



General Instructions

- (i) The test is of 2 hours duration.
- (ii) This test paper consists of 120 questions. The maximum marks are 120.
- (iii) Each question carries +1 marks for correct answer and there is no negative marking for wrong answer.

1. The matrix

$$A = \begin{bmatrix} 1 & 1+i & 2i \\ 1-i & 3 & 4 \\ -2i & 4 & 5 \end{bmatrix}$$

has

- (A) only real eigen values
- (B) eigen values of the form $a + ib$, $a \neq 0$, $b \neq 0$
- (C) eigen values of the form $x + iy$, $x = 0$
- (D) no inverse

2. An eigen vector of the matrix

$$A = \begin{bmatrix} 3 & 2 \\ 1 & 2 \end{bmatrix}$$

is

(A) $\begin{bmatrix} 7 \\ 2 \end{bmatrix}$

- (B) $\begin{bmatrix} -2 \\ 1 \end{bmatrix}$
- (C) $\begin{bmatrix} -1 \\ 2 \end{bmatrix}$
- (D) $\begin{bmatrix} 5 \\ -5 \end{bmatrix}$

3. A convergent series from the given series is

(A)

$$\sum_{n=1}^{\infty} \frac{1}{\sqrt{n}}$$

(B)

$$\sum_{n=1}^{\infty} \frac{(-1)^n}{\sqrt{n+1}}$$

(C)

$$\sum_{n=1}^{\infty} \frac{3n^4 + 5}{n^2(n^2 + 4n + 5)}$$

(D)

$$\sum_{n=3}^{\infty} \frac{\log n}{n}$$

4. Fourier series of x^2 , $0 < x < 2$ is

$$f(x) = \frac{a_0}{2} + \sum_{n=1}^{\infty} a_n \cos(n\pi x) + \sum_{n=1}^{\infty} b_n \sin(n\pi x),$$

then $b_2 =$

(A) Zero since x^2 is an even function

(B)

$$\int_0^2 x^2 \sin 2x \, dx$$

(C)

$$\int_0^2 x^2 \cos 2\pi x \, dx = -\frac{2}{\pi}$$

(D)

$$\int_0^2 x^2 \sin 2\pi x \, dx = -\frac{2}{\pi}$$

5. If y_1, y_2 are two dependent solutions of a second order linear homogeneous differential equation then $y_1 y_2' - y_2 y_1'$ is

- (A) Positive
 - (B) Negative
 - (C) Non-zero
 - (D) Zero
-

6. The general solution of one dimensional wave equation

$$\frac{\partial^2 v}{\partial t^2} = c^2 \frac{\partial^2 v}{\partial x^2}$$

is $u(x, t) =$

- (A) $f(x + ct)g(x - ct)$
 - (B) $f(x + ct) + g(x - ct)$
 - (C) $f(x - ct) + g(x - ct)$
 - (D) $f(x + ct) + g(x + ct)$
-

7. If

$$F(x) = \begin{cases} 0, & x < -7, \\ \left(\frac{x+7}{a}\right), & -7 < x < 7, \\ 1, & x > 7, \end{cases}$$

represents the probability distribution function of a continuous random variable, then $a =$

- (A) -7
- (B) 21
- (C) 7
- (D) 14

8. Mean and variance pair is given below. A pair representing the data of a binomial distribution is

- (A) (7, 4)
 - (B) (12, 5)
 - (C) (15, 6)
 - (D) (18, 10)
-

9. If $x_0 = 1.2$ is the initial guess of the solution of $x^3 + 2x - 1 = 0$, then the 1st iteration solution $x_1 =$

- (A) 0.705
 - (B) 0.675
 - (C) 0.815
 - (D) 0.795
-

10. A multistep method used to solve differential equations is

- (A) Runge-Kutta 4th order differential method
 - (B) Euler's modified method
 - (C) Adams-Bashforth method
 - (D) Successive approximation method
-

11. Origin of replication usually contains

- (A) GC Rich Sequences
 - (B) GCG-Rich Sequences
 - (C) No particular stretch of Sequences
 - (D) AT-Rich Sequences
-

12. Which of the following cellular components is present in eukaryotic cells but absent in prokaryotic cells?

- (A) Plasma membrane
- (B) Ribosomes

- (C) Mitochondria
(D) Cell wall
-

13. A bacterium has a generation time of 30 minutes. Starting with 1×10^4 (10000) cells, how many cells will be present after 2 hours?

- (A) 4×10^4
(B) 8×10^4
(C) 1.6×10^5
(D) 6.4×10^5
-

14. Which of the following correctly matches a virus with its type of nucleic acid?

- (A) Poliovirus – double-stranded DNA
(B) Influenza virus – negative-sense single-stranded RNA
(C) Adenovirus – single-stranded RNA
(D) HIV – single-stranded DNA
-

15. Viruses are considered as living organisms because they perform

- (A) Metabolism
(B) Respiration
(C) Replication
(D) Multiply outside the host cell
-

16. Match the following

	Genetic element/process		Characteristic
A	F plasmid	I	Uptake of naked DNA
B	Transformation	II	Sex pilus formation
C	Generalized transduction	III	Random bacterial DNA transfer
D	Hfr strain	IV	High-frequency chromosomal gene transfer

The correct answer is

- (A) A – II, B – I, C – III, D – IV
(B) A – I, B – II, C – IV, D – III

- (C) A – III, B – IV, C – I, D – II
(D) A – II, B – III, C – I, D – IV
-

17. The site of light reactions of photosynthesis occurs on

- (A) Stroma
(B) Cytosol
(C) Thylakoid membrane
(D) Inner mitochondrial membrane
-

18. Which of the following yields the maximum ATP?

- (A) Glycolysis
(B) Fermentation
(C) Aerobic respiration
(D) Anaerobic respiration
-

19. Consider the following and choose the correct answer

Assertion [A]: Aerobic respiration is more efficient than anaerobic respiration.

Reason [R]: Oxygen allows complete oxidation of glucose.

The correct answer is

- (A) Both [A] and [R] are true and [R] is the correct explanation of [A]
(B) Both [A] and [R] are true and [R] is not correct explanation of [A]
(C) [A] is true, but [R] is false
(D) [A] is false, but [R] is true
-

20. What are the products of the light reaction utilized during the Calvin cycle?

- (A) Oxygen
(B) NADH
(C) ATP and NADPH
(D) CO₂
-

21. Identify the following organism which is a symbiotic nitrogen fixer?

- (A) Azotobacter
 - (B) Rhizobium
 - (C) Clostridium
 - (D) Nitrosomonas
-

22. Match the following

	List-I		List-II
A	<i>Azotobacter</i>	I	Anaerobic nitrogen fixer
B	<i>Clostridium</i>	II	Symbiotic nitrogen fixer
C	<i>Rhizobium</i>	III	Free-living aerobic fixer
D	Leghemoglobin	IV	Oxygen buffering protein

The correct answer is

- (A) A – III, B – I, C – II, D – IV
 - (B) A – I, B – III, C – IV, D – II
 - (C) A – I, B – IV, C – II, D – III
 - (D) A – IV, B – II, C – III, D – I
-

23. Select the enzyme complex responsible for biological nitrogen fixation?

- (A) Nitrate reductase
 - (B) Nitrogenase
 - (C) Nitrite reductase
 - (D) Glutamine synthetase
-

24. Consider the following and choose the correct answer

Assertion [A]: Tautomeric shifts in DNA bases are a source of spontaneous mutations.

Reason [R]: Rare tautomeric forms have altered hydrogen-bonding patterns.

The correct answer is

- (A) Both [A] and [R] are true and [R] is the correct explanation of [A]
 - (B) Both [A] and [R] are true and [R] is not the correct explanation of [A]
 - (C) [A] is true, but [R] is false
 - (D) [A] is false, but [R] is true
-

25. Identify the obligate intracellular microorganism?

- (A) *Mycoplasma*
 - (B) *Chlamydia*
 - (C) *Escherichia coli*
 - (D) *Bacillus subtilis*
-

26. Which among the following is not a key component of signal transduction process?

- (A) G protein coupled receptors
 - (B) Reverse transcriptase
 - (C) Second messengers
 - (D) Phosphorylation cascade
-

27. Consider the following and choose the correct answer

Assertion [A]: B-DNA is the most stable and predominant form of DNA under physiological conditions.

Reason [R]: B-DNA possesses major and minor grooves.

The correct answer is

- (A) Both [A] and [R] are true and [R] is the correct explanation of [A]
 - (B) Both [A] and [R] are true and [R] is not the correct explanation of [A]
 - (C) [A] is true, but [R] is false
 - (D) [A] is false, but [R] is true
-

28. What is the pH of 0.01 M HCl?

- (A) 1
 - (B) 2
 - (C) 3
 - (D) 12
-

29. Which buffer resists changes in pH most effectively?

- (A) $\text{pH} = 2$, $\text{pK}_a = 2$
- (B) $\text{pH} = 4$, $\text{pK}_a = 5$

(C) $\text{pH} = 7$, $\text{pK}_a = 3$

(D) $\text{pH} = 9$, $\text{pK}_a = 5$

30. Match the following

	List-I		List-II
A	Apoenzyme	I	Non-protein part
B	Coenzyme	II	Protein part
C	Holoenzyme	III	Enzyme + cofactor
D	Active site	IV	Substrate-binding region

The correct answer is

(A) A – II, B – I, C – III, D – IV

(B) A – I, B – II, C – IV, D – III

(C) A – III, B – IV, C – I, D – II

(D) A – IV, B – III, C – II, D – I

31. Identify the checkpoint that controls entry into DNA replication

(A) G_2/M checkpoint

(B) Spindle checkpoint

(C) G_1/S checkpoint

(D) Metaphase checkpoint

32. If a mammalian cell completes one cell cycle in 24 hours and the S phase lasts 8 hours, what fraction of the cell cycle is spent in S phase?

(A) $\frac{1}{2}$

(B) $\frac{1}{3}$

(C) $\frac{1}{4}$

(D) $\frac{1}{8}$

33. Determine the second messenger involved in mobilizing Ca^{2+} from the endoplasmic reticulum?

- (A) cAMP
 - (B) DAG
 - (C) IP_3
 - (D) cGMP
-

34. Which electron transport chain complex does not pump protons across the mitochondrial inner membrane?

- (A) Complex I
 - (B) Complex II
 - (C) Complex III
 - (D) Complex IV
-

35. In what ratio does the Na^+/K^+ pump transport sodium and potassium ions?

- (A) 2 Na^+ out : 2 K^+ in
 - (B) 3 Na^+ out : 2 K^+ in
 - (C) 2 Na^+ in : 3 K^+ out
 - (D) 1 Na^+ out : 1 K^+ in
-

36. In a population, the frequency of a recessive allele (q) is 0.4. Calculate the frequency of homozygous dominant individuals?

- (A) 0.16
 - (B) 0.36
 - (C) 0.48
 - (D) 0.64
-

37. Consider the following and choose the correct answer

Assertion [A]: DNA replication is semiconservative in nature.

Reason [R]: Each daughter DNA molecule contains one parental strand and one newly synthesized strand.

The correct answer is

- (A) Both [A] and [R] are true and [R] is the correct explanation of [A]
 - (B) Both [A] and [R] are true and [R] is not the correct explanation of [A]
-

- (C) [A] is true, but [R] is false
(D) [A] is false, but [R] is true
-

38. Enzyme responsible for transcription in prokaryotes?

- (A) DNA polymerase
(B) RNA polymerase
(C) Reverse transcriptase
(D) Primase
-

39. Consider the following and choose the correct answer

Assertion [A]: Peptide bond formation occurs at the P site of the ribosome.

Reason [R]: Peptidyl transferase activity is an intrinsic property of rRNA.

The correct answer is

- (A) Both [A] and [R] are true and [R] is the correct explanation of [A]
(B) Both [A] and [R] are true and [R] is not the correct explanation of [A]
(C) [A] is true, but [R] is false
(D) [A] is false, but [R] is true
-

40. In a dihybrid cross ($AaBb \times AaBb$), what is the probability of obtaining an individual heterozygous for both traits ($AaBb$)?

- (A) $\frac{1}{16}$
(B) $\frac{1}{8}$
(C) $\frac{1}{4}$
(D) $\frac{1}{2}$
-

41. A phenotypic ratio of 12 : 3 : 1 is produced due to

- (A) Recessive epistasis
(B) Dominant epistasis
(C) Duplicate recessive epistasis
(D) Complementation
-

42. The following cross can never result in a recessive phenotype?

- (A) $Tt Pp \times Tt Pp$
 - (B) $TT Pp \times tt pp$
 - (C) $tt pp \times TT PP$
 - (D) $tt pp \times Tt Pp$
-

43. If the percentage of crossing over between two genes is 10, then the distance between two genes will be

- (A) 5 morganoid
 - (B) 10 centimorgans
 - (C) 20 centimorgans
 - (D) 40 map units
-

44. Extra-chromosomal inheritance is often called maternal inheritance because

- (A) Genes are inherited from both parents equally
 - (B) Cytoplasm of the zygote is mainly contributed by the mother
 - (C) Organellar genes show dominance
 - (D) Only females show the trait
-

45. The following is a classic example of extra-chromosomal inheritance?

- (A) Sickle cell anemia
 - (B) Color blindness
 - (C) Variation in *Mirabilis jalapa*
 - (D) Hemophilia
-

46. Identify the organism with polyploidy?

- (A) Humans
 - (B) *Drosophila*
 - (C) Wheat
 - (D) Frog
-

47. Consider a population of sheep to be in Hardy-Weinberg equilibrium. The allele for black wool (p) has a frequency of 0.81 while the allele for white wool (q) has a frequency of 0.19. Then the percentage of heterozygous individuals in the population is

- (A) 4%
 - (B) 15%
 - (C) 31%
 - (D) 66%
-

48. Choose the transposable element which moves via an RNA intermediate?

- (A) Insertion sequence
 - (B) Composite transposon
 - (C) Retrotransposon
 - (D) DNA transposon
-

49. Which application is used to detect genetic disorders at the DNA level?

- (A) Western blotting
 - (B) ELISA
 - (C) PCR
 - (D) Chromatography
-

50. Match the following

	Disease / Application		Molecular basis / Use
A	Sickle cell anemia	I	Frameshift mutation
B	Thalassemia	II	Missense point mutation
C	Duchenne muscular dystrophy	III	β -globin gene defect
D	PCR	IV	DNA amplification technique

The correct matching is

- (A) A – II, B – III, C – I, D – IV
 - (B) A – III, B – II, C – I, D – IV
 - (C) A – II, B – I, C – III, D – IV
 - (D) A – I, B – III, C – II, D – IV
-

51. Following process is primarily employed for the aerobic stabilization of liquid waste

- (A) Anaerobic digester
 - (B) Activated sludge process
 - (C) Septic tank
 - (D) Methanogenesis
-

52. Final stage of anaerobic digestion is

- (A) Hydrolysis
 - (B) Acidogenesis
 - (C) Acetogenesis
 - (D) Methanogenesis
-

53. Match the following

	List-I		List-II
A	Bioaugmentation	I	Nutrient addition
B	Biostimulation	II	Addition of specific microbes
C	Phytoremediation	III	Use of plants
D	Composting	IV	Solid waste aerobic treatment

The correct matching is

- (A) A – II, B – I, C – III, D – IV
 - (B) A – I, B – II, C – IV, D – III
 - (C) A – III, B – IV, C – II, D – I
 - (D) A – IV, B – III, C – I, D – II
-

54. Consider the following and choose the correct answer

Assertion [A]: Bioremediation is an environmentally friendly technology.

Reason [R]: Bioremediation removes pollutants mainly by converting them into highly toxic intermediate compounds that persist in the environment.

The correct answer is

- (A) Both [A] and [R] are true and [R] is the correct explanation of [A]
 - (B) Both [A] and [R] are true and [R] is not the correct explanation of [A]
-

- (C) [A] is true, but [R] is false
(D) [A] is false, but [R] is true
-

55. Identify the microorganism that is industrially used for baker's yeast production?

- (A) *Aspergillus niger*
(B) *Saccharomyces cerevisiae*
(C) *Penicillium chrysogenum*
(D) *Lactobacillus*
-

56. Exopolysaccharides are best described as

- (A) Intracellular storage polymers
(B) Cell wall components
(C) Polymers secreted outside the cell
(D) Secondary metabolites only
-

57. Which amino acid is produced industrially using *Corynebacterium glutamicum*?

- (A) Tryptophan
(B) Lysine
(C) Methionine
(D) Histidine
-

58. Match the following

	List-I		List-II
A	Amylase	I	Protein hydrolysis
B	Protease	II	Starch hydrolysis
C	Cellulase	III	Fat hydrolysis
D	Lipase	IV	Cellulose degradation

The correct matching is

- (A) A – I, B – II, C – IV, D – III
(B) A – III, B – IV, C – I, D – II
(C) A – IV, B – III, C – II, D – I
-

(D) A – II, B – I, C – IV, D – III

59. Consider the following and choose the correct answer

Assertion [A]: Downstream processing significantly increases the cost of enzyme production.

Reason [R]: Enzymes are usually produced in very pure form during fermentation.

The correct answer is

- (A) Both [A] and [R] are true and [R] is the correct explanation of [A]
 - (B) Both [A] and [R] are true and [R] is not the correct explanation of [A]
 - (C) [A] is true, but [R] is false
 - (D) [A] is false, but [R] is true
-

60. Why are extracellular enzymes preferred in industrial production?

- (A) Higher molecular weight
 - (B) Require cell disruption
 - (C) Easier purification
 - (D) Low stability
-

61. Which bioreactor type is most commonly used for large-scale recombinant protein production?

- (A) Packed bed reactor
 - (B) Stirred-tank bioreactor
 - (C) Airlift reactor
 - (D) Trickling filter
-

62. Which purification method is commonly used when recombinant proteins carry a His-tag?

- (A) Ion exchange chromatography
 - (B) Gel filtration chromatography
 - (C) Affinity chromatography
 - (D) Ultracentrifugation
-

63. In gel filtration chromatography, which molecules elute first?

- (A) Small molecules
 - (B) Highly charged molecules
 - (C) Hydrophobic molecules
 - (D) Large molecules
-

64. Match the following

	List-I		List-II
<i>A</i>	Microfiltration	<i>I</i>	Removal of salts
<i>B</i>	Ultrafiltration	<i>II</i>	Protein concentration
<i>C</i>	Reverse osmosis	<i>III</i>	Suspended solids/bacteria
<i>D</i>	Dialysis	<i>IV</i>	Small solute diffusion

The correct matching is

- (A) A – III, B – II, C – I, D – IV
 - (B) A – II, B – III, C – IV, D – I
 - (C) A – I, B – IV, C – III, D – II
 - (D) A – IV, B – I, C – II, D – III
-

65. Most commonly used method for enzyme immobilisation is

- (A) Adsorption
 - (B) Denaturation
 - (C) Fermentation
 - (D) Dialysis
-

66. An enzyme-based biosensor primarily consists of

- (A) A catalyst and substrate
 - (B) A signal amplifier and detector
 - (C) A membrane and power source
 - (D) A bioreceptor and transducer
-

67. Which of the following is a characteristic of diauxic growth?

- (A) A single exponential growth phase

- (B) Two distinct exponential growth phases
 - (C) A prolonged lag phase
 - (D) A rapid death phase
-

68. The rate at which substrate is consumed by microorganisms is directly related to

- (A) Only substrate concentration
 - (B) Only product concentration
 - (C) Cell concentration
 - (D) Temperature only
-

69. How does fed-batch fermentation help in overcoming substrate inhibition?

- (A) By maintaining a high substrate concentration
 - (B) By maintaining a low substrate concentration
 - (C) By adding substrate in a single batch
 - (D) By not adding substrate at all
-

70. Simple structured models are most useful for studying

- (A) Heat transfer in fermenters
 - (B) Mixing and aeration
 - (C) Mechanical agitation effects
 - (D) Metabolic regulation during growth
-

71. Which method is the most commonly used for sterilization of culture media?

- (A) Dry heat sterilization
 - (B) Autoclaving
 - (C) UV radiation
 - (D) Filtration
-

72. Match the following

	List-I		List-II
A	Batch	I	Steady-state operation
B	Fed-batch	II	Substrate feeding without outflow
C	Continuous	III	No input or output
D	Chemostat	IV	Constant dilution rate

The correct matching is

- (A) A – III, B – II, C – I, D – IV
 (B) A – I, B – III, C – II, D – IV
 (C) A – II, B – IV, C – I, D – III
 (D) A – IV, B – II, C – III, D – I
-

73. The primary purpose of aeration in aerobic fermentation is to

- (A) Control temperature
 (B) Provide oxygen for microbial metabolism
 (C) Prevent foaming
 (D) Increase pH
-

74. The term $k_L a$ represents

- (A) Oxygen solubility
 (B) Interfacial area only
 (C) Oxygen uptake rate
 (D) Overall gas–liquid mass transfer coefficient
-

75. Match the following

	List-I		List-II
A	Carbon source	I	Enzyme cofactor
B	Nitrogen source	II	Energy and cell material
C	Trace elements	III	Protein and nucleic acid synthesis
D	Buffer	IV	pH maintenance

The correct matching is

- (A) A – II, B – III, C – I, D – IV
 (B) A – III, B – II, C – IV, D – I
-

(C) A – IV, B – I, C – II, D – III

(D) A – I, B – IV, C – III, D – II

76. Consider the following and choose the correct answer

Assertion [A]: Ethylene is a gaseous plant hormone.

Reason [R]: Ethylene inhibits fruit ripening.

The correct answer is

(A) Both [A] and [R] are true and [R] is the correct explanation of [A]

(B) Both [A] and [R] are true and [R] is not the correct explanation of [A]

(C) [A] is true, but [R] is false

(D) [A] is false, but [R] is true

77. The genes responsible for hairy root formation are located on

(A) Ti plasmid

(B) Ri plasmid

(C) F plasmid

(D) R plasmid

78. Secondary metabolite production in plant suspension cultures generally occurs during

(A) Lag phase

(B) Exponential phase

(C) Stationary phase

(D) Death phase

79. Which core genes are present in the T-DNA region of the Ti plasmid of *Agrobacterium tumefaciens*?

(A) *vir* genes

(B) Opine, Auxin and Cytokinin synthesis

(C) Antibiotic resistance genes

(D) Replication origin genes

80. Match the following

	Technique		Description / Application
A	Agrobacterium-mediated transformation	I	Gene transfer using particle bombardment
B	Microinjection	II	Direct injection of DNA into nucleus
C	Biolistic method	III	Ti plasmid-based gene transfer
D	Electroporation	IV	DNA uptake through membrane pores

The correct matching is

- (A) A – III, B – II, C – I, D – IV
(B) A – II, B – I, C – III, D – IV
(C) A – IV, B – III, C – II, D – I
(D) A – I, B – IV, C – III, D – II
-

81. Animal cloning is commonly achieved by

- (A) Embryo splitting
(B) Somatic Cell Nuclear Transfer
(C) Parthenogenesis
(D) In vitro fertilization
-

82. Which chemical is commonly used to fuse B cells and myeloma cells?

- (A) Trypsin
(B) Calcium chloride
(C) Polyethylene glycol
(D) EDTA
-

83. Animal cell lines are typically preserved long-term in liquid nitrogen at

- (A) 0°C
(B) –20°C
(C) –80°C
(D) –196°C
-

84. Consider the following and choose the correct answer

Assertion [A]: Product inhibition can reduce overall process productivity.

Reason [R]: Accumulated products may interfere with enzyme activity or cell viability.

The correct answer is

- (A) Both [A] and [R] are true and [R] is the correct explanation of [A]
 - (B) Both [A] and [R] are true and [R] is not the correct explanation of [A]
 - (C) [A] is true, but [R] is false
 - (D) [A] is false, but [R] is true
-

85. A low K_m value of an enzyme indicates

- (A) Low affinity for substrate
 - (B) High affinity for substrate
 - (C) No enzyme–substrate complex formation
 - (D) Enzyme inhibition
-

86. Which of the following is a component of innate immunity?

- (A) Antibodies
 - (B) Memory cells
 - (C) T lymphocytes
 - (D) Phagocytes
-

87. Match the following

	List-I		List-II
A	Thymus	I	B-cell maturation
B	Bone marrow	II	T-cell maturation
C	Spleen	III	Blood filtration
D	Lymph node	IV	Lymph filtration

The correct matching is

- (A) A – II, B – I, C – III, D – IV
 - (B) A – II, B – I, C – IV, D – III
 - (C) A – III, B – IV, C – I, D – II
 - (D) A – IV, B – III, C – II, D – I
-

88. Which immunoglobulin is produced first during a primary immune response?

- (A) IgG
 - (B) IgA
 - (C) IgM
 - (D) IgE
-

89. Which cells constitutively express MHC class I molecules?

- (A) Only antigen-presenting cells
 - (B) Only T lymphocytes
 - (C) All nucleated cells
 - (D) Red blood cells
-

90. Consider the following and choose the correct answer

Assertion [A]: MHC Class I presents endogenous antigens to CD8⁺ T cells.

Reason [R]: Endogenous peptides are generated in lysosomes.

The correct answer is

- (A) Both [A] and [R] are true and [R] is the correct explanation of [A]
 - (B) Both [A] and [R] are true and [R] is not the correct explanation of [A]
 - (C) [A] is true, but [R] is false
 - (D) [A] is false, but [R] is true
-

91. Antibodies are synthesized by

- (A) T lymphocytes
 - (B) Macrophages
 - (C) NK cells
 - (D) Plasma cells
-

92. Somatic hypermutation mainly contributes to

- (A) Antibody class change
 - (B) Increased affinity of antibodies
 - (C) T-cell activation
 - (D) Isotype switching
-

93. Consider the following and choose the correct answer

Assertion [A]: Monoclonal antibodies have higher specificity than polyclonal antibodies.

Reason [R]: They recognize only one epitope on an antigen.

The correct answer is

- (A) Both [A] and [R] are true and [R] is the correct explanation of [A]
 - (B) Both [A] and [R] are true and [R] is not the correct explanation of [A]
 - (C) [A] is true, but [R] is false
 - (D) [A] is false, but [R] is true
-

94. Identify the cytokine which is primarily immunosuppressive?

- (A) IL-2
 - (B) IFN- γ
 - (C) IL-10
 - (D) TNF- α
-

95. Anaphylaxis is an example of

- (A) Type I hypersensitivity
 - (B) Type II hypersensitivity
 - (C) Type III hypersensitivity
 - (D) Type IV hypersensitivity
-

96. Which enzyme protects host DNA from restriction digestion?

- (A) DNA ligase
 - (B) Restriction endonuclease
 - (C) DNA methyltransferase
 - (D) DNA polymerase
-

97. Bacteriophage λ vectors can accommodate foreign DNA of about

- (A) 2–5 kb
 - (B) 15–20 kb
-

- (C) 50 kb
 - (D) 300 kb
-

98. Which vector can carry the largest DNA inserts?

- (A) Plasmid
 - (B) Cosmid
 - (C) BAC
 - (D) YAC
-

99. Consider the following and choose the correct answer

Assertion [A]: Type II restriction enzymes are preferred in recombinant DNA technology.

Reason [R]: They cleave DNA at random sites far away from their recognition sequences.

The correct answer is

- (A) Both [A] and [R] are true and [R] is the correct explanation of [A]
 - (B) Both [A] and [R] are true and [R] is not the correct explanation of [A]
 - (C) [A] is true, but [R] is false
 - (D) [A] is false, but [R] is true
-

100. A major advantage of a cDNA library over a genomic library is that cDNA

- (A) Contains introns
 - (B) Represents non-coding regions
 - (C) Contains only expressed genes
 - (D) Is identical in all tissues
-

101. Insertional inactivation is commonly used for screening recombinants in

- (A) YAC vectors
 - (B) BAC vectors
 - (C) Cosmid vectors
 - (D) pBR322 plasmid
-

102. Which promoter is commonly used for high-level expression in *E. coli*?

- (A) Lac promoter
 - (B) T7 promoter
 - (C) SV40 promoter
 - (D) CMV promoter
-

103. Which nucleotide lacks a 3'-OH group?

- (A) ddTTP
 - (B) dATP
 - (C) dGTP
 - (D) dCTP
-

104. Which isotope is commonly used for radioactive DNA labelling?

- (A) ^{12}C
 - (B) ^{32}P
 - (C) ^{14}N
 - (D) ^{16}O
-

105. Southern blotting is used to detect

- (A) RNA sequences
 - (B) Protein molecules
 - (C) Specific DNA sequences
 - (D) Lipids
-

106. A key difference between Southern and Northern blotting is that Northern blotting

- (A) Uses antibodies
 - (B) Does not involve restriction digestion
 - (C) Uses protein probes
 - (D) Transfers proteins
-

107. A major limitation of RAPD is

- (A) Low sensitivity
 - (B) Poor reproducibility
-

- (C) Requirement of radioactive probes
(D) High cost
-

108. Match the following

	List-I		List-II
A	RAPD	I	Plant gene transfer
B	RFLP	II	Specific base change
C	Site-directed mutagenesis	III	Restriction-based polymorphism
D	Agrobacterium-mediated transformation	IV	Random PCR markers

The correct matching is

- (A) A – IV, B – II, C – III, D – I
(B) A – II, B – I, C – IV, D – III
(C) A – III, B – IV, C – I, D – II
(D) A – IV, B – III, C – II, D – I
-

109. Which of the following is NOT a challenge in gene therapy?

- (A) Immune response
(B) Targeted delivery
(C) Ethical concerns
(D) PCR amplification
-

110. What does a genomic DNA library represent?

- (A) Only expressed genes
(B) Only protein-coding sequences
(C) The entire genome of an organism
(D) Only mRNA sequences
-

111. Which resource is NOT primarily used for protein analysis?

- (A) ExPASy
(B) UniProt
(C) InterPro
(D) GenBank
-

112. Which database stores 3D structures of biomolecules?

- (A) GenBank
- (B) UniProt
- (C) PDB
- (D) KEGG

113. Which database provides non-redundant protein sequences?

- (A) GenBank
- (B) UniProt
- (C) PDB
- (D) KEGG

114. FASTA format contains

- (A) Only sequence
- (B) Only annotation
- (C) Header line and sequence
- (D) Alignment scores

115. Which technique is used in proteomics?

- (A) DNA sequencing
- (B) PCR
- (C) Mass spectrometry
- (D) Southern blot

116. Which is NOT a force field?

- (A) CHARMM
- (B) AMBER
- (C) GROMOS
- (D) BLAST

117. Incorrectly matched pair?

- (A) NCBI – GenBank
 - (B) EBI – EMBL
 - (C) ExPASy – Swiss-Prot
 - (D) PDB – NCBI
-

118. Match the following

	List-I		List-II
<i>A</i>	Microarray	<i>I</i>	Whole genome study
<i>B</i>	RNA-Seq	<i>II</i>	Protein expression
<i>C</i>	Proteomics	<i>III</i>	Sequencing-based
<i>D</i>	Genomics	<i>IV</i>	Hybridization-based

The correct matching is

- (A) A – I, B – II, C – III, D – IV
 - (B) A – II, B – I, C – IV, D – III
 - (C) A – III, B – IV, C – I, D – II
 - (D) A – IV, B – III, C – II, D – I
-

119. Select the technique used to predict ligand binding orientation?

- (A) Molecular docking
 - (B) Energy minimisation
 - (C) Molecular dynamics
 - (D) Homology modelling
-

120. A gene consists of 900 nucleotide bases. How many amino acids will it code?

- (A) 150
 - (B) 300
 - (C) 450
 - (D) 900
-