TEST SERIES CSIR-NET/JRF JUNE 2019

BOOKLET SERIES E
Full Length Test – II

Paper Code 03 **Test Type: TEST SERIES**

LIFE SCIENCES

Duration: 3:00 Hours **Date: 08-06-2019**

Maximum Marks: 300

Read the following instructions carefully:

* Single Paper Test is divided into **THREE** Parts.

Part - A: This part shall carry **15** questions. Each question shall be of **2 marks.**

Part - B: This part shall carry **35** questions. Each question shall be of **2 marks.**

Part - C: This part shall contain **50** questions. Each question shall be of **4 marks**.

* Darken the appropriate bubbles with HB pencil/Ball Pen to write your answer.

* There will be negative marking @25% for each wrong answer.

* The candidates shall be allowed to carry the Question Paper Booklet after completion of the exam.

* For rough work, blank sheet is attached at the end of test booklet.

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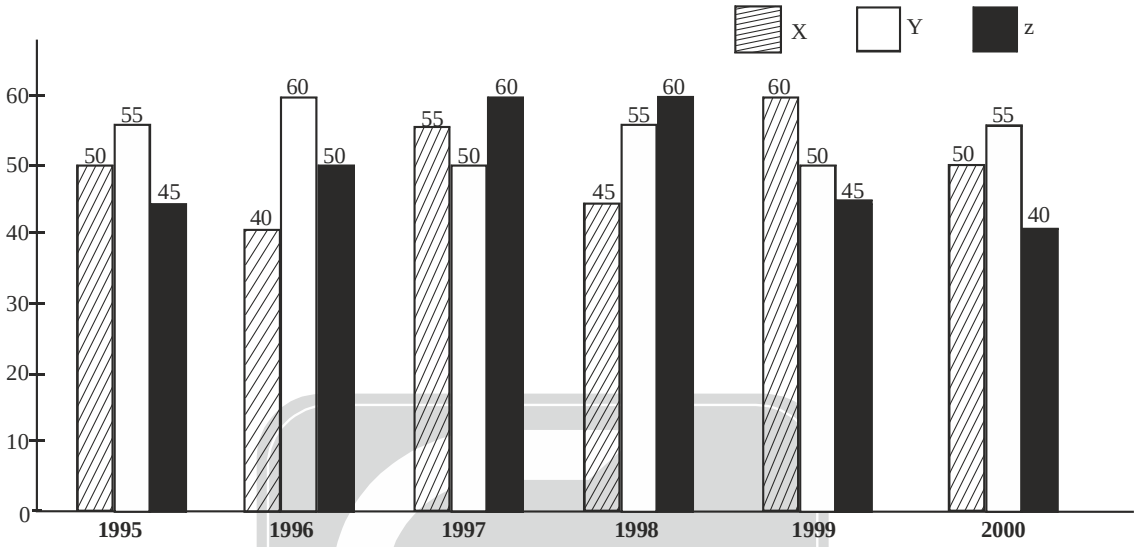
PART-A

1. An express train travelled at an average speed of 100 km/hr, stopping for 3 minutes after every 75 km. How long did it take to reach its destination 600 km away from the starting point ?
   (a) 6 hrs 21 min (b) 6 hrs 24 min (c) 6 hrs and 27 min (d) 6 hrs 30 min
2. If in a certain code language 'INDIA' is coded as 'OJEBJ' and 'DELHI' is coded as 'FEMJI', then in the same language code for 'TAKEN' is
   (a) UZJOF (b) BULOF (c) BUJOF (d) BULFO
3. Six students A, B, C, D, E, F are there in a class and they are to be seated in ascending order based on their ages from left to right ?
   A is as old as C.
   D is not the oldest student.
   B is younger than C, but older than E.
   D is older than both A and B.
   If E is the youngest student, then who is the oldest among the students ?
   (a) F (b) A (c) D (d) B
4. In the series given below follows a certain pattern. What should come following the same pattern in place of question mark (?) ?

3	8	19	39	71	?

   (a) 118 (b) 138 (c) 142 (d) 125
5. (i) Anup is father of Ram,
   (ii) Ram is brother of Lakshman, and
   (iii) Kamla is sister of Ram.
   How is Kamla's husband related to Anup's wife ?
   (a) Son (b) Son-in-law (c) Uncle (d) Grandson
6. A courier boy starts delivering letters 3 km southwards and then turns right. He covers 4 km on this road and again turns right. He delivers letters for 3 km and completes his daily beat. Then he turns left for lunch at home, which is 5 km away. How far he has to travel to reach the post office after lunch?
   (a) 15 km (b) 10 km (c) 9 km (d) 8 km
7. In an job interview A and B appear for two vacancies in the same post. The probability of A's selection is 1/7 and the probability that B doesn't get selected is 4/5. What is the probability that only one of them is selected?
   (a) 2/5 (b) 1/10 (c) 2/7 (d) 3/20
8. $\frac{1}{\log_a bc+1}+\frac{1}{\log_b ac+1}+\frac{1}{\log_c ab+1}$ is equal to
   (a) abc (b) $a+b+c$ (c) 1 (d) 0
9. As price of apple reduced by $6\frac{1}{4}\%$, Amit was able to buy 1 kg more apple for ` 120. Find the reduced rate of apple per kg ?
   (a) 8 (b) 7.5 (c) 15 (d) 10

10. The sweet cola company prepares drinks of three different flavours –X, Y and Z. The production of the three flavours over a period of six years has been expressed in the bar-graph provided below. Study the graph and answer the question based on it. Production of three different flavour of soft-drinks X, Y, Z by the company over the years (in lakh bottles)



For which flavour was the average annual production maximum in the given period?

(a) X (b) Y (c) Z (d) X and Y

11. **Directions:** In the question below is given few statements followed by the conclusions numbered accordingly. You have to take the given statements to be true even if they seem to be at variance from commonly known facts and then decide which of the given conclusions logically follows from the statements disregarding commonly known facts.

Statements:

1. All P are Q
2. No Q are R
3. All S are P

Conclusions:

I. Some S are R
II. Some P are R
III. Some P are S
IV. Some Q are P

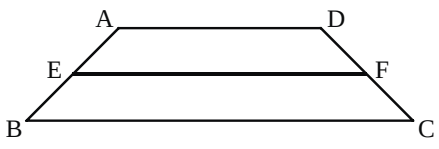
(a) All follows (b) Only III follows (c) Only IV follows (d) Both III and IV follows

12. In the series given below follows a certain pattern. What should come following the same pattern in place of question mark (?) ?

AY	FU	KP	PJ	?

(a) UB (b) UC (c) VC (d) VB

13. In the figure AD || EF || BC, if EB = 2AE, and BC = 20 cm, and AD = 11 cm, then what is the length of EF in cm ?



(a) 12 (b) 14 (c) 16 (d) 15

14. A man standing at a point P is watching the top of a tower, which makes an angle of elevation of 30° with the man's eye. The man walks some distance towards the tower to watch its top and the angle of elevation becomes 60°. What is the distance between the base of the tower and the point P ?

(a) $4\sqrt{3}$ units (b) 8 units (c) Data inadequate (d) None of these

15. In a 100 m race A beats B by 10 m and C by 12 m. In race of 180 m, B will beat C by how much metre ?

(a) 6 (b) 4 (c) 8 (d) 10

PART-B

16. Consider a 51 residue long protein containing only 100 bonds about which rotation can occur. Assume that 3 orientation per bond are possible. Based on these assumptions, how many conformations will be possible for this protein.

(a) 3^{100} (b) 100^6 (c) 3^{51} (d) $51 \times 100 \times 3$

17. In a polypeptide chain, a cis-to-trans rearrangement of two consecutive proline residue can be achieved by rotating the.

(a) ϕ angle to 10° (b) ω angle to 180°

(c) ψ angle to 0° (d) χ angle to 60°

18. A given genome of bacteria has the genes, Ton^R, Lac^+, His^+ and AziR. In an interrupted mating experiment, it is seen that the after 10 minsAzi^R gene in recipient, after 20 minutes there is appearance of ton^R and after 15 mins the recipient is lac+ , but the recipient is almost never his+. Where in the genome is the origin of transfer located?

(a) Between Azi^R and Ton^R genes (b) Between Ton^R and Lac^+

(c) Between Lac^+ and His^+ (d) Between His^+ and Azi^R

19. A population is in Hardy and Weinberg equilibrium. A genetic locus is controlled by two alleles A and a. If the frequency of 'a' allele is represented as 'q' and the frequency of A allele is represented by the 'p', the genotypic frequency in the next generation is given by the formulae

$$p^2 + 2pq + q^2 = 1$$

What is the frequency of the heterozygote from the above equation?

(a) p^2 (b) q^2 (c) 2pq (d) $p^2 + q^2$

20. A cross performed between true breeding lines of dark blue flower plants and white flower plants produces light blue flower plant in F1 progenies. When the F1 progenies are selfed the phenotypic ratio of the progenies in F2 are 1:2:1:: dark blue: light blue: white. What genetic phenomenon is associated with these results?

(a) complete dominance (b) complementation

(c) incomplete dominance (d) codominance

21. Which statement about animal cell junctions is not true?

(a) Tight junctions are barriers to the passage of molecules between cells.

(b) Desmosomes allow cells to adhere firmly to one another.

(c) Gap junctions block communication between adjacent cells.

(d) Connexons are made of protein.

22. Which of the following is an example of a primary active transport process ?

(a) Na^+ – glucose transport in small intestinal epithelial cells.

(b) Na^+ – alanine transport in renal proximal tubular cells.

(c) Insulin-dependent glucose transport in muscle cells

(d) $H^+ - K^+$ transport in gastric parietal cells.

23. In a patient with cystic fibrosis caused by the Δ F508 mutation, the mutant cystic fibrosis transmembrane conductance regulator (CFTR) protein folds incorrectly. The patient's cells modify this abnormal protein by attaching ubiquitin molecules to it. What is the fate of this modified CFTR protein?
    (a) It performs its normal function, as the ubiquitin largely corrects for the effect of the mutation.
    (b) It is placed into storage vesicles.
    (c) It is degraded by the proteasome.
    (d) It is repaired by cellular enzymes.

24. The Ras-like proteins have the following properties except :
    (a) Contain SH2 domains
    (b) Activate protein kinase cascades
    (c) Interact with Raf1
    (d) Mutations may lead to uncontrolled cell growth

25. The direct effect of cAMP in the protein kinase A pathway is to :
    (a) activate adenylate cyclase
    (b) dissociate regulatory subunits from protein kinase
    (c) phosphorylate certain cellular proteins
    (d) phosphorylate protein kinase A

26. Which of the following statements concerning G-proteins is correct?
    (a) G-proteins bind the appropriate hormone at the cell surface
    (b) GTP is bound to G-protein in the resting state
    (c) α subunit may be either stimulatory or inhibitory because it has two forms
    (d) Adenylate cyclase can be activated only if α, β and γ subunits of G-protein are associated with each other

27. Match the column

(I) Pattern recognition receptor	**(II) Target**
P. TLR2	1. CpG
Q. TLR3	2. Cell wall components of gram + bacteria
R. TLR5	3. dsRNA
S. TLR9	4. Flagellin of bacterial flagella

    (a) P-2, Q-1, R-4, S-3
    (b) P-1, Q-3, R-4, S-2
    (c) P-2, Q-3, R-4, S-1
    (d) P-2, Q-4, R-3, S-1

28. J-chain is a polypeptide found attached to secreted forms of IgM and IgA. J-chain
    (a) facilitates secretion and added after polymerization
    (b) facilitates polymerization of IgM and IgA before secretion
    (c) facilitates formation of disulfide bonds between heavy and light chains
    (d) facilitates in functioning of hinge region of IgM and IgA after secretion

29. N-addition during V-(D)-J recombination is performed by enzyme Terminal deoxynucleotidyl Transferase (TdT). Correct statement about process and enzyme is
    (a) N-addition occurs in H- and L-chains both as TdT expression is on during V-(D)-J in H- and L-chain genes
    (b) N-addition occurs in L-chains only as TdT expression is off during V-(D)-J in H-chain genes
    (c) N-addition occurs in constant region of H-chains as TdT is active during class switching only
    (d) N-addition occurs in variable region of H-chain as TdT is active only during V-(D)-J of H-chain genes

30. During gastrulation, the developing embryo undergoes a reorganization of the cells into a multi-layered organism, with each layer necessary to form distinct parts of the eventual fully-formed organism. Which of these primary layers will ultimately form the skin and the nervous system of the organism?
(a) Endoderm (b) Blastopore (c) Ectoderm (d) Mesoderm

31. Formation of the primitive streak occurs during what stage of embryogenesis?
(a) Blastula (b) Gastrula (c) Neurula (d) Morula

32. During embryogenesis, the process in which a committed cell develops distinctive functions and characteristics is known as _____.
(a) determination (b) induction (c) differentiation (d) specification

33. How a keystone species affect the structure and composition of an ecosystem?
(a) It tends to reduce biodiversity by eliminating food resources for other species.
(b) Provide the foundation for the food web
(c) Are most abundant as compare to any other species
(d) Can prevent superior competitor driving inferior competitor to local extinction

34. An evolutionary hypothesis which proposes that organisms must constantly adapt, evolve, and proliferate in order to survive while pitted against ever-evolving opposing organisms in a constantly changing environment, as well as to gain reproductive advantage ?
(a) Red queen hypothesis (b) Zahavi handicapped principal
(c) Copes rule (d) Gaia hypothesis

35. An organism never returns exactly to a former state, even if it finds itself placed in conditions of existence identical to those in which it has previously lived. It always keeps some trace of the intermediate stages through which it has passed.
(a) Dollo's law of irreversibility (b) Rosa's rule
(c) Rapoport's rule (d) Cope's rule

36. All three types of restriction enzyme bind to DNA molecules at specific sequences; however, the type II enzymes are favored for research for which of the following reasons ?
(a) Type II enzymes cut the DNA at a specific site.
(b) Type II enzymes always cut the DNA to yield blunt-ended molecules.
(c) Type II enzymes always cut the DNA to yield sticky-ended molecules.
(d) Type II enzymes are the only restriction enzymes to cleave double-stranded DNA.

37. The proteome of a cell is defined as :
(a) All of the proteins that a cell is capable of synthesizing.
(b) All of the proteins present in a cell over the cell's lifetime.
(c) All of the proteins present in a cell at a given moment.
(d) All of the proteins that are actively being synthesized in a cell at a given moment.

38. Which one of the following is the proofreading steps in protein synthesis that allows the correct incorporation of amino acid during the polypeptide chain formation?
(a) Binding of IF2 with f-met-tRNA
(b) specificity of aminoacyly-tRNA synthase enzyme for each amino acid
(c) IF3 factor prevent the incorrect base pairing
(d) IF1 occupied at the A-site, preventing incorrect binding of amino-acids

39. Pulse-chase analysis is a method in molecular biology used to examine a cellular process occurring over time by successively exposing the cells to a labeled compound (pulse) and then to the same compound in an unlabeled form (chase). A scientist is interested to study DNA replication by Pulse-Chase experiment. Choose the correct radioisotope and nitrogenous base that can be used for the study.
(a) ^{32}P, Thymine (b) ^{35}S , Uracil (c) ^{3}H, Thymine (d) ^{2}H, Uracil

40. A polyribosome (or polysome) is a complex structureof an mRNA molecule and two or more ribosomes that act to translate mRNA instructions into polypeptides simultaneously in the cytoplasm. Which of the given statements are CORRECT for polysome?
(a) The length of the newly synthesize polypeptide chain will be longest for the ribosomes at the 3' end of the mRNA
(b) The length of the newly synthesize polypeptide chain will be longest for the ribosomes at the 5' end of the mRNA
(c) All the ribosome attached will have equal length of the newly synthesize polypeptide chain
(d) The length of the newly synthesize polypeptide chain is independent to the position of ribosome along the mRNA.

41. The time required to kill 90% of the micro-organisms or spores in a sample under specific conditions is called
(a) F value (b) Z value (c) K value (d) D value

42. What does HEPA filter stand for?
(a) Heavy electron particle assay (b) High energy pressurized air
(c) High efficiency particulate air (d) High efficiency pressure air

43. Which of the following is not a CAM plant ?
(a) Cacti (b) Euphorbia
(c) Agave (d) Sorghum

44. Which organelle does not participate in the glycolate pathway ?
(a) Chloroplast (b) Lysosomes
(c) Peroxisomes (d) mitochondria

45. What is the correct order for the following events in the interaction of a cell with a signal?
1. Alteration of cell function.
2. Signal binds to receptor.
3. Signal released from source.
4. Signal transduction.
(a) 1, 2, 3, 4 (b) 2, 3, 1, 4 (c) 3, 2, 1, 4 (d) 3, 2, 4, 1

46. Which of the following statements relating to microtubules is **NOT** correct?
(a) The plus-end of microtubule is the fast-growing end
(b) Addition of short fragments of microtubules enhances polymerization
(c) A microtubule with GDP-cap enters the shrinkage phase (catastrophe)
(d) Critical concentration for polymerization is same for both plus-and minus-ends

47. Which of the following statements is true with respect to the influenza virus?
(a) Hemagglutinin present in the virus envelope is involved in attachment of the virus to sialic acid residues of the host cell surface
(b) Hemagglutinin present in the virus envelope is involved in the attachment of the virus to N-acetylglucosamine residues of the host cell surface
(c) Hemagglutinin proteins form tetramers that project out from viral surface
(d) Hemagglutinin is not a glycoprotein

48. Which one of the following causes pneumonia?
(a) *Helicobacter pylori* (b) *Hemophilus influenzae*
(c) *Vibrio fisheri* (d) *Naegleria fowleri*

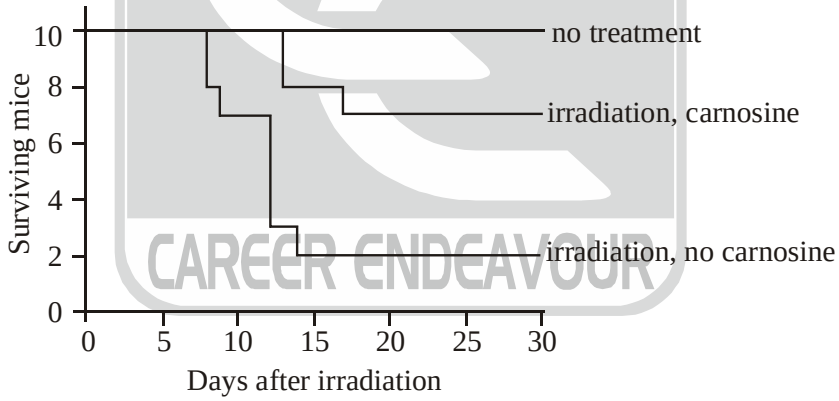
49. A culture of *Mycobacterium leprae* was subjected to alkaline ethanol extraction prior to acid fast staining. The colour of the culture following staining will be
(a) Red (b) Green (c) Yellow (d) Blue

50. A DNA sequencing reaction was performed with the fragment 5'-XXXXGCGATCGYYYY-3' as the template, dideoxy GTP, all the four dNTPs, and the required primers and enzyme. XXXX and YYYY in the given DNA fragment represent primer binding sites. The set of fragments obtained during the reaction will be (the primers are not shown in the amplified fragments).
(a) 5'-CGATCGC-3' only
(b) 5'-CG-3', 5'-CGCTAG-3', 5'-CGCTAGC-3'
(c) 5'-CG-3', 5'-CGATCG-3', 5'-CGATCGC-3'
(d) 5'-G-3', 5'-GCG-3', 5'-GCGATCG-3'

PART-C

51. Electrophoresis of a purified protein 'X' in the presence of SDS & 2-mercaptoethanol, shows a single band of 45kDa. In gel filtration column chromatography, protein X elutes between alcohol dehydrogenase (160 kDa) and beta-amylase (190 kDa). How many identical subunits of protein X composed of
(a) one (b) two (c) three (d) four

52. In an experiment on survival rate of mice after irradiation, the following pattern was observed :



The control group, which was not irradiated 100% survival rate was observed, without carnosine shown significant death rate and the group which was irradiated with carnosine shown reduced no. of deaths due to irradiation. Which of the following is true for carnosine.
(a) Carnosine is a dipeptide synthesized by P-alanine & Histidine found in high conc. in skeletal muscles reacts with hylroxyl radicals and reduce the cellular damage by hydroxyl radicals.
(b) Carnosine is tripeptide produced by P-alanine, Histidine and arginine found in high conc. In brain reacts with oxygen free radicals and reduce the cellular damage by oxygen for reduced
(c) Carnosine is a tripeptide produced by P-alanine, 2-Histidine and 1 arginine found in high concentration in both skeletal muscles and brain reacts with hydroxyl radicals and reduce the cellular damage by hydroxyl radicals
(d) Carnosine is dipeptide produced by P-alanine and Histidine found in high conc. in skeletal muscles reacts with oxygen free radicals and reduce the cellular damage by oxygen free radicals

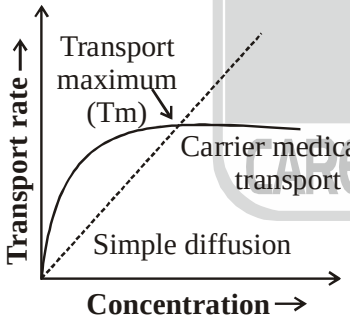
53. You set up a cross between true-breeding wild type male fruit flies and true-breeding female flies with yellow body colour. You notice in the F_1 generation that half the flies, specifically all the males have yellow body colour while the females are wild type (gray). Which of the following explanations would be most likely?
(a) some of your females had already mated with yellow males before you collected them
(b) some of your parental flies must have had a new mutation in their germ cells
(c) the mutations which causes yellow body colour is on X-chromosome
(d) the mutation which causes yellow body colour is on Y-chromosome

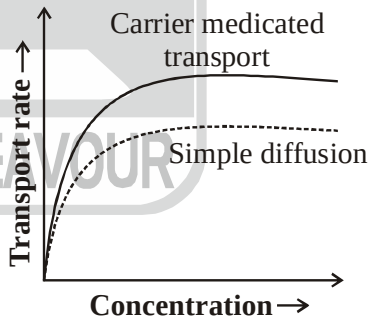
54. Not considering the crossing over, what gamete is not possible from the following diploid individual? Listed are the alleles of five genes, members of homologous are separated by a comma.
chromosome 1 : ABC, abc
chromosome 2 : Qr, qr
(a) ABCqr (b) Abcqr (c) ABCQr (d) abcQr

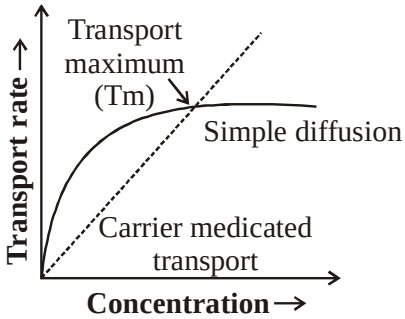
55. You begin to study a novel plant species and discover that this diploid plant has 16 chromosome. How many linkage groups would you expect to find
(a) 16 (b) 8 (c) 4
(d) It is impossible to tell from the information provided

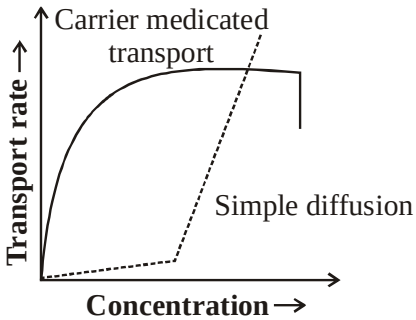
56. An unaffected woman (i.e. without disease symptoms) who is heterozygous for the X-linked allele causing Duchenne Muscular Dystrophy has children with a normal man. What are probabilities of the following combination of offsprings? An affected son (*l*); an affected son or daughter (*m*); a family of 3 children all of whom are affected (*n*).
(a) (*l*)-1/4; (*m*)-1/2; (*n*)-3/8 (b) (*l*)-1/4; (*m*)-3/2; (*n*)-3/64
(c) (*l*)-1/2; (*m*)-1/2; (*n*)-1/64 (d) (*l*)-1/2; (*m*)-3/4; (*n*)-3/64

57. Which of the following graph is correctly representing the property of carrier mediated transport and simple diffusion.

(a)


(b)


(c)


(d)


58. A researcher is studying sub-cellular localization of a particular protein X in an animal cell. The researcher performs successive centrifugation at increasing rotor speed. The researcher starts spinning the cellular homogenate at 600g for 10 min, collects the pellet. Spins the supernatant at 10,000g for 20 min. Collects the pellets, spins the supernatant at 100000g for 1hr, collects both the pellet and the final supernatant. On subjecting various pellets and the final supernatent to western blotting with anti-protein-X antibody, the protein X is observed to be maximally expressed in pellet after centrifugation at 10,000g. Based on the above observation, what will be the most likely localization of protein X.

(a) Nucleus (b) Ribosomes
(c) Mitochondria (d) Peroxisomes

59. Choose the correct statement/s from the following.

(a) In O-linked glycosylation, sugars are attached to the protein via O-glycosidic bonds to the carboxyl groups of Ser and Thr.
(b) In O-linked glycosylation, oligo-saccharides are attached to the relevant protein.
(c) In O-linked glycosylation, N-acetyl-galactosamine is added via O-glycosidic bonds to the OH groups of Ser and Thr after which other sugars are added sequentially.
(d) Both b and c.

60. Membrane proteins are synthesized on endoplasmic reticulum and transported to various organelle membranes. One hypothesis for membrane protein sorting is hyrophobicity matching i.e., the proteins with a shorter transmembrane portion into thinner membranes. You are given the following three observation.

A. It was found that transmembrane portions of proteins in Golgi membranes are shorter than those in plasma membranes.
B. Presence of cholesterol increases the thickness of the bilayer.
C. The phospholipid composition of Golgi and plasma membranes are same.

Which one of the following statements is correct ?

(a) Proteins in plasma membrane have longer transembrane portion than proteins in Golgi membranes.
(b) Proteins in Golgi membranes have longer transmembrane portion than proteins in plasma membranes.
(c) Proteins of both Golgi and plasma membranes have same length of transmembrane portion.
(d) Cholesterol is more in Golgi membrane than in plasma membrane.

61. Cell division cycle is divided into 4 phase G1, S, G2 & M. Standard eukaryotic cell cycles are of 18-24 hrs duration. Early embryonic cell cycles are extremely rapid having time duration of less than an hour. Which of the following phases are drastically reduced in embryonic cell cycles.

1. G1 2. G2 3. S 4. M

(a) G1 or G2 (b) G1 and S (c) G1 and G2 (d) G2 and S

62. The Rb protein is target for certain cancer viruses. For example, human papillomavirus (HPV) - the virus responsible for uterine cervical cancer contains an oncogene that produces a protein called E7 protein. This protein –

1. Binds to the Rb protein of infected cells & prevents it from restraining cell proliferation.
2. Overactivates Rb protein.
3. Ubiquitinates the Rb protein & send it for proteasomal degradation.
4. provides a signal sequence to Rb protein, so that it can change its normal function.

(a) 1 or 4 (b) only 4 (c) only 1 (d) only 2 and 3

63. Both G_s and G_i are targets for some medically important bacterial toxins. Cholera toxin, which is produced by the bacterium that causes cholera & pertussis toxin which is made by the bacterium that cuases pertussis (whooping cough).

Choose the correct about cholera toxin & pertussis toxin.

1. Chloera toxin is an enzyme that catalyzes the transfer of ADP ribose from intracellular NAD^+ to the β subunit of G_s.
2. Cholera toxin is an enzyme that catalyzes the transfer of ADP ribose from intracellular NAD^+ to the α subunit of G_s.
3. Pertussis toxin catalyzes the ADP ribosylation of α subunits of G_i, preventing the subunit from interacting with receptors.
4. Pertussis toxin catalyzes the ADP ribosylation of α subunit of G_s, preventing the subunit from interacting with receptors.

(a) 1 and 3 (b) 1 and 4 (c) 2 and 3 (d) 2 and 4

64. The term proto-oncogenes simply implies that if and when the structure or activity of a proto-oncogene is disrupted by certain kinds of mutations, the mutant form of the gene can cause cancer. The mutations that convert proto-oncogene into oncogenes are created through several distinct mechanisms. Choose that several distinct mechanisms.

1. Point mutation.
2. Gene amplification.
3. Chromosomal translocations.
4. Local DNA rearrangements.
5. Insertional mutagenesis.

(a) 1, 2, 4 and 5 (b) 1, 3, 4, 5 (c) all (d) 2, 3, 5

65. Fetal thymic organ culture (FTOC) has been used to study the development of T-cells, in-vitro. In this, mouse thymic lobes are excised at a gestational age of day 16 and placed in culture. In one such experiment, FTOC has been initiated from TAP-1 knock out mice. The cells were divided into 2 groups, X and Y.

X = TAP-1 knock out FTOC was set up.

Y = TAP-1 knock out FTOC was supplemented with exogenous peptides.

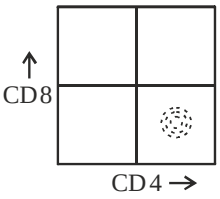
Which among the following is a possible outcome w.r.t. X and Y?

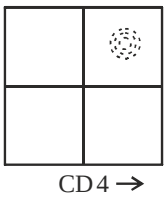
(a) No development of CD8 T-cells in X and Y
(b) Low levels of inflammatory reaction in Y but not in X
(c) Resumption of CD8 T-cells development in Y
(d) Large amount of IL-2 and IFN-γ produced in Y

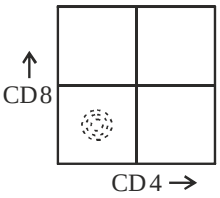
66. A researcher has isolated cells from spleen of RAG-1 knock out mice. Now, he wishes to identify CD4 and CD8 T-cells in the isolated cells.

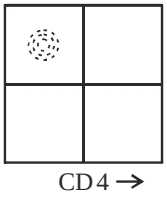
So, he has stained CD4 T-cells using APC anti-CD4 mab and CD8 T-cells using PerCP anti-CD8 mab. Now, he perform a flow cytometry experiment to study the relative population of CD4 and CD8 T-cells.

Likely FACS plot among following

(a) 

(b) 

(c) 

(d) 

67. Cyclosporin and FK506 are powerful immuno-suppressive drugs. They are given to transplant recipients to suppress T-cell mediated transplant rejection. These drugs act by
(a) Blocking complex formation between calcineurin and Ca^{2+} / calmodulin
(b) Blocking formation of DAG and IP_3
(c) Blocking the action of ZAP-70
(d) Blocking ITAM motif in CD3

68. $CD4^+$ $CD25^+$ sub-population of CD4 T-cells acts to negatively regulate immune response. In an experimental modulation, it was proposed to increase the suppressive activity of these cells. This increased activity could be used for
(a) Increasing response to traditional vaccines
(b) Increasing immunity to cancer antigens
(c) Treatment of autoimmune disorders
(d) Treatment of HIV infection

69. Given below is a comparison of primary and secondary antibody responses w.r.t. some properties. Find inappropriate comparison.

	Property	**1º response**	**2º response**
(a)	Lag period	4-7 days	1-3 days
(b)	Antigen type	Thymus dependent & thymus independent	Thymus dependent & thymus independent
(c)	Ab affinity	Lower	Higher
(d)	Isotype produced	IgM major	IgG major

70. Germinal centres are very important during proper induction of humoral responses. Given below are some statements about germinal centre
(P) It has 2 zones, dark and light
(Q) Dark zone contains tingible body macrophages
(R) Selection for affinity maturation takes place in dark zone
(S) Development of plasma cells takes place in light zone
Combination of correct statements are
(a) P, Q (b) Q, R (c) R, S (d) P, S

71. If the nerve supply to a newt limb is severed before amputation, how will this affect regeneration?
(a) It will have no effect, since regeneration involves growth of new muscle, bone, and connective tissue.
(b) Regeneration of most tissues will occur normally, but regeneration of the nerves will not occur.
(c) Outgrowth will occur, but the identity of the limb will be lost and normal proximo-distal patterning will not occur.
(d) A blastema will form but will not grow, and regeneration will fail.

72. Is regeneration in Hydra similar to regeneration in vertebrates, or is it fundamentally different in some way?
(a) Regeneration in Hydra occurs through a repatterning of existing cells by morphallaxis, unlike regeneration in vertebrates, which occurs through epimorphosis.
(b) Regeneration in Hydra occurs through the reinitiation of cell division in existing cells, followed by repatterning of those cells, very much like regeneration in vertebrates.
(c) Regeneration in Hydra occurs through the reinitiation of cell division in existing cells, followed by repatterning of those cells, which is totally different from regeneration in vertebrates.
(d) Regeneration in Hydra occurs through the reinitiation of cell division in existing cells, followed by repatterning of those cells, whereas regeneration in vertebrates occurs through a process of repatterning of existing cells.

73. What statement is correct when comparing morphallaxis and epimorphosis?
(a) Epimorphosis: a new boundary is established at the cut and the positional values are changed
(b) In epimorphosis, regeneration occurs by repatterning of existing tissue
(c) Regeneration of amphibian limbs involves epimorphosis
(d) In planarians, only morphallaxis is involved in regeneration

74. Disease, injuries, and birth defects that compromise the function of the pituitary may lead to decreased stature (height). What treatment might be prescribed, and what would be its rationale?
(a) Since the pituitary is damaged or missing, the only possible treatment would be the transplantation of a donor pituitary.
(b) Loss of pituitary function could lead to decreased growth hormone production, and hence short stature; recombinant human growth hormone might be prescribed.
(c) Since the pituitary is responsible for secretion of luteinizing hormone and follicle stimulating hormone, both of which are required for normal fertility, replacement therapy with these hormones may be prescribed for fertility problems, but no therapy would be possible for the short stature.
(d) Since growth hormone controls growth hormone releasing hormone and somatostatin production in the hypothalamus, its absence would be compensated for by administration of those hormones.

75. After eating a monarch butterfly and regurgitating, a bird will subsequently avoid orange and black butterflies. This is not an example of
(a) trial-and-error learning. (b) associative learning.
(c) innate behavior. (d) operant conditioning.

76. In which of the following food chains, the Pyramid of Numbers will be always inverted?
(a) Grassland Food chain (b) Ponds Food chain
(c) Forests Food (d) Parasitic food chain

77. Which among the following city was declared as "Tiger Gateway of India"?
(a) Bhopal (b) Nagpur (c) Mysore (d) Lucknow

78. In cooperatively breeding species, a single dominant female breeds while other subordinate adult females in the group rarely breed. Which of the following statements below are PROXIMATE explanations for this phenomenon?
P) When resources are limited, and competition for reproduction is strong, females evolve costly traits to monopolize reproduction
Q) Intense aggression by the dominant female towards subordinate females results in chronic stress, elevated stress hormone levels, and lowered rates of conception in subordinates
R) When dispersal is costly, natural selection favours delayed dispersal of the young who instead help rear siblings, in return for continued residence on their natal territory
S) Pregnant subordinate females are evicted from the group by the dominant female, and harsh conditions outside the group result in loss of body condition and increased risk of abortions
(a) P and Q (b) P and R (c) Q and S (d) Q and R

79. In male tribolium of a certain genus, size of antennae and sensitivity to female pheromone are under the influence of sexual selection. Species X and Species Y of beetles within this genus occur together in the same geographical location. Species X naturally occurs in dense populations while Species Y naturally occurs in sparse populations. All else being equal, which of the following is most likely to be correct?
(a) Males of Species X have larger antennae and are more sensitive to female pheromone
(b) Males of Species Y have smaller antennae and are less sensitive to female pheromone
(c) Males of Species X have smaller antennae and are less sensitive to female pheromone
(d) Males of Species Y have larger antennae and are less sensitive to female pheromone

80. Animal of temperate region have wider tolerance ranges for temperature than do tropical organisms. If in a scenario temperatures increase across the globe by 3°C, which of the following is possible?
(a) Temperate organisms will be more negatively affected than tropical organisms
(b) Tropical organisms will be more negatively affected than temperate organisms
(c) The effects on tropical and temperate organisms will be the same
(d) This will have no effect on temperate or tropical organisms

81. You are given a plasmid containing part of a gene of *D. melanogaster*. The gene fragment is 303 base pairs long. You would like to amplify it using the polymerase chain reaction (PCR). You design oligonucleotide primers 19 nucleotides in length that are complementary to the plasmid sequences immediately adjacent to both ends of the cloning site. What would be the exact size of the resulting PCR product ?

(a) a = 303 bps (b) b = 322 bps (c) c = 343 bps (d) d = 341 bps

82. The restriction enzyme HindIII cuts DNA at the sequence AAGCTT, and the restriction enzyme HpaII cuts DNA at the sequence CCGG. On average, how frequently will each enzyme cut double stranded DNA (what is the average spacing between restriction sites).

(a) For HindIII, approx 4Kb and for HpaII, approx 2.5 Kb

(b) For HindIII, approx 0.4Kb and for HpaII, approx 0.25 Kb

(c) For HindIII, approx 40Kb and for HpaII, approx 25 Kb

(d) For HindIII, approx 4Kb and for HpaII, approx 0.25 Kb

83. The first step of protein translation is aminoacylation reaction that is covalently linking an amino acid to its cognate tRNA by enzymes, Aminoacyl-tRNAsynthetases. Aminoacyl-tRNAsynthetase is specific for each of the standard 20 amino acids found in all cells. But someprokaryotic organism lacks the enzyme glutaminyl-tRNAsynthetase that is responsible for charging glutamine (Gln) amino acid to the tRNAGln, however glutamine residue are found in many of the bacterial proteins.

Which of the given statements are TRUE about the charging and addition of glutamine in the newly synthesized proteins for such organisms.

A. aminocayl-tRNA synthase for the glutamate (Glu) are used to charged glutamine amino acid to tRNAGlutamine (tRNAGln).

B. aminocayl-tRNA synthase for the glutamate are used to charged glutamate to tRNAGlutamine (tRNAGln).

C. Glutamate is inserted by aminocayl-tRNA synthase for the glutamate and later it is converted to glutamine after translation.

D. The glutamate-tRNAGln is converted to glutamine-tRNAGln first and later inserted to the new protein chain during translation.

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

84. Shine-Dalgarno sequence in the 5' leader regions binds the Ribosome to initiate the protein synthesis in prokaryotic system. A Tryptophan operon (trp operon) mutation was constructed at the Shine-Dalgarno regions so that it deactivates the protein synthesis of the transcripts.

Which of the following is TRUE for the expression of Tryptophan synthesis enzyme?

A) Synthesis of Tryptophan synthase enzyme maximum at low level of tryptophan in the medium.

B) At high level of tryptophan region 2 of trpL paired to the region 3 of trpL, forming an anti-terminator structure.

C) At high level of tryptophan region 1 paired to 2, region 3 paired to region 4 of trpLforming a terminator structure.

D) No ribosome stalled at region 1 of trpL at low level of tryptophan, transcription attenuation at trpL.

E) Transcription attenuation at low level of tryptophan but no Tryptophan synthase enzyme.

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

85. Bacteriophage lamda (λ), a temperate phage has two modes of life cycle, lytic and lysogenic. During the lysogenic cycle, the expression of the phage genes, replication genes, heads genes, tail genes, lysis genes are suppressed. The two regulatory genes CI and CRO repressor switch ON and OFF to regulate the lytic and lysogenic cycle.

The following are statements of gene regulation in lamda phage.

A) CI protein is repressor for Cro and activator for CI itself.

B) The expression of CI is dependent on the CII and CIII

C) Expression of CI is associated to lytic cycle in phage lamda.

D) Mutation in CI is associated to the formation of clear plaque in E.coli (λ +) lysogen.

E) CII stimulates expression of CI from P_{RM} Promoter and maintain lysogenic life cycle in lamda phage.

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

86. Capping of 7-methylguanosine residue at the 5' end of the pre mRNA transcripts is characteristic features of eukaryotic mRNA. Which of the following statements are CORRECT about the 5' capping in eukaryotes?

A) During the capping the ã-phosphate are released from the 5' end of the nascent RNA.

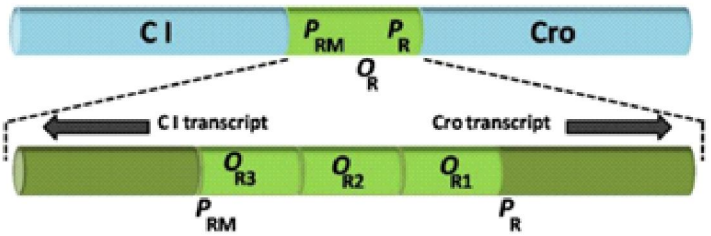
B) During the capping process an unusual 5'-5' phosphate linkage is formed between the â-phosphate of the nascent RNA and á-phosphate of the GTP

C) 5' capping happens after the completion of transcription.

D) 5' cap protects the mRNA from the 5'-exoribonuclease enzyme.

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

87. Gene switch in Bacteriophage lamda (ë), a temperate phage is important for the phage to maintain two modes of life cycle, lytic and lysogenic. The two regulatory genes CI and CRO switch ON and OFF to regulate the lytic and lysogenic cycle in phage. CI is transcribed from promoter P_{RM} and CRO from the P_R promoter as leftward and rightward transcripts in opposite direction, having common regulator region, OR1, OR2, OR3.



Which of the statements are NOT TRUE for the phage to enter a lytic cycle?

A. Constitutive expression of CRO due to mutation at OR1 and OR2.

B. A mutation in the P_{RM} promoter that inhibits the expression of CI.

C. A mutation in the PR promoter that inhibits the expression of CRO

D. Binding of CRO to OR1 and OR2 abolished lysogenic genes.

E. Binding of CI at OR1 and OR2 activates lytic genes.

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

88. Which among the following statements are correct regarding facultative anaerobes and aerotolerant anaerobes?

(a) Both grows equally well in presence as well as absence of O_2

(b) Facultative anaerobes grows better in presence of O_2, whereas aerotolerant anaerobes grows equally well in presence and absence of O_2

(c) Aerotolerant anaerobes grows better in presence of O_2, whereas facultative anaerobes grows equally well in presence and absence of O_2

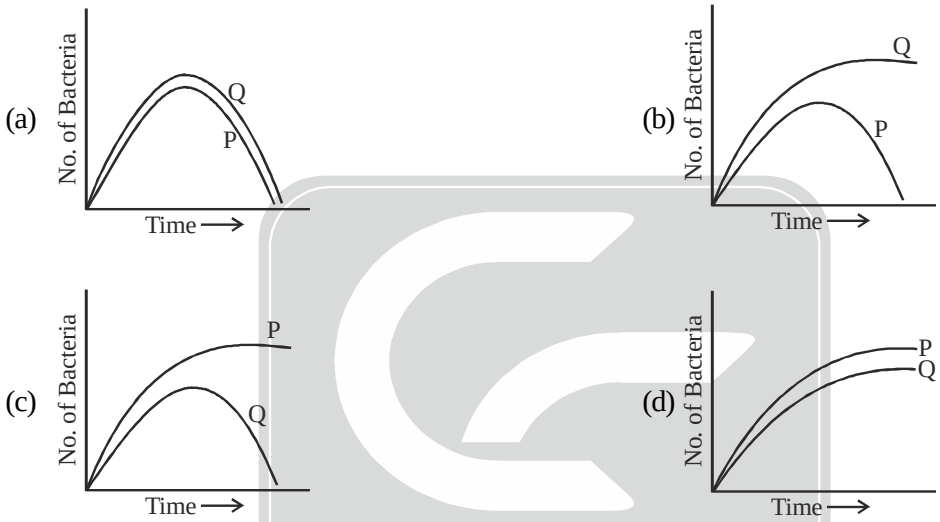
(d) Both facultative anaerobes and aerotolerant anaerobes grows better in absence of O_2 but can tolerate O_2

89. Choose the correct method you would use to sterilize the following objects

(i) Inoculation loop	p) UV radiation
(ii) Antibiotics	q) Gamma radiation
(iii) Beef	r) Incineration
(iv) Drinking water	s) Filtration

(a) (i)-(q), (ii)-(p), (iii)-(r), (iv)-(s) (b) (i)-(r), (ii)-(s), (iii)-(p), (iv)-(q)
(c) (i)-(p), (ii)-(q), (iii)-(r), (iv)-(s) (d) (i)-(r), (ii)-(s), (iii)-(q), (iv)-(p)

90. Choose the correct graph representing bacterial growth condition in presence of
P → Virulent phage
Q → Temperate phage



91. Which of the following statements are true for secondary metabolites ?
A. They are not necessary for growth or development of plants.
B. Substances such as amino acids, nucleotides, sugars, lipids are called secondary metabolites.
C. They act as attractants for pollinators or seed-dispersals.
D. They protect the plants against herbivores.
(a) A and B (b) A, B, C (c) B, C, D (d) A, C, D

92. Match the plant hormones with their physiological functions.

A. Abscisic acid	(i) Shortening of juvenile period
B. Ethylene	(ii) Delayed senescence
C. Cytokinin	(iii) Initiation of leaf abscission
D. Gibberellin	(iv) Delayed seed germination

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

93. Fill the following table using suitable options.

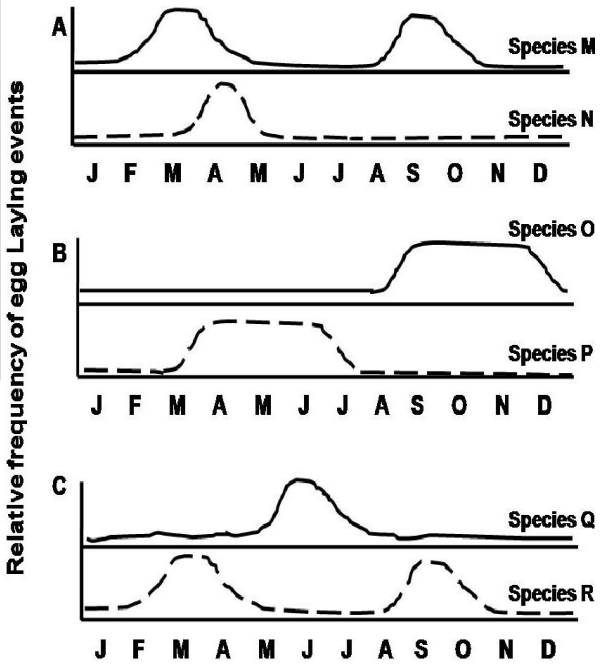
	C_3 Plants	C_4 Plants	CAM Plants
Kranz anatomy	Not present	Present	(A)
Initial CO_2 acceptor	RuBP	(B)	Phosphoenol pyruvate
Ist stable product	(C)	(D)	(E)

(a) A-Not present, B-Phosphoenol pyruvate, C-3-Phosphoglyceric acid, D-Malate, E-Oxaloacetate
(b) A-Present, B-Phosphoenol pyruvate, C- Oxaloacetate, D-3-Phosphoglyceric acid, E-3-Phosphoglyceric acid
(c) A-Not present, B-Phosphoenol pyruvate, C-3-Phosphoglyceric acid, D- Oxaloacetate, E-Oxaloacetate
(d) A-Present, B-Ribulose bisphosphate, C-3-Phosphoglyceric acid, D- Oxaloacetate, E-3-Phosphoglyceric acid

94. A $lac^{+}tet-r$ plasmid is cleaved in the *lac* gene with a restriction enzyme. The enzyme cleaves at four-base restriction sites and produces fragments with a two-base single-stranded overhang. The cutting site in the *lac* gene is in the codon for the second amino acid in the chain, a site that can tolerate any amino acid without loss of function. After cleavage, the single-stranded ends are converted into blunt ends with DNA polymerase I, and then the ends are joined by blunt-end ligation to recreate a circle. A $lac^{-}tet-s$ bacterial strain is transformed with the DNA, and tetracycline-resistant bacteria are selected. What is the Lac phenotype of the colonies ?

(a) 50% lac^{-} and 50% lac^{+}
(b) All colonies should be lac^{-}
(c) All colonies should be lac^{+}
(d) 50% lac^{+} and 50% lac^{-}

95. Temporal isolation in breeding seasons between closely related species leads to reproductive isolation. Given below are breeding seasons of different species of frogs.



Which of the above plots represents temporal isolation in breeding seasons among closely related sympatric species?

(a) Plot A
(b) Plots A and B
(c) Plots B and C
(d) Plots A and C

96. The mean (μ) and standard deviation (σ) of body size in a Drosophila population are 8.5 and 2.2 mm, respectively. Under natural selection over many generations the μ and σ of body size change to 8.5 and 0.8 mm, respectively. The type of natural selection responsible for the change is called

(a) directional.
(b) neutral.
(c) disruptive.
(d) stabilizing.

97. In pre-industrial period in England, peppered moths had light coloration which effectively camouflaged them against light coloured trees and lichens. During industrial revolution, many lichens died out and trees became blackened by soot from factories and interestingly, dark coloured moths were predominantly seen. This happened due to

(a) natural selection of dark coloured moths which were initially present in fewer numbers.
(b) new mutation which arose due to environmental pollution.
(c) macroevolution occurring due to environmental change.
(d) natural selection of the camouflaging mechanism of the moths.

98. Choose the correct set of matches between **Groups I** and **II**.

Group I	**Group II**
P. Embryoid	1. An unorganized growth of plant cells in a culture medium
Q. Callus	2. A localized group of actively dividing cells from which permanent tissue systems such as root, shoot, leaf, and flower and derived
R. Meristem	3. A process whereby specialized, non-dividing cells begin to proliferate by mitotic division, presumed to involve regression to an undifferentiated state
S. Scutellum	4. Mass of cells which has an external morphology resembling a proombryo
	5. The embryonic cotyledon of monocot plants

(a) P-4, Q-2, R-3, S-5 (b) P-4, Q-1, R-2, S-5
(c) P-3, Q-4, R-2, S-1 (d) P-2, Q-1, R-3, S-4

99. Which of the following membranes have a proton-pumping ATPases?

BPM Bacterial plasma membrane
CIM Chloroplast inner membrane
TGM Trans-Golgi membrane
LM Lysosomal membrane
MIM Mitochondrial inner membrane
VM Vacuolar membrane

(a) BPM, CIM, MIM and VM (b) BPM, TGM, MIM and VM
(c) CIM, LM, MIM and VM (d) BPM, LM, MIM and VM

100. Which of the following statements pertaining to cell and tissue culture are CORRECT?

P. In a tissue culture incubator, increasing the partial pressure of CO_2 results in a decrease of the pH of the medium
Q. An inactive telomerase is required for a cell to achieve immortality
R. Antibiotics are added to the culture media to prevent microbial contamination
S. Hayflick limit refers to the number of cells that can grow in a culture flask
T. Serum proteins are required for the adhesion of cells to the surface of a solid substrate

(a) P, Q, S and T (b) P, Q and T
(c) P, R and T (d) Q, R and T

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[ANSWER KEY]

PART-A

1. (a)	**2.** (b)	**3.** (a)	**4.** (a)	**5.** (b)
6. (c)	**7.** (c)	**8.** (c)	**9.** (b)	**10.** (b)
11. (d)	**12.** (b)	**13.** (b)	**14.** (c)	**15.** (b)

PART-B

16. (a)	**17.** (b)	**18.** (d)	**19.** (c)	**20.** (c)
21. (c)	**22.** (d)	**23.** (c)	**24.** (a)	**25.** (b)
26. (c)	**27.** (c)	**28.** (b)	**29.** (d)	**30.** (c)
31. (a)	**32.** (c)	**33.** (d)	**34.** (a)	**35.** (a)
36. (b)	**37.** (c)	**38.** (b)	**39.** (c)	**40.** (a)
41. (d)	**42.** (c)	**43.** (d)	**44.** (b)	**45.** (d)
46. (d)	**47.** (a)	**48.** (b)	**49.** (d)	**50.** (b)

PART-C

51. (d)	**52.** (a)	**53.** (c)	**54.** (b)	**55.** (b)
56. (c)	**57.** (a)	**58.** (c)	**59.** (c)	**60.** (a)
61. (c)	**62.** (c)	**63.** (c)	**64.** (c)	**65.** (c)
66. (c)	**67.** (a)	**68.** (c)	**69.** (b)	**70.** (d)
71. (d)	**72.** (a)	**73.** (c)	**74.** (b)	**75.** (c)
76. (d)	**77.** (b)	**78.** (c)	**79.** (c)	**80.** (b)
81. (d)	**82.** (d)	**83.** (c)	**84.** (c)	**85.** (d)
86. (c)	**87.** (c)	**88.** (b)	**89.** (d)	**90.** (b)
91. (d)	**92.** (b)	**93.** (c)	**94.** (c)	**95.** (c)
96. (d)	**97.** (a)	**98.** (b)	**99.** (d)	**100.** (c)