TEST SERIES CSIR-NET/JRF JUNE 2019

BOOKLET SERIES D
Full Length Test – I

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

LIFE SCIENCES

Duration: 3:00 Hours **Date: 07-06-2019**

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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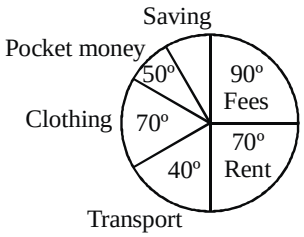
PART-A

1. Below given pie-chart shows the expenditure of Rahul in different fields. If his saving is 800,



then the Average expenditure on pocket money, transport and fees is what percentage of the total income ?

(a) $14\frac{2}{7}$ (b) $12\frac{1}{2}$ (c) $16\frac{2}{3}$ (d) 20 %

2. What should come in place of *x*?

0 6 24 60 *x*

(a) 90 (b) 120 (c) 100 (d) 96

3. In the afternoon Manu starts walking facing the Sun. After walking for 5 km he takes a right turn, and walks 6 km. After that he takes a left turn and walks for 3 km more and at this point he meets Mainak and the point of meeting is in which direction of the starting point ?

(a) 10 km, North-west (b) 14 km, North

(c) 10 km, North (d) 14 km, North-west

4. A is sister of B, C is father of B
E is D's father-in-law. C is the only son of E.
How is C related to D ?

(a) Son (b) Husband (c) Son-in-law (d) Brother-in-law

5. A, B, C, D, E, F, G, H are sitting in a circular table facing the centre, if C sits third to the left of A and D is second to the right of C. F is between A and E. B is third to the left of F. Two persons are sitting between B and H. Who sits second to the right of G ?

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

6. Two unbiased dice are thrown in random, what is the probability that he sum of the outcomes is eight ?

(a) 2/9 (b) 1/6 (c) 5/6 (d) 5/36

7. At what times past 4 pm the hours and minute hands of a clock would make a right angle ?

(a) $5\frac{5}{11}$ mins, $31\frac{2}{11}$ mins (b) $3\frac{2}{11}$ mins, $32\frac{2}{11}$ mins

(c) $4\frac{3}{11}$ mins, $33\frac{1}{11}$ mins (d) $5\frac{5}{11}$ mins, $38\frac{2}{11}$ mins

8. What is the unit digit of $(8522)^{162} - (529)^{102} - (153)^{401}$?

(a) 5 (b) 2 (c) 1 (d) 0

9. 2 men and 3 boys can do a work in 4 days. The same work is done by 3 men and 8 boys in 2 days. In how many days 2 boys and 1 man can do the work ?

(a) 8 (b) 10 (c) 6 (d) 7

10. If $x + \frac{1}{x} = 1$, then what is the value of $x^9 + \frac{1}{x^6} = ?$

(a) 1 (b) 2 (c) –1 (d) 0

11. If the radius ratio of two circular cylinders in ratio 1 : 2 and curved surface area is in the ratio 2 : 3, then what is the ratio of heights of the cylinders ?

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

12. CAT is coded as B1S, and MICE is coded as L3B2, then what will be the code for EDUCATION ?

(a) DCB5SZ3M (b) 2C5BZSH4M

(c) 2C5BZS34M (d) 2C5BZ3S4M

13. In a bottle there was pure syrup of 10 litre. Each time one litre is taken out and replaced by water for total of 3 times. What is the present ratio of syrup and water in the bottle.

(a) 5 : 2 (b) 100 : 81 (c) 1000 : 729 (d) 729 : 271

14. **Direction:** In the question below are 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: **Conclusions:**

(i) Some A are B (1) All B are C

(ii) All A are C (2) Some D are C

(iii) Some B are D (3) Some A are D

(a) Only (1) (b) Only (2) (c) All (d) None

15. In a exam there are 4 questions and every question has five different options. In how many ways a student can not give correct answer for all the questions.

(a) 624 (b) 19 (c) 625 (d) 99

PART-B

16. Shell coiling in Limnaea shows maternal effect in the progenies. Right-handed shell coiling is controlled by D and is dominant to left-handed coiling which is control by d. A cross between two Limnaea of the genotypes Dd female and dd male will always have progenies of the phenotypes

(a) All right handed (b) All left handed

(c) 50% right-handed and 50% left-handed (d) 75% right handed and 25 % left handed

17. In a disputed parentage case, the child is blood group O, while the mother is Blood group A. What blood type would exclude a male from being a father?

(a) Blood type AB and A (b) Blood type A and B

(c) Blood type A, B, O (d) Blood type AB only

18. A given meiotic process results in gametes of the type Normal (n), Trisomic (n+1) and monosomic (n-1). Which of the following phenomenon is TRUE for the meiotic process?

(a) non-disjunction at first division

(b) non-disjunction at second division

(c) non-disjunction at first division and second division both

(d) No non-disjunction but translocation of chromosome

19. When Hemoglobin is converted from the deoxy form to oxyhaemoglabin?
(a) It becomes more acidic and release protons. (b) Carbamino formation is promoted
(c) Binding of BPG is favored (d) Bound NO is transfered to glutathione

20. 10.0 ml of gastric juice obtained was titrated with 0.1 M NaOH to neutral and 7.2 ml of NaOH required. Calculate the pH of gastric juice?
(a) 2.3 (b) 3.1 (c) 1.1 (d) 1.8

21. The pH of blood of a healthy person is maintained at 7.401 ± 0.05. Assuming that this pH is maintained entirely by the bicarbonate buffer (pKa_1 and pKa_2 of carbon acid are 6.1 and 10.2 respectively. The molar ratio of [bicarbonate] [carbonic acid] in the blood is
[Given antilog 0.3 = 1.99, antilog 1.3 = 19.9]
(a) 0.05 (b) 2 (c) 10 (d) 20

22. Which statement about mitosis is not true?
(a) A single nucleus gives rise to two identical daughter nuclei.
(b) The daughter nuclei are genetically identical to the parent nucleus.
(c) The chromosomes separate at the onset of anaphase.
(d) Homologous chromosomes synapse in prophase.

23. The number of daughter chromosomes in a human cell (diploid number 46) in anaphase II of meiosis is
(a) 2 (b) 23 (c) 46 (d) 69

24. Plasmodesmata and gap junctions
(a) allow small molecules and ions to pass rapidly between cells.
(b) are both membrane-lined channels.
(c) are channels about 1 mm in diameter.
(d) are present only once per cell.

25. What takes place when a heterotrimeric G-protein is activated by a plasma membrane receptor ?
(a) The G protein is phosphorylated on a tyrosine residue
(b) The regulatory subunits dissociate
(c) A phosphate is removed from a tyrosine residue of the G protein by a protein phosphatase
(d) The α – subunit phosphorylates an intracellular signal transduction protein.

26. A family has a genetic defect in the G proteins that interact with adenylyl cyclase. The action of which of the following hormones would be directly affected ?
(a) Thyroxine (b) Cortisol (c) Insulin (d) Epinephrine

27. You have been culturing a special line of irreplaceable cells for over a month. Your laboratory technician accidentally treats them with trypsin. You have been planning receptor studies on the cells. Which of the following hormone receptors could you still study ?
(a) Insulin (b) Parathyroid hormone
(c) Cortisol (d) Glucagon

28. During tissue damage, liver produces many acute phase proteins. C-reactive protein is most common among them. It acts by
(a) Activating complement system directly
(b) Initiating pore formation in pathogen membrane
(c) Increases cytotoxic activity of NK cells
(d) Binding to C-polysaccharide found in cell wall of bacteria and fungi

29. Which among the following is NOT produced or released by activated macrophages?
(a) IFN-α (b) Defensins (c) IFN-γ (d) TNF-α

30. M-cells
    (a) found in respiratory epithelium for gaseous exchange control
    (b) found in inductive sites in mucosal epithelium for antigen transport
    (c) found in eyes for activating lacrimal glands
    (d) found in nasal epithelium for detection of odor

31. During embryogenesis, the separation of cells into the three individual germ layers first occurs during which of the following?
    (a) Neurulation (b) Organogenesis (c) Cleavage (d) Gastrulation

32. What is the name of the structure that forms during development when the embryo becomes a fluid-filled ball?
    (a) Neurula (b) Blastocyst (c) Morula (d) Gastrula

33. Which of the following defines the process by which the entry of one sperm into an oocyte prevents other sperms from fertilizing the same egg?
    (a) Differentiation (b) The cortical reaction
    (c) The induction reaction (d) Determination

34. The pattern of dispersion for a certain species of sea weed is clumped. The pattern of dispersion for a certain species of snail that lives only on this sea weed would likely be
    (a) clumped (b) demographic (c) random (d) uniform

35. Which of the following would be most likely to exhibit uniform dispersion?
    (a) cattails, which grow primarily at edges of lakes and streams
    (b) dwarf mistletoes, which parasitize particular species of forest trees
    (c) lake trout, which seek out deep water
    (d) red squirrels, which hide food and actively defend territories

36. Resource partitioning is best described by which of the following statements?
    (a) A climax community is reached when no new niches are available.
    (b) Slight variations in niche allow similar species to coexist.
    (c) Two species can co-evolve and share the same niche.
    (d) Competitive exclusion results in the success of the superior species.

37. In the selection of colonies of bacteria that carry cloned DNA in plasmids, such as pBR322, and that contain two antibiotic resistance genes :
    (a) one antibiotic resistance gene is nonfunctional in the desired bacterial colonies.
    (b) untransformed bacteria are antibiotic resistant.
    (c) both antibiotic resistance genes are functional in the desired bacterial colonies.
    (d) radiolabeled DNA or RNA probes play a role.

38. PCR is advantageous to gene cloning for all of the following reasons except :
    (a) PCR does not require that the sequence of the gene be known.
    (b) PCR is a very rapid technique for the isolation of a gene.
    (c) PCR requires very small amounts of starting DNA compared to gene cloning.
    (d) PCR is very useful for mapping DNA markers.

39. The diploid genome of a species comprises 8.6 X 10^9bp and fits into a nucleus that is 6 pm in diameter. If base pairs occur at intervals of 0.34 nm along the DNA helix, what is the total length of DNA in a resting cell?
    (a) 2.0 m (b) 5 m (c) 2.9 m (d) 1.5 m

40. A relaxed circular chromosome has right handed double helix DNA with helix turn 60. To pack the DNA into a bacteria cytosol the DNA is supercoiled positively. Given are the statements about the circular DNA. Which of the following statements are true about the DNA?

A) The topology of the DNA will be changed.

B) Linking number of the DNA will change.

C) An enzyme topoisomerase cleaved the sugar phosphate backbone and is sealed immediately the topology of the DNA will remains same.

D) Linking number of the DNA remain same but twist of the DNA will be changed.

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

41. DNA ligase is commonly found in both eukaryotes and prokaryotes, Which reaction in DNA replication is catalysed by DNA ligase?

(a) Addition of new nucleotides to the lagging strand.

(b) Addition of new nucleotides to the leading strand

(c) Base pairing of the template and the newly formed DNA strand.

(d) Formation of a phosphodiester bond between the 3'-OH of one Okazaki fragment and the 5'-phosphate of the next on the lagging strand.

42. The sterol like molecules present in bacterial membrane are

(a) Flavinoids (b) Teichoic acids

(c) Hopanoids (d) Steroids

43. Plasmid curing is

(a) Loss of a plasmid (b) Division of a plasmid

(c) Gain of a plasmid (d) Transfer of a plasmid

44. Which of the following is not natural auxin ?

(a) Indole-3-acetic acid (b) 4-chloroindole-3-acetic acid

(c) 2-methoxy-3, 6-dicholorobenzoic acid (d) Indole-3-butyric acid

45. Which of the following statements is not true ?

(a) Translocation of photosynthates occurs in the form of sucrose

(b) Translocation of photosynthates occurs in the form of both sucrose and starch

(c) The site of sucrose synthesis is the cytosol

(d) The site of starch synthesis is the chloroplast

46. Resolution of a light microscope depends on wavelength of light (λ), refractive index (n) and the half-angle (θ) by which light enters into the microscope. Which of the following would be the best choice for the user?

(a) $\lambda = 420$nm; $\theta = 90^o$; medium - air (b) $\lambda = 405$nm; $\theta = 45^o$; medium - air

(c) $\lambda = 420$nm; $\theta = 90^o$; medium - oil (d) $\lambda = 405$nm; $\theta = 90^o$; medium - oil

47. Which one of the following protozoan parasites belongs to the phylum *Apicomplexa?*

(a) *Toxoplasma gondii* (b) *Leishmania donovani*

(c) *Entamoeba histolytica* (d) *Trichomonas vaginalis*

48. Which of the following feature(s) should be present in a protein to generate strong immune response (antibody production) in an animal?

I. At least one B-cell epitope II. At least one T-cell epitope

III. Proteolytic cleavage site(s)

(a) I only (b) II and III

(c) I and III (d) I. II and III

49. The natural geographical distribution of kangaroos is limited to the Australian continent because
(a) abiotic factors determine the distribution
(b) dispersal is limited by accessibility to other continents
(c) kangaroos have not selected habitats in other continents
(d) predators limit the distribution in other continents

50. Which of the following is NOT an example of an adaptive defense mechanism against predation ?
(a) Bright colors of bird pollinated flower (b) Insect that resembles a stick
(c) Nicotine in the tobacco plant (d) Spines on porcupine

PART-C

51. A 4 years old boy presents to the physician's office with coarse facies, short stature, stiffening of the joints and mental retardation. His parents, a 10 years old sister and an 8 years old brother all appear unaffected. The patients mother is pregnant. She had a brother who died at 15 years of age with similar findings that seemed to worsen with age. She also has a nephew (her sister's son) who exhibits similar features. Based on the probable mode of inheritance, what is the risk that her fetus is affected?
(a) 100% (b) 50% (c) 25% (d) 0%

52. What would be the frequency of AABBCC individuals from a mating of individuals with genotypes AaBbCc and AABbCc?
(a) $\frac{1}{64}$ (b) $\frac{1}{32}$ (c) $\frac{3}{32}$ (d) $\frac{1}{16}$

53. If 'C' encodes coloured petals and 'c' means colourless petals, 'S' gives smooth leaves and 's' means rough leaves, 'W' gives waxy endosperm and 'w' means non-waxy endosperm. The expected frequency of progenies having atleast 2 dominant features would be if the SsCcWw parent is test crossed.
(a) $\frac{1}{8}$ (b) $\frac{1}{4}$ (c) $\frac{1}{2}$ (d) $\frac{1}{16}$

54. Black coat colour in mice is dominant to albino. Black mice get higher price at a pet store. A breeder got disappointed when he crossed a black mouse with an albino mouse and got 6 albino and 2 black mice in the litter. He expected all black. What mistake did he make?
(a) assumed that black alleles were more common that white
(b) assumed that white alleles were more common than black
(c) assumed that black mouse was true-breeding
(d) assumed that white mouse was true-breeding

55. Treatment of a polypeptide by 2-mercaptoethanol yields two polypeptide that have the following amino acid sequences
X : Ala-Phe-Cys-Met-Tyr-Cys-Leu-Trp-Cys-Ala
Y : Val-Cys-Trp-Val-Ile-Phe-Gly-Cys-Lys
Chymotrypsin-catalysed hydrolysis of the intact polypeptide yields polypeptide fragments with the following amino acid composition.
(Ala, Phe) (Asn, Cys2, Met, Tyr) (Cys, Gly, Lys) (Cys2, Leu, Trp2, Val) (Ile, Phe, Val)
Indicate the positions of the disulfide bonds in the original polypeptide cysteines are numbered in order (C_1, C_2, C_3) in X: and (C_4, C_5) in Y
(a) C1-C2 and C4-C5 (b) C2-C3 and C1-C4
(c) C1-C3 and C2-C4 (d) C2-C3 and C1-C5

56. A group was studying the acid base properties of adenosine (Nucleoside). It was titrated from pH 7 to 3, it was observed that one of the nitrogen in its structure gain proton and has pKa value of 3.7 + 0.02. Which nitrogen of adenosine gets perorated if pH of nudeoside is lowered from 7 to 3?

(a) N1 (b) N3 (c) N7 (d) N9

57. Imagine you are generating a site-directed mutant of a protein in which a given residue is replaced by another residue. Which one of the following substitutions will result in the highest isoelectric point of the mutant compared to the wild type ? (X → Y means residue X in the wild type is replaced by residue Y in the mutant).

(a) Phe → Tyr (b) Gly → Asp

(c) Glu → Arg (d) Arg → Asp

58. A Jewish couple present at the pediatrician's office with concerns about their 6-month-old child. They report that the infant was perfectly fine for the first few months of life, but lately he is very easily startled by noise, he has difficulty swallowing, he can no longer hold his head up, and he had a seizure earlier in the day. On physical examination, the doctor also notes "cherry-red" spots in the childs eyes. These symptoms are due to accumulation of harmful quantities of which of the following substances in the brain?

(a) Beta-amyloid (b) Beta-hexosaminidase A

(c) Ganglioside GM2 (d) Sphingomyelin

59. A 65-year-old man being treated with a beta-blocker and an angiotensin-converting enzyme (ACE) inhibitor for his heart failure presents to his cardiologists office complaining of fatigue, weakness, shortness of breath, and an irregular heartbeat. An electrocardiogram (ECG) reveals atrial fibrillation, so his cardiologist adds digoxin to his treatment regimen, but tells the patient that he will need to get his blood drawn to check for low K^+ on a regular basis. Hypokalemia will increase the risk and severity of digitalis toxicity because of which of the following ?

(a) Hypopolarization of cardiac muscle membranes

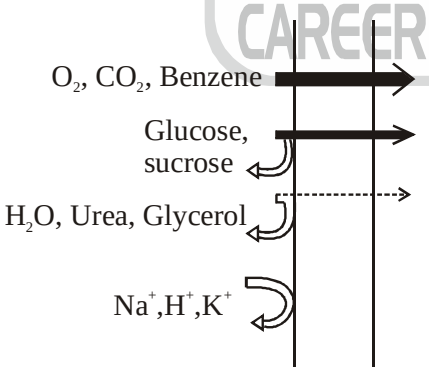
(b) Increased amplitude of cardiac muscle action potentials

(c) Increased excitability of cardiac muscle cells

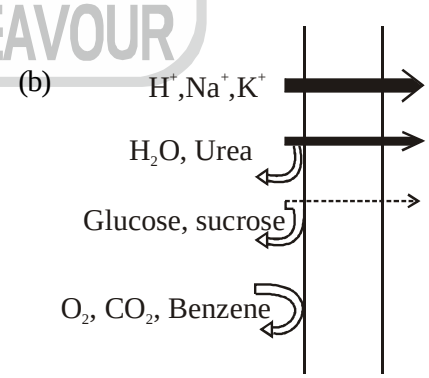
(d) Increased inhibition of the Na^+ - K^+ pump

60. Following giving figures are of relative permeability of a synthetic lipid bilayer to different classes of molecules. Find out the correct figure.

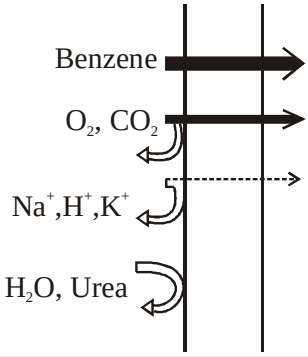
(a)



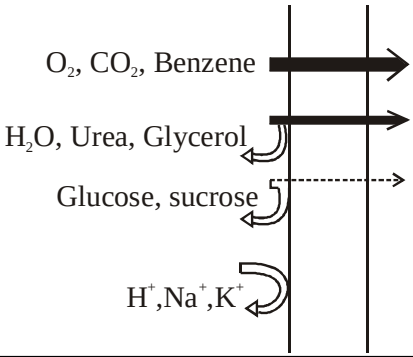
(b)



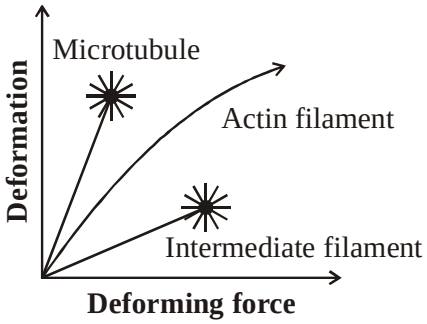
(c)

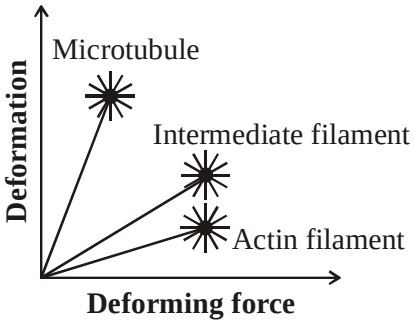


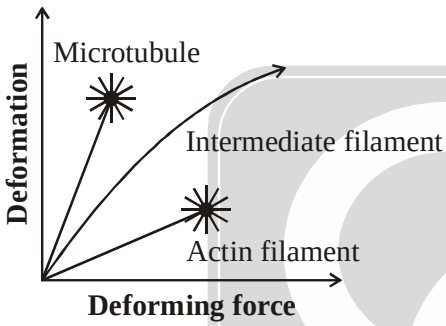
(d)

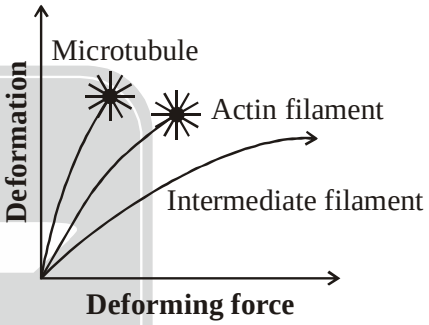


61. Networks composed of microtubules, actin filaments or a type of intermediate filament called vimentin, all at equal concentration, were exposed to a shear force in a viscometer & the resulting degree of stretch was measured. Which of the following could be the right result ?

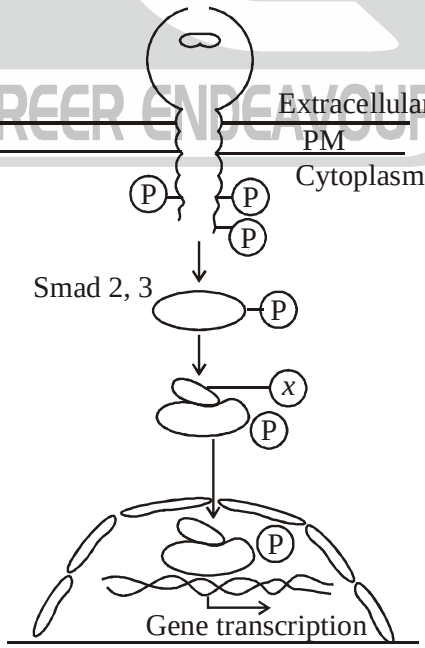
(a)


(b)


(c)


(d)


62. Following is diagramatic representation of Smad pathway, activated by TGF-β superfamily ligands.



In this pathway what is *x* ??

(a) Smad-1 (b) Smad-5 (c) STAT-4 (d) Smad-4

63. The Ras protein was first identified as the product of an oncogene that causes rat sarcomas and mutations in Ras found in many human tumors. The Ras pathway is used to respond to growth factors and mutations that turn on these pathways in the absence of growth factors lead to cancer. Which kinds of mutations in Ras would you expect to see in cancer cells ?

(a) Nonsense mutation

(b) Missense mutations that ↓ GTP hydrolysis

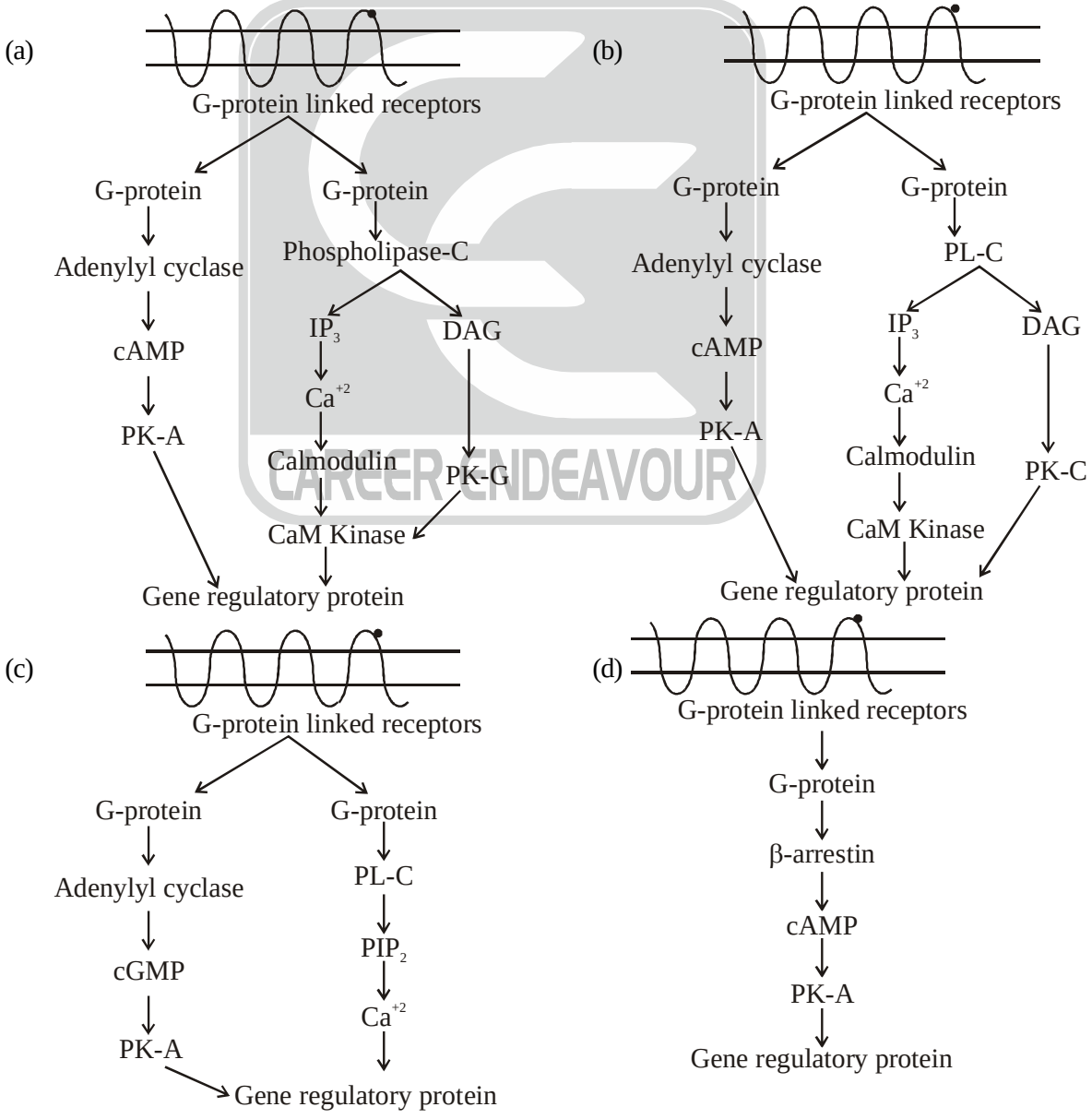
(c) Missense mutations that ↓ interaction with SOS

(d) Missense mutation that decrease the interaction with MAPKKKs. (RAF)

64. The cell cycle is regulated by proteins like kinases and cyclins. Protein kinases are enzymes that modulate the activity of other proteins by phosphorylating them. Such signelling molecules are produced during G1 phase for the cells to enter into S phase and during G2 phase for the cells to enter M phase. When 2 Mammalian cells in different cell cycle stages were fused and the 2 nuclei were analysed soon after the fusion both the nuclei were found to be in S phase. Therefore, before fusion the 2 cells were in

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

65. Given diagrams representing the intracellular signalling pathways activated by G-protein linked receptors. Identify the diagram with correct cascading event.



66. An antigen-X was injected in a mice. IgM formed during primary response and IgG formed during secondary response were isolated. They were put to sequencing and their sequences in variable (V) region were compared. The differences were found to be highly clustered in a part of V region in both the antibodies. This region of Ab is likely

(a) CDR1 (b) CDR2 (c) CDR3 (d) None

67. In order to develop a rabbit antiserum that is specific for mouse IgG, a researcher injected the rabbit with purified mouse IgG. The antiserum so obtained reacted very strongly with mouse IgG. But the same antiserum also reacted with other antibody isotypes of mouse and made the antiserum unsuitable for specific detection of mouse IgG. Why did the antiserum react with all isotypes of ab and NOT only with IgG as expected?

(a) Mouse IgG used for injection had impurities

(b) IgG ab was injected and not the γ-chain alone

(c) Ab specific for IgG has cross-reactivity with other isotypes

(d) Antiserum was interchanged with an unpurified serum

68. An immunotoxin was prepared by conjugating diphtheria toxin with monoclonal antibody specific for a tumor antigen. However, when the immunotoxin was injected in human subjects it was found that antibody part of the immunotoxin was degraded and toxin was released. Likely effect of this on body will be?

(a) Both normal and cancer cells will be killed by toxin

(b) Only normal cells will be killed by toxin

(c) Only cancer cells will be killed by toxin

(d) No cells will be killed by toxin

69. New recruits in a laboratory of immunology were gives spleen cells from a mouse immunized with LCM virus. These recruits were tasked with detection of antigen specific functional activity of these splenocytes using following 2 assays.

(i) Spleen cells are incubated with macrophages that have been briefly exposed to LCM virus.

(ii) Spleen cells are incubated with LCM-infected target cells

What will be the positive response in both these assays to show their antigen specificity against LCM antigens?

(a) IL-4 production in (i) and cell killing in (ii) (b) IL-2 production in (i) and cell killing in (ii)

(c) Cell killing in (i) and IL-2 production in (ii) (d) Cell killing in (i) and IFN-γ production in (ii)

70. During study of target cell killing activity of T_c-cells, following interventions were performed on target cells before incubating them with class I MHC restricted T_C-cells.

Treatment of target cell	**CTL activity by T_C-cell**
-Infectious virus	(P)
-UV-inactivated non-infectious virus	(Q)
-Infectious virus + emetine	(R)
-Infectious virus + chloroquine	(S)

Positive CTL activity will be seen in

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

71. During the study of positive selection of developing T-cells is thymus, researchers created a MHC class-I deficient mice. They were allowed to develop normally and on maturity their T-cell population was analyzed. Which among the following is a likely observation?

(a) Absence of CD4 and CD8 T-cells (b) Absence of CD4 but not CD8 T-cells

(c) Absence of CD8 but not CD4 T-cells (d) Very high population of double positive cells

72. What does it tell us about aging that cells from different organisms are capable of a fixed number of divisions in culture, and that number of divisions reflects the relative life-span of the organism?
   (a) The cells from these different organisms are not all equally adapted to growth in culture.
   (b) In each organism, the cells seem to be capable of a genetically determined number of divisions, after which the organism undergoes senescence and dies.
   (c) Cells growing in culture live for the same number of years that the organism from which they are derived would be expected to live, indicating a genetically determined life span.
   (d) The conditions cells encounter in culture lead to oxidative damage which reflects the kind of damage that normally leads to aging in the organism.

73. Which of the following is consistent with a model for aging in which stresses leading to DNA damage cause senescence and aging?
   (a) The DAF-16 protein of C.elegans is involved in the activation of stress responses.
   (b) Dietary restriction in mammals reduces the production of DNA-damaging free radicals in the mitochondria.
   (c) Werner's syndrome is a premature aging illness, possibly caused by a defect in DNA repair.
   (d) All of the above are consistent with a model for aging based on DNA damage.

74. Epimorphosis is regeneration through:
   (a) repatterning of existing cells, as occurs in Hydra
   (b) thereinitiation of division in existing cells, followed by patterning, as occurs in Hydra
   (c) thereinitiation of division in existing cells, followed by patterning, as occurs in amphibians such as newts
   (d) repatterning of existing cells, as occurs in amphibians
   (e) reinitiation of embryonic growth from the remaining cells, as occurs in Hydra

75. When the blastema forms after amputation of a newt limb, what processes must the cells undergo in order for regeneration to occur?
   (a) The cells must only begin to divide for regeneration to occur.
   (b) The cells must simply dedifferentiate in order for regeneration to occur.
   (c) The overlying wound epidermis takes on a role similar to that of the apical ectodermal ridge in normal limb development, and limb regeneration can then occur.
   (d) Dedifferentiation, cell division, transdifferentiation, and formation of an AER-like function are all involved.

76. Resource partitioning would be most likely to occur between
   (a) sympatric populations of species with similar ecological niches.
   (b) allopatric populations of species with similar ecological niches.
   (c) sympatric populations of a predator and its prey.
   (d) allopatric populations of the same animal species.

77. All of the following act to increase species diversity except
   (a) competitive exclusion.
   (b) patchy environments.
   (c) migration of populations.
   (d) moderate disturbances.

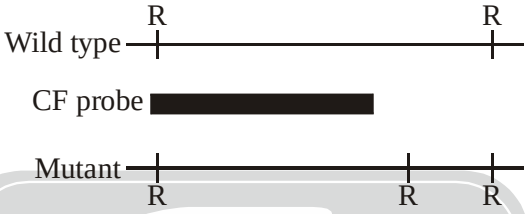
78. To measure the population density of snails occupying a particular park, 100 Snails are captured, marked with a small dot on a wing, and then released. The next day, another 100 snails are captured, including the recapture of 20 marked snails. One would correctly estimate the population to be
   (a) 500 (b) 200 (c) 1,000 (d) 10,000

79. Which one of the following statements is correct?
   (a) Both Azotobacter and Rhizobium fix atmospheric nitrogen in root nodules of plants
   (b) Cyanobacteria such as Anabaena and Nostoc are important mobilizers of phosphates and forplant nutrition in soil
   (c) At present it is not possible to grow maize without chemical fertilizers
   (d) Extensive use of chemical fertilizers may lead to eutrophication of nearby water bodies.

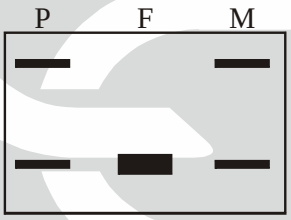
80. In which one of the following the BOD (Biochemical Oxygen Demand) of sewage (S),distillery effluent (DE), paper mill effluent (PE) and sugar mill effluent (SE) have beenarranged in ascending order?
(a) SE < PE < S < DE (b) PE < S < SE < DE
(c) S < DE < PE < S (d) SE < S < PE < DE

81. A biologist measures predation rates by crab spiders on flower-visiting insects in a particular field community and then experimentally removes as many of the spiders as she can. She discovers that predation rates remain the same but that the major predators shift from spiders to ambush bugs. Which of the following community structure models is most consistent with her findings?
(a) manipulative (b) interactive (c) redundancy (d) rivet

82. The maps of the sites for restriction enzyme R in the wild type and the mutated cystic fibrosis genes are shown schematically in the following figure.



Samples of DNA obtained from a fetus (F) and her parents (M and P) were analysed by gel electrophoresis followed by the southern blot technique and hybridization with the radio-labeled probe designated "CF probe" in the figure. The auto radiographic results are shown in the following figure :



After analysing this, find out the correct option
(a) Both the parents are homozygous for disease and featus is heterozygous
(b) Father is heterozygous for disease and mother is homozygous dominant while featus is homozygous recessive
(c) Both parents are heterozygous for disease while featus is homozygous recessive and have disease
(d) Both parents are heterozygous for disease but could'nt find out about featus phenotype.

83. A DNA molecule has 23 occurrences of the sequence 5'-AATT3' along one strand. How many times does the same sequence occur along the other strand.
(a) Could not tell exactly, how many times it be (b) 23/2 times
(c) 23 times (d) 46 times

84. In the transformation experiment of Avery, MacLeod, and McCarty that established the transforming principle of DNA in a study using several strains of *Diplococcuspneumoniae*. IIIS (virulent) forms culture was processed and heat killed, which is followed by homogenization. The soluble ûltrate prepared from this culture were treated with different enzymes, protease, RNase, DNase, amylase separately. The enzyme treated filtrate is incubatedwith liveIIR (non-virulent) culture separately to infect mice. Which is of the following observation is TRUE about the study,
A) live Type IIR + RNase treated IIIS filtrate cause death of the mice
B) live Type IIR + Protease treated IIIS filtratedoes cause death of the mice
C) Live Type IIR + DNase treated IIIS filtrate cause death of the mice
D) live Type IIR + amylase treated IIIS filtrate cause death of the mice
(a) A, B (b) B, C (c) A, C (d) C, D

85. Consider a relaxed circular plasmid has linking number 200. The plasmid is transformed into an E. coli cells and re-isolated again from the culture. The newly isolated plasmid has twist 220. Given are the statement regarding the newly isolated plasmid.

A) The reisolated plasmid has linking number of 220 with positive supercoiling.

B) The reisolated plasmid has same linking number to original plasmid, but positive supercoiling by writhe 20.

C) The reisolated plasmid has same linking number to original plasmid, but negative supercoiling by writhe 20.

D) The reisolated plasmid has linking number always equal to Twist.

Which of the following is NOT TRUE about the new plasmid?

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

86. Identified the mismatched pairs

Section A	**Section B**
A) DNA pol α	i) primer synthesis in prokaryotes
B) DNA pol I	ii) gap filling after primer removal
C) Topoisomerase	iii) removing the DNA supercoils
D) Dna A	iv) Unwinding of DNA double helix

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

87. DNA replication is regulated to ensure all chromosomes replicate once and only once per cell division in *E. coli*. DNA replication in prokaryotes happens during the initiation step of replication. Given are the statements for DNA replication in E.coli cells.

A. Expression of Dna A protein is high during the replication initiation.

B. High level of Dna A – ATP complex is required for replication initiation in E.coli.

C. Dna A – ADP complex inhibits reinitiation of replication of bacterial chromosome.

D. Binding of Seq A protein at oriC activatesreplication initiation at oriC.

E. Replication initiation is independent to the Dna A – ATP but a high level of Dna A – ADP initiate replication at origin in E. coli.

Which of the statements are TRUE about the regulation of bacterial replication initiation?

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

88. In the Meselson and Stahl experiment, *E. coli* was grown in a medium rich in $^{15}NH_4cl$. The doubling time for the E. coli is 24hrs. Following *E.coli* cells were transferred to medium containing $^{14}NH_4cl$. After every 24 hrs in medium containing $^{14}NH_4Cl$ E. coli cells were removed and the DNA were isolated. The isolated DNA were subjected to Cscl density gradient equilibrium centrifugation. Which of the following will be true about the isolated DNA if DNA replication is semiconservative?

A) 100% DNA were radiolabelled of $^{15}N/^{15}N$ after first generation in $^{14}NH_4Cl$ medium.

B) Equal amount of DNA were of hybrid (15N/14N) and light (14N/14N) after 48 hrs in $^{14}NH_4Cl$ medium.

C) Equal amount of DNA were of hybrid (15N/14N) and heavy (15N/15N) after 48 hrs in $^{14}NH_4Cl$ medium.

D) Equal amount of DNA were of hybrid (15N/14N) and light (14N/14N) after 24hrs in $^{14}NH_4Cl$ medium.

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

89. Which amongst the following statements are true regarding the function of inclusion bodies found in bacteria?

(i) Stores carbon

(ii) Stores inorganic substances such as sulphur, phosphate and nitrogen

(iii) Provides buoyancy

(iv) Guides direction to bacteria

(a) only (i) (b) only (ii)

(c) both (i) and (ii) (d) (i), (ii), (iii), (iv)

90. Match the type of bacteria with their flagellar distribution and correct example.

Name	**Flagellar distribution**	**Example**
i) Lophotrichous	a) Flagella over the whole surface	p) *Rhodospirillum rubrum*
ii) Monotrichous	b) One flagellum	q) *Proteus vulgaris*
iii) Amphitrichous	c) Cluster of flagella	r) *Pseudomonas*
iv) Peritrichous	d) Single flagellum at each pole	s) *Spirillum*

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

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

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

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

91. Choose the correct combination of different nutritional types of bacteria and their representative examples

Nutritional type	**Example**
i) Photolithoautotroph	p) Fungi
ii) Chemoorganoheterotroph	q) Purple and green sulphur bacteria
iii) Chemolithoautotroph	r) Purple non-sulphur bacteria
iv) Photoorganoheterotroph	s) Methanogens

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

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

92. Which of the following statements are correct with regard to translocation ?

I. Movement of photosynthate from mesophyll chloroplast to sieve elements of mature leaves by short distance transport is called phloem loading.

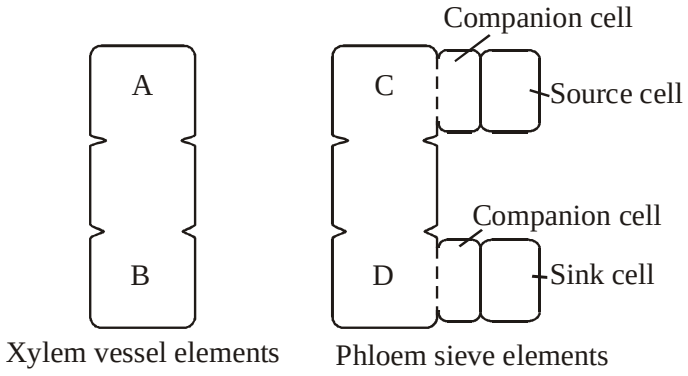
II. Movement of photosynthate from mesophyll chloroplast to sieve elements of mature leaves by short distance transport is called phloem unloading.

III. Transport of assimilate from source to sink is called import.

IV. The movement of sugars from mesophyll cells to sieve tubes may occur either through symplast or apoplast.

(a) I and III (b) I, III and IV (c) I and IV (d) II, III and IV

93. During translocation of photosynthates from source cells to sink cells, the photosynthates are first loaded into phloem. The translocation is carried forward by movement of water. In the above diagram, in which direction does water move between xylem and phloem elements ?



(a) Water moves from cell A to C to D and back to B.
(b) Water moves from cell B to D to C and back to A.
(c) Water moves from cell A to C and from B to D.
(d) Water moves from cell A to B and from D to C.

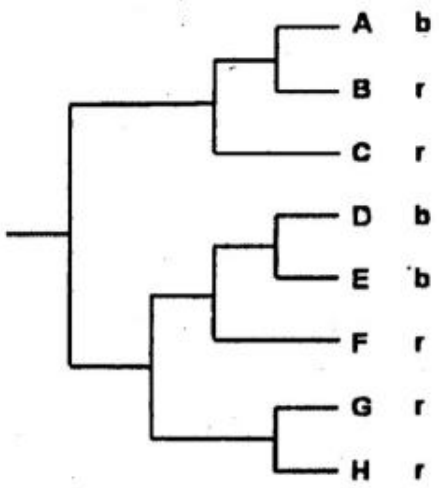
94. Which of the following statements is not true about suberin ?
(a) They are formed from hydroxyl or epoxy fatty acids joined by ester linkages
(b) It is a principal constituent of cuticle coating outside epidermis
(c) They are present on casparian strip of root endodermis
(d) They are found on cork cells of periderm during secondary growth

95. Following are a few statements about Phase contrast microscopy:
i) It is useful in viewing live colorless samples.
ii) Samples are fixed with formaldehyde.
iii) Useful for studying localization of a protein within the cell.
iv) Make use of optics to create a contrast in the specimen.
The combination with all correct statements is:
(a) (i) and (ii) only (b) (i), (ii) and (iii) only
(c) (i) and (iv) only (d) All of these.

96. EDTA is commonly used with antibacterial agents or in cell lysis. The following statements explain its effects on cell wall.
1. EDTA destabilizes the outer membrane of Gram negative bacteria.
2. EDTA removes LPS layer of bacterial cell wall
3. EDTA inhibits DNA degradation.
4. EDTA attacks peptidoglycan interbridges.
The combination with all the true statements is:
(a) 1, 2 and 3 (b) 1, 3 and 4 (c) 1 and 2 only (d) All of these

97. Which one of the following statements is NOT TRUE about the Neutral Theory as proposed by Motoo Kimura?
(a) Except for advantageous mutations, most alleles are under neutral selection
(b) The rate of evolution for most genes will be equal to the neutral mutation rate
(c) Advantageous mutations are exceedingly rare
(d) At the level of DNA sequences, genetic drift dominates evolution

98. The phylogenetic tree below shows evolutionary relationships among 8 species. Males of these species are either blue (b) or red (r) in colour, the colour being indicated next to each species name.



Based on the principle of parsimony, which of the following statements best represents the evolution of male body colour in this set of species?

(a) The most recent common ancestor of all 8 species was blue; red evolved independently 5 times.
(b) The most recent common ancestor of all 8 species was blue; red evolved in dependently 4 times.
(c) The most recent common ancestor of all 8 species was red; blue evolved independently 3 times.
(d) The most recent common ancestor of all 8 species was red; blue evolved indecent dently 2 times

99. Twenty small populations of a species, each polymorphic for a given locus (T, t) were bred in captivity. In 10 of them the population size was kept constant by random removal of individuals, while other 10 were allowed to increase their population size. After several generations it was observed that in 7 of the size restricted populations only T was present, in the remaining 3 only t was present. In the growing populations 8 retained their polymorphism and in 2 only t was observed. The experiment illustrates

(a) Genetic drift which is more likely in large populations,
(b) Genetic drift which is more likely in small populations.
(c) Density dependent selection against T.
(d) Density dependent selection against t.

100. There are 'n' numbers of alleles at a given locus in a diploid population. The proportion of all homozygotes in the population

A. All alleles are equal abundant
B. All alleles are not in equal abundant

(a) $1/n$ and $<1/n$
(b) $1/n$ and $>1/n$
(c) $1/n^2$ and $<1/n^2$
(d) $1/n^2$ and $>1/n^2$

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[ANSWER KEY]

PART-A

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

PART-B

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

PART-C

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