growth yield is same as the theoretical growth yield.

146. Hemolytic disease of the newborn develops when maternal IgG antibodies specific for fetal blood-group antigens cross the placenta and destroy fetal red blood cells. The disease is called:
(a) Erythroblastosis fetalis
(b) Haemolytic Anaemia
(c) Systemic lupus erythematosus
(d) Hemophillia A

147. Which of the following is **NOT** TRUE for microalgae?
(a) Microalgae can perform photosynthesis only if the light source is available.
(b) Respiration by the microalgae continues throughout light and dark period.
(c) Photosynthesis by microalgae is an oxidation reaction.
(d) Microalgae can take both CO_2 and bicarbonate as source of carbon.

148. Clustering in a gene expression analysis via microarray experiment refers to:
(a) Cluster of probes used to monitor gene expression.
(b) Cluster of cDNAs printed on the array.
(c) Genes clustered together in the genome.
(d) A set of genes that are likely to work together in a given biological context.

149. Chemically, what is milk of magnesia?
(a) Calcium hydroxide
(b) Magnesium carbonate
(c) Magnesium hydroxide
(d) Sodium bicarbonate

150. Which of the following marker proteins is **NOT** derived from cnidarians?
(a) Green fluorescent protein
(b) DSRED protein
(c) Red fluorescent protein
(d) Orange fluorescent protein

151. CRISPR-Cas9 technology is typically used for:
(a) Genomic Sequencing
(b) Gene editing
(c) DNA replication
(d) Gene Mapping

152. Which among the following techniques does **NOT** depend on nucleic acid hybridization?
   (a) DNA microarray
   (b) Chromatin Immunoprecipitation
   (c) Chromosome painting
   (d) Southern blotting

153. Which of the following BLAST search program is used to find the putative function of a given nucleotide sequence to search a protein sequence database?
   (a) BLASTX
   (b) BLASTP
   (c) BLASTN
   (d) BLASTZ

154. What are proto-oncogenes?
   (a) They are a type of tumor suppressor genes.
   (b) They stall cancer progression.
   (c) They can become oncogenes.
   (d) They have no relation with cancer progression.

155. Which of these is **NOT** a multiple sequence alignment program?
   (a) T-coffee
   (b) Clustal W
   (c) Clustal X
   (d) BLAST

156. Nitrogenase is a complex enzyme consisting of MoFe protein and Fe-protein. Which one of the following statements regarding Nitrogenase enzyme is **NOT** CORRECT?
   (a) It comprises of Component I and Component II.
   (b) MoFe proteins are dinitrogenase reductases.
   (c) Fe proteins are homodimer.
   (d) MoFe proteins are heterotetramer.

157. Among the following, the feature that does **NOT** contribute to host tropism in bacterial pathogenesis is
   (a) Genomic information of pathogen.
   (b) Genomic information of host.
   (c) Body temperature of the host.
   (d) Adhesins and pilins of pathogen.

158. Which is the most common side effect of beta-lactam antibiotics?
   (a) Allergic reaction
   (b) Yellowing of teeth
   (c) Headache
   (d) Hearing loss

159. Megakaryocytes are the major source of:
   (a) Erythrocytes
   (b) Monocytes
   (c) Macrophages
   (d) Platelets

160. The RecA protein is involved in:

(a) Transposition
(b) Recombination
(c) Replication
(d) Transcription

161. Which of the following cloning vectors will you use to clone a 200 kb gene?
(a) Plasmid
(b) Cosmid
(c) Bacterial Artificial Chromosome
(d) Bacteriophage lambda based vectors

162. Given below are two statements:
Statement I: CpG islands are sequences present in eukaryotic DNA.
Statement II: Promoter regions of many expressed genes in eukaryotes are generally enriched in CpG islands.
In the light of the above statements, choose the CORRECT answer from the options given below
(a) Both Statement I and Statement II are true.
(b) Both Statement I and Statement II are false.
(c) Statement I is correct but Statement II is false.
(d) Statement I is incorrect but Statement II is true.

163. Which of the following statements is **NOT** TRUE for penicillin production using Penicillium notatum?
(a) Penicillin is a secondary metabolite.
(b) Penicillin is recovered from the fermented broth by solvent extraction.
(c) The process is carried out in fed batch mode.
(d) The process follows growth associated product formation kinetics.

164. A batch reactor produces 25g/L of product. The fermentation time is 4 days and 1 day extra is required as downtime for cleaning, sterilization and setting up the reactor. If total number of working days is taken at 300 days/year. Then to produce 1 ton/year of product the reactor size has to be approximately:
(a) 6.67 L
(b) 66.7 L
(c) 667 L
(d) 6667 L

165. Why progesterone-only contraceptives are **NOT** recommended as emergency (post-coitus) contraceptives?
(a) Progesterone-only contraceptives have high failure rates.
(b) Progesterone acts on the reproductive tract as a whole.
(c) Progesterone makes the reproductive tract inhospitable for sperm and any fertilized oocyte.
(d) Progesterone may not block follicular development or ovulation.

166. Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R
Assertion A: Mitogen-activated protein kinases (MAPK) are activated by upstream mitogen-activated protein kinase kinases (MAPKK).
Reason R: The activated MAPK are inactivated by mitogen-activated protein kinase phosphatase.
In the light of the above statements, choose the CORRECT answer from the options given below
(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is NOT the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

167. Which one of the following is the drug of choice for sexually transmitted disease caused by Chlamydia trachomatis?
(a) Ampicillin
(b) Azithromycin
(c) Ciprofloxacin
(d) Metronidazole

168. How many isoprene units are present in a Diterpene?
(a) Two
(b) Four
(c) Five
(d) Twenty

169. Match List I with List II

	List I		List II
A	Interleukin-2 (IL-2)	i	Activates NK cells and T cells; potently induces production of Interferons; shifts immune response to T_H1
B	Interferon-γ (IFN-γ)	ii	Major mediator of inflammation; stimulate macrophages and cytokine production
C	Tumor necrosis factor (TNF)	iii	Strong macrophage-activating factor; causes a variety of cells to express class II MHC molecules.
D	Interleukin-12 (IL- 12)	iv	Major growth factor for T and B cells; enhances cytolytic activity of natural killer cells

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

170. Which of the following will generally **NOT** occur if the function of myosin I and myosin II is blocked?
(a) Apoptosis
(b) Cell crawling
(c) Phagocytosis
(d) Vesicle transport

171. The function of sieve tube in plants includes transmission of:
A. Chemical signals
B. mRNAs
C. Electrical signals
D. Spheroplasts
(a) b. c and d only
(b) a, b and c only
(c) a and b only
(d) a and c only

172. Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R
Assertion A: Threading is a de novo protein structure prediction method suitable for sequence with very low similarities.
Reason R: The threading method is more efficient than homology modelling.
In the light of the above statements, choose the most appropriate answer from the options given below
(a) Both A and R are correct and R is the correct explanation of A.
(b) Both A and R are true but R is NOT the correct explanation of A.

(c) A is correct but R is not correct.
(d) A is not correct but R is correct.

173. Equine embryo collection is commonly performed on day 7 or 8 (day ovulation) because
(a) The embryo has separated from placenta.
(b) The embryo has crossed all the developmental stages.
(c) Recovery rates are high and the blastocysts can be easily recovered and handled.
(d) The lifespan of embryo is limited to 9 days.

174. Recombinant Interferon Gamma is commercially produced by cell culture of:
(a) T3 fibroblast cells
(b) Chinese hamster ovary cells
(c) Peripheral lymphocyte cells
(d) Human leucocyte cells

175. Match the plant source (List I) with the corresponding secondary metabolites (List II)

	List I		List II
A	Belladonna	i	Menthol
B	Foxglove	ii	Atropine
C	Pacific yew	iii	Digitalin
D	Eucalyptus	iv	Taxol

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

176. "TORCH" test is utilized in pregnant females to detect Antibodies against:
(a) Toxoplasma gondii only
(b) Toxoplasma sp., Rubella virus and Cytomegalo virus
(c) Rubella and Cytomegalo virus
(d) Rubella virus only

177. Smith-Waterman's algorithm is:
(a) An algorithm to perform global alignments
(b) An algorithm to perform local alignments
(c) An algorithm to perform homology modelling
(d) An algorithm to perform threading based modelling of proteins

178. The concentration and absolute partial pressure of CO_2 in the flue gas at variouspower plants are as follows:

	Plant	CO_2 concentration (%)	Absolute Partial Pressure (atm)
A	Plant A	42	1
B	Plant B	10	40
C	Plant C	40	60
D	Plant D	20	3

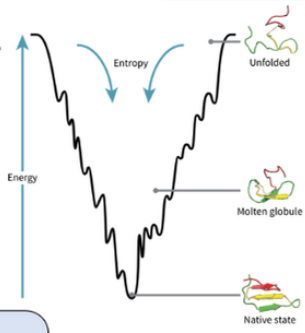
At which plant(s) will it be easiest to capture the CO_2?
(a) Plant A and Plant D

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

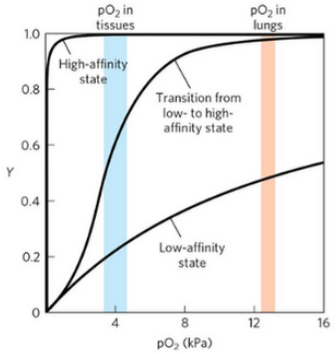
Low

Urmila **M**atoldkar ka **DNA** **A**chha hai

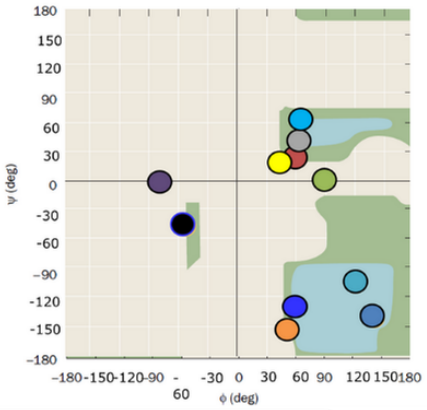
Hemoglobin

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

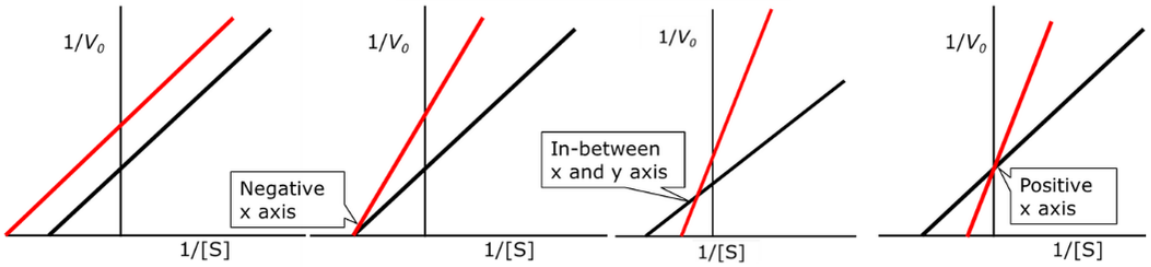


Ramachandran plot



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
- Parallel
- Uncompetitive
- Negative x axis
- Non-competitive
- In-between x and y axis
- Mixed
- Positive x axis
- Competitive

(b) Plant C only
(c) Plant B only
(d) Plant C and Plant D

179. A 'co-integrate vector' is used to transfer cloned genes into which one of the following?
(a) Yeast
(b) Plants
(c) Animals
(d) Parasites

180. Human genome contains approximately 25,000 genes, but the number of proteins in a human cell is estimated to be approximately 250,000. Which of the following can explain this difference?
(a) Alternative splicing and protein folding.
(b) Post-transcriptional silencing.
(c) Multiple promoters.
(d) Alternative splicing and post-translational modifications.

181. Which of the following types of plastids is formed first when Etioplast types are exposed to light?
(a) Gerontoplast
(b) Amyloplast
(c) Pregranal plastid
(d) Mature Chloroplast

182. Mammalian cell cultures are difficult to scale up in conventional bio-reactors for the production of therapeutic proteins primarily because of:
(a) High oxygen demand.
(b) High shear sensitivity.
(c) Different process control due to the complexity of the cells.
(d) Complex media requirements.

183. The technique commonly used to resolve large sized DNA fragments (>20 kb) following digestion with restriction enzymes is:
(a) Polyacrylamide gel-electrophoresis.
(b) Capillary electrophoresis.
(c) Pulse field gel-electrophoresis.
(d) Preparative HPLC.

184. Which one of the following is **NOT** a type of Intellectual property rights?
(a) Patent
(b) Articraft
(c) Industrial Design
(d) Geographical Indicator

185. Which of the following enzymes adds an extra Adenine at the 3' end of a DNAstrand?
(a) Klenow DNA polymerase
(b) Taq DNA polymerase
(c) Reverse transcriptase
(d) Topoisomerase

186. Conversion of organic matter to biogas proceeds in four stages: hydrolysis, acidogenesis, acetogenesis and methanogenesis. Which one of the following microorganisms play key role in methanogenesis conversion stage?
(a) Yeast

(b) Phototrophic bacteria
(c) Archaea
(d) Aerobic bacteria

187. Which one of the following does **NOT** directly account for water potential in plants?
(a) Pressure
(b) Temperature
(c) Osmotic components
(d) Gravitation

188. Which one of the following is **NOT** TRUE regarding phosphoenolpyruvate carboxykinase type of C4 photosynthesis?
(a) Aspartate is transported from mesophyll cell to bundle sheath cell.
(b) Alanine is transported from bundle sheath cell to mesophyll cell.
(c) Oxaloacetate is formed both in mesophyll cell to bundle sheath cell.
(d) Malate is transported from mesophyll cell to bundle sheath cell.

189. Match the animal cell lines (List I) with their commercial applications (List II)

	List I		List II
A	Baby hamster kidney cells	i	Monoclonal antibodies
B	Myeloma cell lines	ii	Urokinase
C	Simian kidney epithelial cells III. Polio vaccine	iii	Polio vaccine
D	Porcine kidney cells	iv	Foot and mouth vaccine

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

190. The binding site on an antibody is known as:
(a) Paratope
(b) Epitope
(c) Elbow region
(d) Hinge region

191. The intrinsic apoptotic pathway is primarily regulated by:
(a) Lysosome
(b) Endoplasmic Reticulum
(c) Mitochondria
(d) Golgi bodies

192. Which one of the following is a neurovegetative disease?
(a) Hepatitis
(b) Huntington
(c) Osteoporosis
(d) Sarcoma

193. Enzymes immobilized on porous beads are used for conversion of substrate to product in a reaction. When the bead diameter is halved the reaction rate is observed to increase. This implies that:
(a) Internal mass transfer is rate controlling.
(b) External mass transfer is rate controlling.
(c) Enzyme gets partially deactivated during the process of entrapment.

(d) Steric hindrance is reduced when bead diameter is reduced.

194. What contributes the most towards the hydrophobic effect when a protein is folding at room temperature?
(a) Entropy of the water molecules.
(b) Entropy of the protein molecules.
(c) Entropy of the protein chain.
(d) Free energy of interaction between the protein residues.

195. Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R
Assertion A: Termination of DNA synthesis occurs upon incorporation of a nucleotide lacking hydroxyl group on the 3' carbon of the pentose sugar into the growing DNA chain.
Reason R: The hydroxyl group on the 3' carbon of the pentose sugar is involved in phosphodiester bond formation.
In the light of the above statements, choose the CORRECT answer from the options given below
(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is NOT the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

196. An integral plasma membrane protein is glycosylated. Scientists can trace the journey of this protein from the time of its initial translation to its translocation to the plasma membrane in its mature form. Which of the following changes in its molecular weight can be expected to take place during its maturation?
(a) A gradual decrease after translation.
(b) An initial decrease followed by an increase.
(c) An initial increase followed by a decrease.
(d) There will be no change in the molecular weight.

197. Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R
Assertion A: The strand separation of DNA occurs in vivo during processes such as DNA replication and transcription
Reason R: The sites where these processes are initiated are often rich in C/G base pairs
In the light of the above statements, choose the most appropriate answer from the options given below
(a) Both A and R are correct and R is the correct explanation of A.
(b) Both A and R are correct but R is NOT the correct explanation of A.
(c) A is correct but R is not correct.
(d) A is not correct but R is correct.

198. The E. $coli$ strain $BL21(DE3)$ is used for expressing recombinant proteins whose genes are cloned in the pET series vectors. The primary reason for this is:
(a) $BL21(DE3)$ lacks proteases that degrade polymerases required for the expression of genes in PET vectors.
(b) $BL21(DE3)$ encodes proteases that specifically process the expressed protein.
(c) $BL21(DE3)$ harbors a polymerase that is required for expressing the genes in pET vectors.
(d) $BL21(DE3)$ has more efficient protein translation system than cloning strains of E. $coli$.

199. Which stage of mitosis is blocked by colchicine?
(a) Prophase
(b) Telophase
(c) Anaphase
(d) Metaphase

200. Many bacteria produce an extracellular capsule composed of a network of polysaccharides and/or proteins that are loosely attached to the cell wall. Which of the following statement is INCORRECT about the capsule?

(a) It is a virulence factor.
(b) May potentially inhibit binding of host complement proteins.
(c) Helps the bacteria to evade the host immune system.
(d) It prevents the pathogen from acquiring nutrients.

DBT-BET-JRF 2023 ANSWER KEY

DBT-BET-JRF 2023 ANSWER KEY																			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
d	b	c	d	c	d	b	b	a	c	b	a	b	d	c	b	c	c	d	c
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
a	c	b	a	d	c	a	a	a	b	a	a	b	b	d	c	c	d	d	d
41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
c	b	c	a	a	c	b	c	b	c	a	b	c	d	b	a	d	d	c	a
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
a	c	c	c	a	d	c	c	c	a	a	c	b	d	b	d	a	c	d	a
81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
a	b	b	d	a	c	d	b	c	c	c	b	c	b	a	b	c	b	a	a
101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
b	c	c	b	a	c	c	b	a	b	c	b	d	b	c	c	c	c	c	a
121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140
a	a	d	c	c	b	b	c	b	b	c	c	c	b	c	b	c	a	c	b
141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160
b	b	c	b	d	a	c	d	c	b	b	b	a	c	d	b	c	a	d	b
161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180
c	a	d	c	d	b	b	b	d	b	b	c	c	c	a	b	b	b	b	d
181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200
c	b	b	b	b	c	b	d	a	a	c	b	a	a	a	b	c	c	c	d