E

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Sr.No. **34030**

SUBJECT CODE   BOOKLET CODE

2013(II)
LIFE SCIENCES
TEST BOOKLET

3   **A**

Time   : 3:00 Hours

Maximum Marks: 200

INSTRUCTIONS

1. **You have opted for English as medium of Question Paper.** This Test Booklet contains one hundred and forty five (20 Part 'A'+50 Part 'B' +75 Part 'C') Multiple Choice Questions (MCQs). You are required to answer a maximum of 15, 35 and 25 questions from part 'A' 'B' and 'C' respectively. If more than required number of questions are answered, only first 15, 35 and 25 questions in Parts 'A' 'B' and 'C' respectively, will be taken up for evaluation.

2. Answer sheet has been provided separately. Before you start filling up your particulars, please ensure that the booklet contains requisite number of pages and that these are not torn or mutilated. If it is so, you may request the Invigilator to change the booklet. Likewise, check the answer sheet also. Sheets for rough work have been appended to the test booklet.

3. Write your Roll No., Name and Serial Number of this Test Booklet on the Answer sheet in the space provided. Also put your signatures in the space earmarked.

4. **You must darken the appropriate circles with a black ball pen related to Roll Number, Subject Code, Booklet Code and Centre Code on the OMR answer sheet. It is the sole responsibility of the candidate to meticulously follow the instructions given on the Answer Sheet, failing which, the computer shall not be able to decipher the correct details which may ultimately result in loss, including rejection of the OMR answer sheet.**

5. Each question in Part 'A' and 'B' carries **2** marks and Part 'C' questions carry **4** marks each respectively. There will be negative marking @ 25% for each wrong answer.

6. Below each question in Part 'A', 'B' and 'C' four alternatives or responses are given. Only one of these alternatives is the "correct" option to the question. You have to find, for each question, the correct or the best answer.

7. Candidates found copying or resorting to any unfair means are liable to be disqualified from this and future examinations.

8. Candidate should not write anything anywhere except on answer sheet or sheets for rough work.

9. Use of calculator is not permitted.

10. **After the test is over, at the perforation point, tear the OMR answer sheet, hand over the original OMR answer sheet to the invigilator and retain the carbonless copy.**

Roll No..................................

Name ....

I have verified all the information filled in by the candidate.

....
Signature of the Invigilator

OMR Answer Sheet No.....................

S/62 PV/13–3 AE–1A

PART 'A'

1. A cart wheel rolls along a straight line. If the distance covered is equal to the diameter of the wheel, what is the angle through which the wheel has turned?

1. 90°
2. between 90° and 120°
3. between 120° and 150°
4. between 150° and 180°

2. In a class of 10 students, 3 failed in History, 6 failed in Geography and 2 failed in both. How many passed in both the subjects?
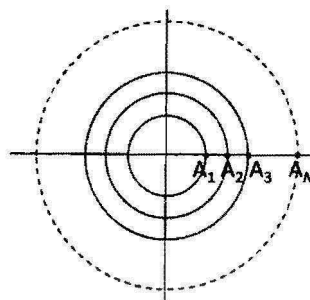
1. 1
2. 2
3. 3
4. 0

3.
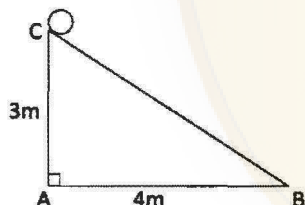
As shown in the diagram above, a sphere is placed on the top of an incline. It rolls down the incline without slipping in exactly 50 turns. The radius of the sphere is
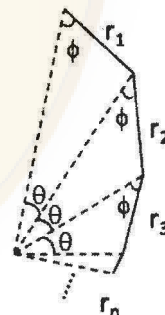
1. $\left(\dfrac{5}{\pi}\right)$ cm
2. $\left(\dfrac{5}{\pi}\right)$ m
3. $\left(\dfrac{10}{\pi}\right)$ cm
4. 10 cm

4.

A set of concentric circles of integer radii $1, 2, \cdots N$ is shown in the figure above. An ant starts at point A_1, goes round the first circle, returns to A_1, moves to A_2, goes round the second circle, returns to A_2, moves to A_3 and repeats this until it reaches A_N. The distance covered by the ant is

1. $N(N+1)\pi$
2. $2N\pi + N$
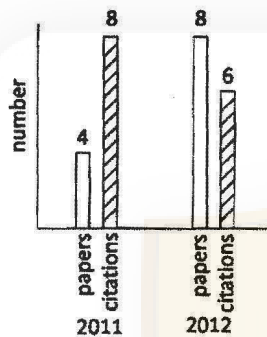3. $\pi(N+1)N + N - 1$
4. $\pi(N-1)N + N - 1$

5.

The figure above shows an infinite series of triangles, in which $r_1 > r_2 > r_3 \ldots$ What is the total length of the solid line segments in the figure?

1. $\dfrac{r_1}{r_2} + \dfrac{r_2}{r_3} + \cdots$
2. $\dfrac{r_1^2}{r_1 - r_2}$
3. $\dfrac{r_2^2}{r_1 + r_2}$
4. $\dfrac{r_1 - r_2}{r_1^2}$

6. If a_i, b_i and c_i are distinct, how many terms will the expansion of the product $(a_1 + a_2 + a_3)(b_1 + b_2 + b_3 + b_4)(c_1 + c_2 + c_3 + c_4 + c_5)$ contain?
   1. 12
   2. 30
   3. 23
   4. 60

7.

The above plot depicts the number of research publications of a scientist along with the number of citations.

Which of the following statements is **not** correct?

1. In the year 2012, 50% more papers were published but citations decreased by 25%.
2. In the year 2012, 100% more papers were published but citations were 75% of the number of papers in that year.
3. The papers published in year 2011 is only 33.33% of the total number of papers in both years.
4. The total number of citations for both years is 16.66% more than the total number of papers.

8. The next number of the sequence 1, 5, 14, 30, 55, . . . is
   1. 85
   2. 90
   3. 91
   4. 95

9.
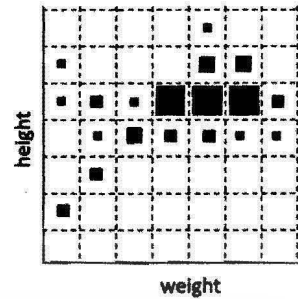
The distribution of heights and weights in a population is shown above in a 2-parameter scatter plot. The size of the square is proportional to the number of persons having a particular combination of weight and height. Which statement best describes the trend in the population?

1. Height and weight are strongly correlated.
2. Height and weight are anticorrelated.
3. Large heights do not imply proportionately large weights.
4. Height and weight are independent characteristics.

10. What is the maximum sum of the numbers of Saturdays and Sundays in a leap year?
    1. 104
    2. 105
    3. 106
    4. 107

11. Two trains of lengths 150 m and 250 m pass each other with constant speeds on parallel tracks in opposite directions. The drivers and guards are at the extremities of the trains. The time gap between the drivers passing each other and first driver-guard pair passing each other is 30 s. How much later will the other driver-guard pair pass by?
    1. 10 s
    2. 20 s
    3. 30 s
    4. 50 s

12. In a room, we have one grandfather, two fathers, two sons, and a grandson. The age of one father is seven times the age of his son. The age of the other father is twice his son's age. Assuming that there are only 3 people in the room and the grandfather is 70 years old, how old is the grandson?

    1. 1
    2. 2
    3. 5
    4. Cannot be determined

13. A hemispherical bowl is being filled with water at a constant volumetric rate. The level of water in the bowl increases

    1. in direct proportion to time,
    2. in inverse proportion to time,
    3. faster than direct proportion to time,
    4. slower than direct proportion to time.

14. Equal masses of two liquids of densities 6 kg/m^3 and 4 kg/m^3 are mixed thoroughly. The density of the mixture is

    1. 4.8 kg/m^3.
    2. 5.0 kg/m^3.
    3. 5.2 kg/m^3.
    4. 5.4 kg/m^3.

15. Two points A and B on the surface of the Earth have the following latitude and longitude co-ordinates.
    A: 30°N , 45°E
    B: 30°N, 135°W
    If R is the radius of the Earth, the length of the shortest path from A to B is

    1. $\frac{\sqrt{3}}{2}\pi R$
    2. $\frac{\pi R}{3}$
    3. $\frac{\pi R}{6}$
    4. $\frac{2\pi R}{3}$

16. Amoebae are known to double in 3 min. Two identical vessels A & B, respectively contain one and two amoebae to start with. The vessel B gets filled in 3 hours. When will A get filled?

    1. 3 hours
    2. 2 hours 57 min
    3. 3 hours 3 min
    4. 6 hours

17. Students of a school are divided into 4 groups. What is the probability that three friends get into the same group?

    1. $\frac{3}{4}$
    2. $\frac{1}{64}$
    3. $\frac{1}{16}$
    4. $\frac{1}{3}$

18. A fruit vendor buys 120 Shimla apples at 4 for Rs. 100, and 120 Golden apples at 6 for Rs. 100. She decides to mix them and sell at 10 for Rs. 200. She will make

    1. no profit, no loss
    2. a loss of 4%
    3. a gain of 4%
    4. a loss of 10 %

19. $4^0 + 4^2 + 4^{-2} + 4^{1/2} + 4^{-1/2} =$

    1. 4^0
    2. $4^{2\frac{1}{2}} + 4^{-2\frac{1}{2}}$
    3. $19\frac{9}{16}$
    4. $22\frac{9}{16}$

20. In an enclosure there were both crows and cows. If there were 30 heads and 100 legs, what fraction of them are crows?

    1. 1/3
    2. 1/4
    3. 1/10
    4. 3/10

PART 'B'

21. The interaction energy between atom A and B is ~ 400 kJmol^{-1}.
    The type of interaction between them is
    1. pi - pi.
    2. covalent.
    3. ion-dipole.
    4. hydrogen bond.

22. Which one of the following bases has the largest hydrogen bonding possibility?
    1. Adenine
    2. Guanine
    3. Cytosine
    4. Uracil

23. Enzymes help to lower the activation energies of reactions by
    1. covalent interaction with substrates.
    2. binding only with the solvent molecules.
    3. changing reaction equilibria.
    4. forming weak interactions with substrates.

24. Glucose residues in amylose are linked by
    1. $\beta 1 \rightarrow 4$
    2. $\alpha 1 \rightarrow 4$
    3. $\alpha 1 \rightarrow 6$
    4. $\beta 1 \rightarrow 6$

25. When a membrane is depolarized to a voltage value more positive than the threshold voltage, it leads to the generation of
    1. Donnan potential.
    2. action potential.
    3. resting potential.
    4. electrochemical potential.

26. *E. coli* proliferates faster on 'glucose' than it does on 'lactose' because lactose is
    1. taken up more slowly than glucose
    2. not hydrolyzed by *E. coli*.
    3. taken up faster than glucose.
    4. toxic to the cells.

27. Out of the list given below, which is the correct order of increasing lipid bilayer permeability?

    1. N_2 > Ethanol > H_2O > Glucose > Ca^{+2} > RNA
    2. H_2O > Glucose > Ethanol > N_2 > Ca^{+2} > RNA
    3. Ca^{+2} > RNA > N_2 > Ethanol > H_2O > Glucose
    4. Ethanol > RNA > Ca^{+2} > H_2O > Glucose > N_2

28. In the lysogenic state of λ phage
    1. both CI and Cro are on.
    2. both CI and Cro are off.
    3. CI is on while Cro is off.
    4. CI is off while Cro is on.

29. In bacteria chromosomal DNA replication starts at
    1. one specific locus.
    2. several specific loci.
    3. a single locus, randomly.
    4. from several loci, randomly.

30. The 'Uvr ABC' repair mechanism is involved in repairing
    1. missing bases.
    2. strand break.
    3. cross linked strands.
    4. DNA damage caused by "bulky" chemical adducts.

31. Which of the following phenomena is observed in compatible plant-pathogen interactions?
    1. Virulence in pathogen.
    2. Hypersensitive response in host.
    3. Resistance in host.
    4. Avirulence in pathogen.

32. Which one of the following is NOT an extracellular matrix protein?
    1. Fibronectin
    2. Vitronectin
   3. Laminin
    4. Cyclin

33. The cylindrical channels in gap junctions are made of
    1. connexin
    2. collagen.
    3. fibronectin.
    4. N-CAM.

34. A tumour suppressor protein
    1. is one whose function brings about regression of a tumour
    2. is one where mutations are shown to cause or are associated with tumours.
    3. is inactivated by oncogenes.
    4. inhibits the progression of the cell cycle by phosphorylating cyclins.

35. Immediate hypersensitivity reactions are associated with
    1. IgG
    2. IgE
    3. IgM
    4. IgA

36. The change in the state of specification of imaginal disc of *Drosophila* to that of a different disc type is known as
    1. transdetermination.
    2. transdifferentiation.
    3. transformation.
    4. transduction.

37. During double fertilization in plants, one sperm fuses with the egg cell and the other sperm fuses with
    1. synergid cell.
    2. central cell.
    3. antipodal cell.
    4. nucellar cell.

38. Over-expression of a dominant negative FGF receptor during amphibian development would prevent formation of
    1. trunk and tail.
    2. head and trunks.
    3. trunk and fore limbs.
    4. head and forelimbs.

39. The cell death pathway in *C. elegans* can be schematically represented as:

$$ced\,9 \longrightarrow\!\!| \quad ced\,4 \longrightarrow ced\,3$$

Based on the above, which one of the following statements is TRUE?

1. A loss-of-function allele of *ced9* would lead to survival of cells that normally die.
2. A loss-of function allele of *ced9* would lead to excessive cell death.
3. A gain-of-function allele of *ced9* would lead to excessive cell death.
4. Neither loss or gain-of-function of *ced9* would make any change to the cell death pathway.

40. Which of the following mechanisms is **NOT** involved in providing photoprotection to plants?
    1. Degradation of D1 protein.
    2. Zeaxanthin formation.
    3. Photolysis of water.
    4. Thermal dissipation.

41. Which of the following plant hormones can mimic the *det1* mutation, causing de-etiolation and chloroplast development in dark?
    1. Cytokinin
    2. Gibberellin
    3. Auxin
    4. Ethylene

42. Under which conditions do members of the family *Gramineae* synthesize and release phytosiderophores?
    1. Iron deficiency.
    2. Phosphorus deficiency.
    3. Availability of iron complexes in rhizosphere.
    4. Availability of phosphorus complexes in rhizosphere.

43. The membranes of chilling–sensitive plants are characterized by
    1. higher proportion of saturated fatty acids
    2. lower transition temperature
    3. lower proportion of saturated fatty acids

4. lower transition temperature and higher proportion of unsaturated fatty acids

44. The only bone marrow cell that never appears in peripheral blood is
1. myeloblast.
2. myelocyte.
3. lymphoblast.
4. megaloblast.

45.
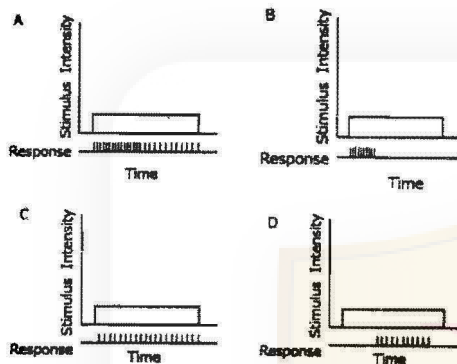
Various types of excitable tissues when stimulated showed response as shown in the above figures. Which one of them is an example of fast adapting tissue?
1. A.
2. B.
3. C.
4. D.

46. After gull nestlings hatch, the parents remove the egg-shells from the nest. This behaviour is to
1. clean the area.
2. reduce infection.
3. make more space in the nest.
4. minimise nest detection by predators

47. Thyroxin releasing hormone (TRH) receptor belongs to
1. nuclear receptor family.
2. receptor tyrosin kinase family.
3. G-protein – coupled receptor family.
4. guanylate cyclase receptor family.

48. A cross is made between a pure breeding plant having red coloured flowers with a pure breeding plant having white coloured flowers. Such a cross is called as
1. test cross.
2. monohybrid cross.
3. dihybrid cross.
4. back cross.

49. A *cis-trans* complementation test is carried out to identify
1. if two mutations are allelic in nature.
2. if two genes interact with one another
3. the number of genes influencing a phenotype.
4. to understand the dominance/recessive relationships between alleles.

50. The following is the inheritance pattern of a trait under observation:
(i) The trait often skips a generation
(ii) The number of affected males and females is almost equal
(iii) The trait is often found in pedigrees with consanguineous marriages.

The trait is likely to be
1. autosomal recessive
2. autosomal dominant.
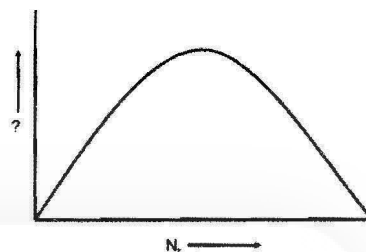3. sex-linked recessive.
4. sex-linked dominant.

51. Given below is an evolutionary tree.
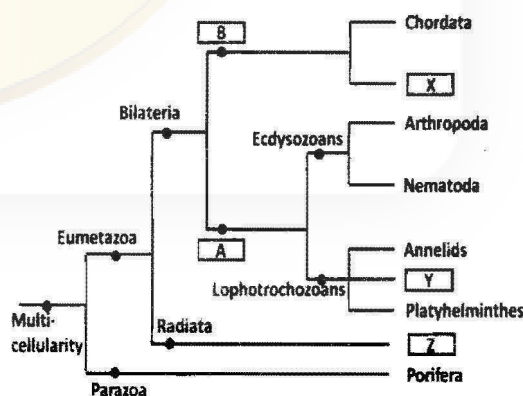
Based on the above, which one of the following combinations is correct?

1. A – Protostome; B – Deuterostome;
    X – Mollusca; Y – Cnidaria;
    Z – Protozoa
2. A – Protostome; B – Deuterostome;
    X – Echinodermata;
    Y – Mollusca; Z – Cnidaria
3. A – Deuterostome; B – Protostome;
    X – Crustacea; Y – Mollusca;
    Z – Cnidaria
4. A – Deuterostome; B – Protostome;
    X – Echinodermata;
    Y – Roundworm; Z – Ctenophora

52. The fungal group presently classified under protists is
    1. Zygomycetes.
    2. Oomycetes.
    3. Deuteromycetes.
    4. Discomycetes.

53. Name the common Indian bird that is generally seen in groups (aggregation)
    1. Bulbul
    2. Warbler
    3. Babbler
    4. Sun bird

54. The fungus associated with human oral or vaginal infection is
    1. *Fusarium*.
    2. *Aspergillus*.
    3. *Candida*.
    4. *Pneumocytis*.

55. The most common vegetation in the Western Ghats of India is tropical moist deciduous forest but that in Deccan plateau is depleted thorn forest. The possible reason is

    1. richer soil of Western Ghats compared to Deccan plateau.
    2. extensive deforestation in Deccan plateau compared to Western Ghats.
    3. higher rainfall in Western Ghats compared to Deccan plateau.
    4. higher temperature in Deccan plateau compared to Western Ghats.

56. The following graph is for a logistically growing population, with N_t plotted on the X-axis. What is the parameter plotted on the Y-axis?

    1. dN/dt
    2. N_{t+1}
    3. $dN/dt \cdot \dfrac{1}{N}$
    4. K

57. Annual weeds of arable lands are classified as
    1. phonerophytes.
    2. therophytes.
    3. chamaephytes.
    4. geophytes.

58. Which one of the following advancements in animal classification is correct?

    1. Protostomes → Pseudocoelomates → Deuterostomes → Eucoelomates
    2. Acoelomates → Protostomes → Eucoelomates → Deuterostomes
    3. Pseudocoelomates → Encoclomates → Protostomes → Deuterostomes
    4. Protostomes → Deuterostomes → Acoelomates → Eucoelomates

59. Which of the following is the most appropriate spectral bands for vegetation analysis using remote sensing platforms?
    1. Red, Near Infrared
    2. Infrared, Visible
    3. Red, Microwave
   4. Visible, Microwave

60. Which of the following diseases **does not** leave any paleontological evidence?
    1. Tuberculosis
    2. Arthritis
    3. Rickets
    4. Cholera

61. Greater male investment in the care of offspring is most likely to lead to
    1. a lek system.
    2. stronger female choice.
    3. reverse sexual dimorphism.
    4. run-away selection.

62. A neuron that fires when an individual is eating by hand, also fires when he sees someone else eating with hand. Such neurons are called
    1. mirror neurons.
    2. mimicry neurons.
    3. motor neurons.
    4. reward neurons.

63. Which of the following microbial fermentations are anaerobic?
    1. Ethanol and acetone-butanol.
    2. Citric acid and propionic acid.
    3. Penicillin and vitamin B_{12}.
    4. Streptomycin and rifampicin.

64. Encasing of which of the following plant cells in a gelatinous matrix is referred as artificial seed?
    1. Microcalli
    2. Somatic embryos
    3. Root tips
    4. Shoot tips

65. Which of the following transgenic crop(s) have been approved for commercial cultivation in India?
    1. Cotton
    2. Brinjal
    3. Cotton and brinjal
    4. Cotton, *Brasica*, brinjal

66. Chinese Brake fern (*Pteris vittata*) is a hyperaccumulator of :
    1. Cadmium.
    2. Arsenic.
    3. Lead.
    4. Chromium.

67. Which of the following is **NOT** a post-translational modification in a mammalian system?
    1. Palmitoylation
    2. glycosylation
    3. peptidylation
    4. phosphorylation

68. Haemoglobin has characteristic circular dichroism (CD) peaks C in the far-UV, near UV and Soret regions. Contribution to near-UV CD comes entirely from
    1. aromatic amino acid residues.
    2. heme group.
    3. heme and aromatic amino acid residues.
    4. peptide bonds and aromatic amino acid residues.

69. A weed is assumed to be dispersed randomly in a meadow. What statistical distribution will describe the dispersion correctly?
    1. Binomial
    2. Negative Binomial
    3. Poisson
    4. Normal

70. Co-localization of two fluorescently labelled proteins in an organelle in cells is usually visualised by
    1. interference-contrast microscopy.
    2. scanning electron microscopy.
    3. confocal microscopy.
    4. atomic force microscopy.

PART 'C'

71. Tryptic digest of a heptapeptide (built from 3 lysine (K), 2 alanine (A), 1 tyrosine (Y) and 1 phenylalanine (F)) yielded tri and tetrapeptide. Which of the following is the correct sequence of the heptapeptide?

1. KAYAKFK
2. YKAAFKK
3. KYKAAKF
4. KYAAFKK

1. A and C
2. B and D
3. A and D
4. B and C

72. 100 ml of 0.1 M sodium acetate solution has a pH of 8.90. To this solution 1000 µl of 1M acetic acid (pKa = 4.76) of pH 2.80 is added. The pH of this mixture will be:
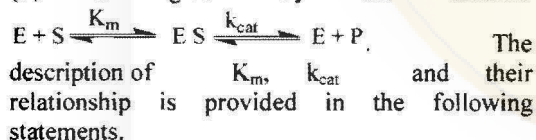
1. 8.90
2. 4.76
3. 2.80
4. 5.76

73. What are A, B and C in the following reactions?
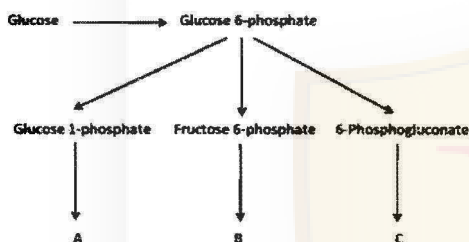
1. Pyruvate, ribose 5-phosphate, glycogen.
2. Ribose 5-phosphate, glycogen, pyruvate.
3. Glycogen, pyruvate, ribose 5-phosphate.
4. Glycogen, citrate, ribose 5-phosphate.

74. Michaelis-Menten enzyme kinetics for a simple reaction involving an enzyme (E) and substrate (S) is given by the scheme:

$$E + S \underset{K_m}{\rightleftharpoons} ES \xrightarrow{k_{cat}} E + P$$

The description of K_m, k_{cat} and their relationship is provided in the following statements.

A. K_m represents association constant of the ES complex.
B. K_m represents the dissociation constant of the ES complex.
C. k_{cat} is the rate constant for the chemical conversion of the ES complex to substrate bound enzyme and product.
D. k_{cat}/K_m is a rate constant that refers to the properties and reactions of the free enzyme and free substrate.

Which of the combinations of above statements is true?

75. A 26-residue peptide composed of alanine and leucine shows a circular dichroism (CD) spectrum characteristic of α-helix at 50°C in 5 mM phosphate buffer at pH 7.4. Deconvolution of the spectrum indicates 60% α-helical and 40% random conformation. When the peptide solution is cooled gradually to 25°C, and the CD spectra are recorded at different temperatures, the most likely observation will be that

1. the % helical content will decrease and % random conformation will increase.
2. the % helical content will increase and % random conformation will decrease.
3. there will be transition from α-helix to β-sheet.
4. there will be transition from α-helix to β-hairpin.

76. It has been observed that for the DNA double helix melting, the value of ΔH (enthalpy change of denaturation) are 80 and 90 kcal/mole at 70° and 80°C, respectively. Assuming that ΔCp (constant-pressure heat capacity change) is independent of temperature, estimate ΔH associated with the denaturation of DNA at 37°C. This estimated value of ΔH (kcal/mole) is

1. 27.
2. 37.
3. 47.
4. 57.

77. Using FRAP (Fluorescence Recovery After Photo-bleaching) techniques, diffusion coefficient of three integral membranes proteins M_1 M_2 and M_3 in a kidney cell is calculated as 1µm/s, 0.05 µm/s and 0.005 µm/s, receptively. Considering fluid-mosaic nature of biological membrane and relationship of structural organization of integral membrane protein with diffusion coefficient, which protein(s) will have highest number of integral membrane domain?

1. M_2 and M_3
2. M_2 only
3. M_3 only
4. M_1 and M_3

78. One highly pathogenic DNA virus enters into the host cells by endocytosis replicates in the nucleus followed by cell lysis. You have drugs at your disposal that block

   A. acidification of vesicles.
   B. mitochondrial transport.
   C. nuclear export.
   D. exocytosis.

   Identify the right combination to prevent its infection.
   1. A and B
   2. B and D
   3. A and C
   4. A and D

79. When cells enter mitosis, their existing array of cytoplasmic microtubules has to be rapidly broken down and replaced with the mitotic spindle, which pulls the chromosomes into the daughter cells. The enzyme Katanin is activated during the onset of mitosis and chops microtubules into short pieces. The possible fate of the microtubule fragments created by Katanin will be
   1. depolymerization.
   2. aggregation.
   3. degradation.
   4. translocation.

80. A bacterial strain can use carbohydrates and hydrocarbons as growth substrates. The strain uses glucose following a minimal lag period after inoculation, regardless of the other carbohydrates and hydrocarbons in the growth medium. The following observations were also made.

   A. In the absence of glucose, lactose is used after a lag period of about three times as long as the lag period for glucose utilization.
   B. The presence of hydrocarbons does not affect the lag period for the utilization of lactose.
   C. The utilization pattern for all hydrocarbons is similar to that of lactose.
   D. Branched hydrocarbons are not immediately utilized if straight chain hydrocarbons are initially present.

   Which one of the following specific regulatory mechanisms is consistent with the above observations related to carbohydrate and hydrocarbon utilization?

   1. Diauxie
   2. End point repression
   3. Catabolite repression
   4. Transcription attenuation

81. Cell cycle is regulated by various cyclins and cyclin dependent kinases (CDK). On receiving mitotic stimuli, cyclin D, the first cyclin expressed, binds with existing CDK4 to form the active cyclin D-CDK4 complex. This in turn phosphorylates retinoblastoma protein (Rb) which activates E2f to further activate the transcription of various downstream cyclins. In a particular cell type there is a mutation in Rb such that it cannot be phosphorylated. What will be the correct expression pattern of cylin E in these cells after mitotic stimulation?
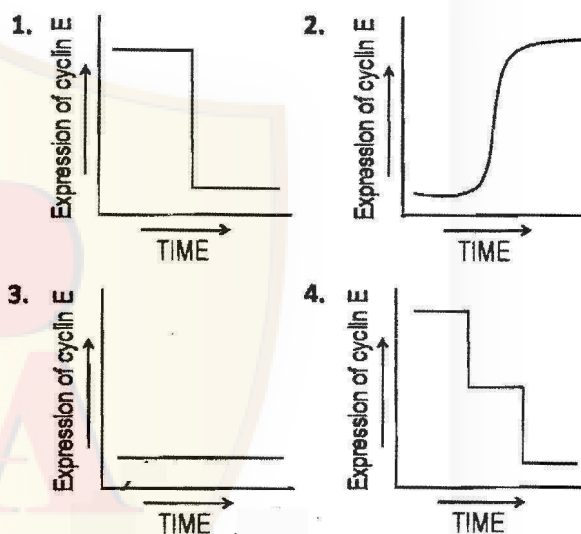
82. A bacterial culture was in log phase in the following figure. At time x, an antibacterial compound was added to the culture.
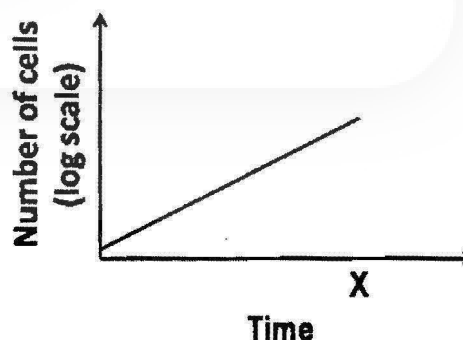
   Which of the following lines in the growth curve represents the antibacterial activities of the compound?
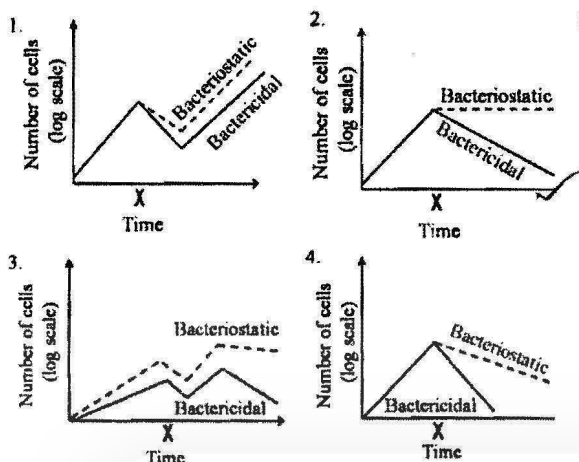
83. In a cell free extract containing DNA polymerase I, Mg^{2+}, dATP, dGTP, dCTP and dTTP (^3H), the following DNA molecules were added:

a. Single stranded closed circular DNA molecule containing 824 nucleotides.

b. Single stranded closed circular DNA molecule having 1578 nucleotides base paired with a linear single standard DNA molecule of 824 nucleotides having a free-3'-OH group.

c. Double stranded linear DNA molecule containing 1578 nucleotides having free-3'-OH group at both ends.

d. Double stranded closed circular DNA molecule having 824 nucleotides.

The rate of DNA synthesis was measured by incorporation of ^3H thymidine in the DNA molecule and expressed as the percentage of DNA synthesis relative to total DNA input.

Which one of the following graphs represents the correct result?
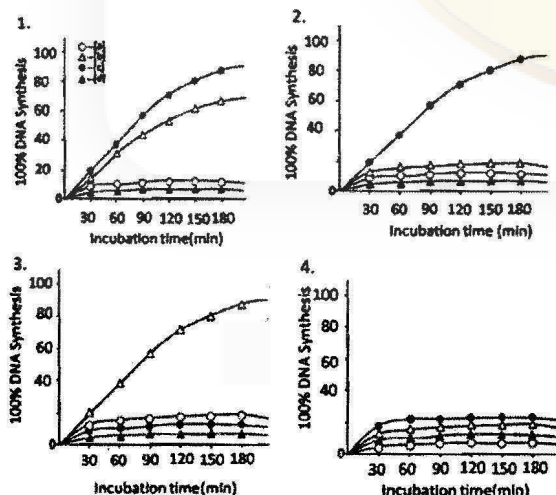
84. The complex responses to different types of DNA damage in both prokaryotes and eukaryotes fall into three main categories:

(i)   damage bypass
(ii) damage reversal
(iii) damage removal

Many repair proteins are isolated like

(a) DNA methyltransferase
(b) DNA glycosylase
(c) DNA polymerase IV

Which one of the following represents the correct combination?

1. (i) – (a), (ii) – (b), (iii) – (c)
2. (i) – (b), (ii) – (c), (iii) – (a)
3. (i) – (c), (ii) – (a), (iii) – (b)
4. (i) – (c), (ii) – (b), (iii) – (a)

85. In recent years, genome-wide transcription study using high throughput sequence analysis has revealed some novel results that include:

(i) presence of RNA polymerase in both intra- and intergenic regions of the genome
(ii) existence of non-coding RNAs generated from mRNA coding genes.
(iii) existence of sense and antisense transcripts generated from the promoter and untranslated region of many annotated genes.

Possible interpretation of the above results are:

A. RNA polymerase can loosely bind to any part of the genome but its affinity becomes strong only when it reaches the promoter.

B. Binding of RNA polymerase to non-promoter regions of the genome leads to the generation of various non-coding regulatory RNAs.

C. Non-coding RNAs are generated from mRNA coding genes due to aberrant transcription initiation and termination.

D. Sense and antisense transcripts are generated from the promoter and untranslated regions of protein coding genes by a novel mechanism of bidirectional transcription.

Identify the correct combination of the above interpretations:
1. A and B
2. B and D
3. A and D
4. B and C

86. Aminoacyl tRNA synthetases face two important challenges:

i) they must recognize the correct set of tRNAs for a particular amino acid.
ii) they must charge all of these isoaccepting tRNAs with the correct amino acid.

Both of these processes are carried out with high fidelity by the following possible mechanisms:

A. The discrimination ability resides predominantly at the acceptor stem of the tRNAs.
B. The specificity is contributed by the anticodon loop in tRNAs.
C. The specificity is embedded in the amino acyl synthetase at the 'N' terminus
D. The specificity is contributed by the variable loop of the tRNA.

Which of the following is correct?

1. A and B
2. A and C
3. B and C
4. A and D

87. During heat shock, mammalian cells shut down global protein synthesis while inducing heat shock proteins (Hsps). The possible molecular regulation(s) that could explain the phenomenon are:

A. mRNA of all proteins, except those of Hsps, undergoes degradation during heat shock.
B. Cap-dependent translation of most mRNAs is affected during heat shock due to denaturation of cap binding protein, eIF-4E.
C. Translation initiation of Hsp mRNAs takes place through their internal ribosome entry sites (IRES)
D. Hsp mRNAs are abundant during heat shock and thus they compete out other mRNAs for ribosome binding and translation.

Which of the following sets is correct?

1. A and D
2. B and C
3. C and D
4. A and D

88. Bacteriophage λ is a temperate bacteriophage and has two modes in its life cycle, lysogenic and lytic. Several genes are involved in these two processes like *N, cI, cII, cIII, Q, int, xis*, etc.

Which one of the following diagrams represents the control mechanism correctly?
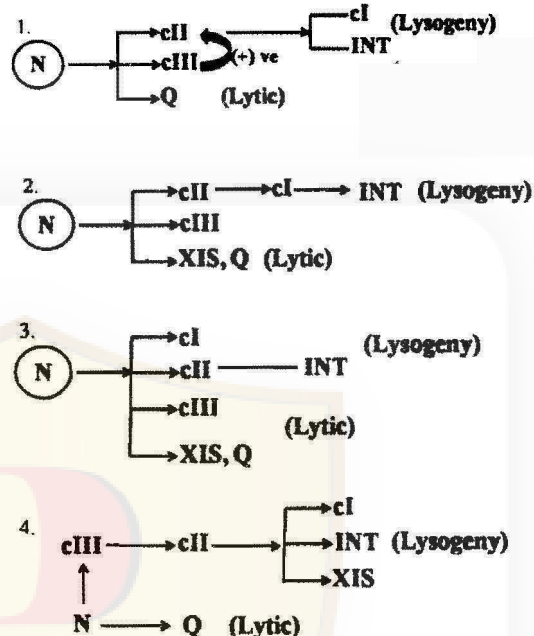
89. Clearance of phagocytosed intracellular parasite like *Leishmania* requires the involvement of reactive oxygen species (ROS) and reactive nitrogen species (RNS). Administration of IFN-γ to macrophages harbouring an intracellular pathogen leads to the production of ROS and RNS by JAK/STAT pathway. A macrophage cell line J774 infected with *Leishmania* is given the following treatments.

A. IFN-γ.
B. IFN-γ+AMT, a potent iNOS inhibitor.
C. IFN-γ + apocyanin, a NADPH oxidase inhibitor.
D. IFN-γ + NMMA (N-monomethyl arginine), an arginine analogue.

What will be the most appropriate graph showing the survival of parasites after these treatments?
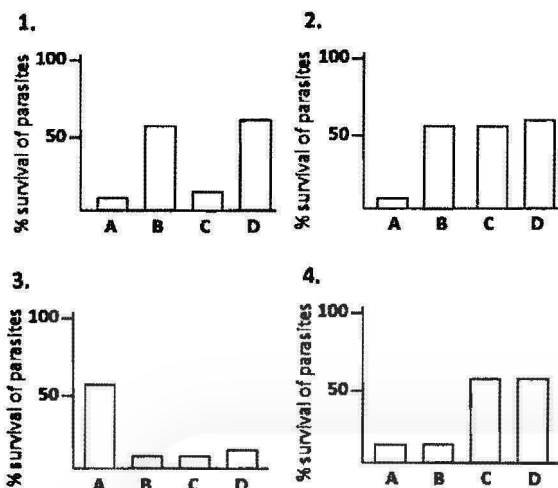
90. A ligand recognizes two different cell surface receptors, A and B, on the same cell type. Receptor A, after binding with the ligand is internalized along with the ligand whereas receptor B, after binding with the ligand, initiates tyrosine kinase activity of the intracellular domain. One particular disease is associated with the loss of receptor-mediated signal transduction of the ligand. Different observers inferred that the disease may be resulted due to

A. loss of binding affinity of receptor A due to mutation in the extracellular domain.
B. loss of binding affinity of receptor B due to mutation in the extracellular domain.
C. mutation in the tyrosine kinase domain rendering it inactive.
D. mutation in the intracellular domain rendering it incapable of endocytosis.

Which combination of the above inferences do you think is appropriate for the cause of the disease?

1. A and B
2. B and C
3. C and D
4. A and D

91. Vascular endothelial (VE)-cadherin is an important cell adhesion molecule for endothelial cells. Endothelial cells that are unable to express VE-cadherin still can adhere to one another via N-cadherin (neural cadherin), but these cells do not survive. Which of the following is the most appropriate reason for this?

1. N-cadherin uses VE-cadherin as coreceptor for adhesion.

2. VE-cadherin acts as coreceptor for VEGF (vascular endothelial growth factor) – mediated signal transduction in endothelial cells.
3. VE-cadherin is important for desmosome formation and interaction of intermediate filaments.
4. Loss of VE-cadherin impairs Ca^{2+}- homeostasis of vascular endothelial cells leading to their death.

92. An important role of Fas and Fas ligand is to mediate elimination of tumor cells by killer lymphocytes. In a study of 35 primary lung and colon tumors, half the tumors were found to have amplified and overexpressed a gene for a "secreted protein" that binds to Fas ligand. The main reason for survival of these tumor cells by this "secreted Fas- ligand binding protein" may be attributed to its

1. decoy receptor activity.
2. anti-proliferative activity.
3. cellular defense activity against immune-cytotoxic killing.
4. anti-contact inhibition activity.

93. A BALB/c mouse was thymectomized on the first day after birth (mouse 1) whereas another was thymectomized on day 7 after birth (mouse 2). A third mouse underwent the same operation on day 21 after birth. After 56 days, sera were prepared from these mice and also from control mice, which had sham operation. The sera were checked for anti-DNA antibodies. Which one of the following observations is the most plausible?

1. Both mouse 1 and mouse 2 had anti-DNA antibodies but mouse 3 did not have anti-DNA antibodies.
2. Only mouse 1 had anti-DNA antibodies.
3. Only mouse 3 had anti-DNA antibodies.
4. Only the control mice had anti-DNA antibodies.

94. A potentially valuable therapeutic approach for killing tumour cells without affecting normal cells is the use of immunotoxins. Immunotoxins consist of particular cell-specific monoclonal

antibodies coupled to lethal toxins. Which of the following molecular approaches is **NOT** appropriate for killing tumor-cells?

1. Cell surface receptor binding polypeptide chain of toxin molecules should be replaced by monoclonal antibodies which are specific for a particular tumor cell.
2. Constant region Fc domain of tumor cell-specific monoclonal antibody should be replaced by toxin molecules.
3. Variable region F(ab) domain of tumor cell-specific monoclonal antibody should be replaced by toxin molecules.
4. Inhibitor polypeptide chain of toxin molecules should be conjugated to the F(ab) domain of tumor-specific monoclonal antibody.

95. A set of experiments that were carried out to demonstrate the effect of Apical Ectodermal Ridge (AER) of the chick limb bud on the underlying mesenchyme are enlisted below, along with their expected outcomes:

    A. Removal of the AER of forelimb leads to cessation of limb development.
    B. If an extra AER is placed in the forelimb bud, duplication of the distal region of the wing takes place.
    C. If an extra AER is placed in the forelimb bud, a leg develops instead of a wing.
    D. If AER of forelimb bud is replaced with beads soaked in FGF2, a normal wing develops.
    E. If a nonlimb mesenchyme is placed below an AER, the AER directs the mesenchyme to form a normal wing.

    Which of the above statements are correct?

    1. A, C and E
    2. C, D and E
    3. B, D and E
    4. A, B and D

96. Hensen's node is established as the avian equivalent of the amphibian dorsal blastopore lip. The following observations are presumed to be in support of the same.

A. It is the region whose cells can both induce and pattern a second embryonic axis when transplanted into other locations of the gastrula.
B. It is equivalent in terms of tissue structure.
C. It expresses the same marker genes as the Spemann's organizer in amphibians.
D. The same micro RNA can interfere with the formation of pre-chordal plate in both Hensen's node and Spemann's organizer.

Choose the correct set among the following:

1. A and D
2. A and C
3. B and C
4. A and B

97. In amphibians, when due to some injury, the eye lens is damaged, the fully differentiated iris cells can regenerate the lens. It is achieved through the following possible processes:

A. Iris cells through some signaling undergo dedifferentiation and transdifferentiation into lens cells to regenerate the lens.
B. Iris cells transform into lens cells spontaneously.
C. Iris cells induce in a stepwise manner, specific genes responsible for their dedifferentiation and then conversion to lens cells.
D. Stem cells present in iris tissue differentiate into lens cells.

Which of the following is correct?

1. A and B
2. A and C
3. B and D
4. B and C

98. The control of flowering is a complex process involving several key regulatory genes. Some statements on flower development are given below:

A. Two major types of genes regulate floral development: meristem identity genes and floral organ identity genes.
B. The important genes in *Arabidopsis* that play key regulatory roles in meristem identity are: *APETALA1, LEAFY* and *SUPPRESSOR OF CONSTANS1*.

AE

C. The genes that determine floral organ identity were discovered as floral homeotic mutants.

D. Most plant homeotic genes belong to a class of related sequences known as FAD box genes.

Which one of the following combinations of the above statements is correct?
1. A, B and C
2. B, C and D
3. A, C and D
4. A, B and D

99. A few statements on early developmental stages in plants are given below:

A. The cells of flower are diploid in nature.
B. Only some specialized cells in the reproductive organs undergo meiosis to produce haploid cells.
C. The haploid cells produced in (B) above, undergo a few normal mitotic cell divisions.
D. All the progeny cells produced in (C) above, differentiate either into haploid egg cells or into haploid sperm cells.

Which one of the following combinations of the above statements is correct?
1. A, B and C
2. B, C and D
3. A, C and D
4. A, B and D

100. Cells from an early frog blastula were removed from the animal pole and used to replace cells from the vegetal pole of the blastula. The following events may be expected.

A. Transplanted cells would develop normally as part of the cells of the vegetal pole.
B. Transplanted cells would develop as cells of the animal pole of the adult on the vegetal pole.
C. Region of the animal pole from where the cells were removed would be missing in the adult.
D. Remaining cells in the animal pole would compensate for the cells that were removed.

Which of the following are true?

1. B, C and D
2. A, B and D
3. A, B and C

4. A, C and D

101. Capacitation of mammalian sperms allows them to be activated within the uterus and facilitate fertilization. The following statements were made regarding events occurring during capacitation:

A. Removal of cholesterol from sperm head.
B. Removal of non-covalently bound glycoproteins.
C. Increased expression of fibronectin.
D. Decreased permeability of calcium ions.

Identify the correct statements:
1. B, C and D
2. A, B and D
3. A, B and C
4. A, C and D

102. Asada-Halliwell pathway protects plants against oxidative stress during unfavorable environmental growth regimes. The following are some statements related to the stress-tolerance mechanism through this pathway in plants.

A. Oxygen accepts electrons as an alternative electron acceptor.
B. Hydrogen peroxide is reduced by catalase to form water.
C. Ascorbate is oxidized and regenerated.
D. Glutathione is oxidized and reduced.

Which one of the following combinations of the above statements is true?
1. B, C and D
2. A, B and C
3. A, B and D
4. A, C and D

103. The following are certain facts regarding biological nitrogen fixation in plants:

A. Oxygen irreversibly inactivates nitrogenase enzyme involved in nitrogen fixation.
B. The *nod* genes that code for nodulation proteins are activated by NodD
C. The two components of nitrogenase enzyme complex, the Fe protein and MoFe protein, can show catalytic activity independently.
D. During the reaction catalyzed by nitrogenase enzyme, the Fe protein reduces

the MoFe protein while the MoFe protein reduces N_2.

Which one of the following combination of the above statements is correct?
1. A, B and C
2. B, C and D
3. A, C and D
4. A, B and D

104. Secondary metabolites are diverse array of organic compounds in plants. The following are certain statements about secondary metabolites:

A. They protect plants against being eaten by herbivores and against being infected by microbial pathogens.
B. Terpenes, the largest class of secondary metabolites are synthesized by methylerythritol phosphate (MEP) pathway and shikimic acid pathway.
C. The most abundant classes of phenolic compounds in plants are derived from phenylalanine.
D. Alkaloids are nitrogen containing secondary metabolites in plants.

Which one of the following combinations of the above statements is correct?
1. A, B and C
2. B, C and D
3. A, C and D
4. A, B and D

105. The following are some statements about long distance translocation of photoassimilates in higher plants:

A. Sugars are translocated in the phloem by mass transfer along a hydrostatic pressure.
B. Gibberellic acid stimulates the unloading of sugars from phloem tissue into apoplasts.
C. Munch pressure-flow hypothesis is crucial to drive translocation in the phloem.
D. Allocation and partition of carbon within a source leaf determine the phloem loading phenomenon.

Which one of the following combinations of the above statements is true?
1. A, B and D
2. A, B and C
3. A, C and D
4. B, C and D

106. Directional growth of plants induced by light is called phototropism. Some statements on phototropism are given below:

A. Phototropism is a photomorphogenetic response.
B. *PHOT1* and *PHOT2* genes mediate phototropism.
C. *CRY1* and *CRY2* genes although help to perceive blue light are not involved in phototropism.
D. Perception of blue light by phyA photoreceptor initiates phototropism.

Which one of the following combination of the above statements is correct?
1. A, B, and C
2. B, C and D
3. A, C and D
4. A, B and D

107. Plants make several hormones that are important for growth and development. Some statements on plant hormones are given below:

A. Auxin is produced primarily in the root apices
B. Cytokinins are a smaller group of related compounds.
C. Gibberellins are a large group of related compounds defined not by their biological functions but by their structures.
D. Brassinosteroids are an important class of plant hormones, which control a broad spectrum of developmental reposes including pollen tube growth.

Which one of the following combination of the above statements is correct?
1. A, B and C
2. B, C and D
3. A, C and D
4. A, B and D

108. An action potential was generated on a nerve fiber by a threshold electrical stimulus. When a second stimulus was applied, no matter how strong it was, during the absolute refractory period of the action potential, the nerve fibre was unable to generate second action potential. This observation was explained in the following statements:

A. A large fraction of potassium channels was voltage inactivated.
B. The critical number of sodium channels required to produce an action potential could not be recruited.
C. A large fraction of sodium channels was voltage inactivated.
D. The critical number of potassium channels required to produce an action potential could not be recruited.

Which one of the following is true?

1. Only A
2. A and B
3. Only C
4. C and D

109. Water and electrolytes like Na⁺ and Cl⁻ are lost from the body in diarrhoea. Oral administration of NaCl solution in this condition does not improve the situation. When glucose is administered with normal NaCl solution through oral route, the absorption of electrolytes along with water occurs and the patient recovers.

A. Glucose enhances ATP production in the mucosal cells of small intestine and thus facilitates sodium absorption.
B. Glucose inhibits the diarrheal toxin induced cAMP production in the mucosal cells of small intestine.
C. Na⁺ is co-transported with glucose on the apical surface of the mucosal cells of small intestine.
D. The epithelial sodium channels (ENaC) are activated by glucose in colon.

Which one of the following is true?

1. Only A
2. A and B
3. Only C
4. C and D

110. A patient has episodes of painful spontaneous muscles contraction, followed by periods of paralysis of the affected muscles. It was identified as primary hyperkalemic paralysis, an inherited disorder. The possible causes of the paralysis are -

A. The elevation of extracellular K⁺ causes hyperpolarization of skeletal muscle cells.
B. The hyperpolarization of the muscle cell membrane inactivates sodium channels.
C. The elevation of extracellular K⁺ causes depolarization of skeletal muscle cells.
D. The sodium channels are voltage inactivated in depolarized state

Which one of the following is true?

1. Only A
2. A and B
3. Only C
4. C and D

111. Myoglobin (Mb) in muscles, Hemoglobin A (HbA) in adult RBC, Hemoglobin C (HbC) in patients with thinner RBC and Hemoglobin S (HbS) in sickle cell disease are four different hemoproteins. Oxygen saturation kinetics of these four proteins is different. Which of the following profile is most plausible?
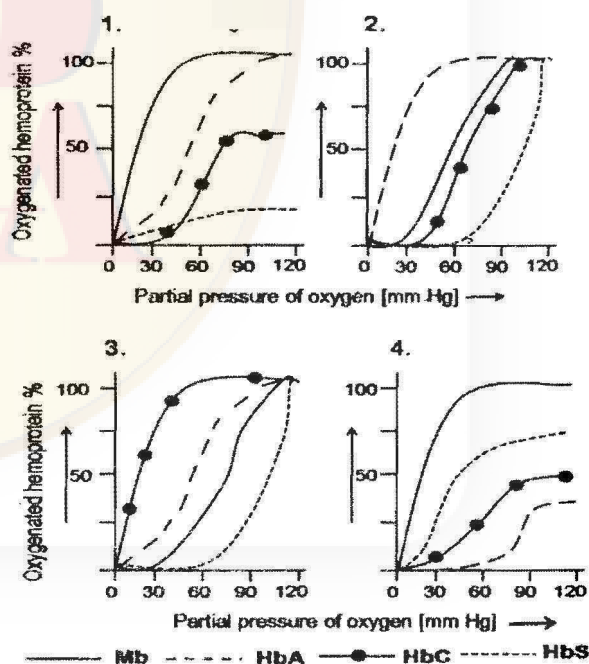

112. Maintaining the salt concentration and volume of plasma are two key parameters for physiological processes achieved by kidney. Which of the following structural and functional combines is the most efficient renal regulatory system in mammals?

Combination No.	Structural	Functional
1	Large glomerulus, long proximal and distal tubules, long Henle's loop	Transepithelial potential in proximal tubule, countercurrent multiplier, ADH responsiveness of distal tubule
2	Small glomerulus, short proximal and distal tubule short Henle's loop	Transepithelial potential in distal tubule, very high ADH concentration in circulation
3	Very large glomerulus, short proximal tubule, very long distal tubule, long Henle's loop	Very efficient glomerular filtration, prevention of solute loss
4	Small glomerulus, long proximal and distal tubules, Henle's loop	Preventing water and solute filtration, excreting solute, lowering ADH responsiveness

113. Which one of the following graphs best represents the hormone profile in a rat right after mating?
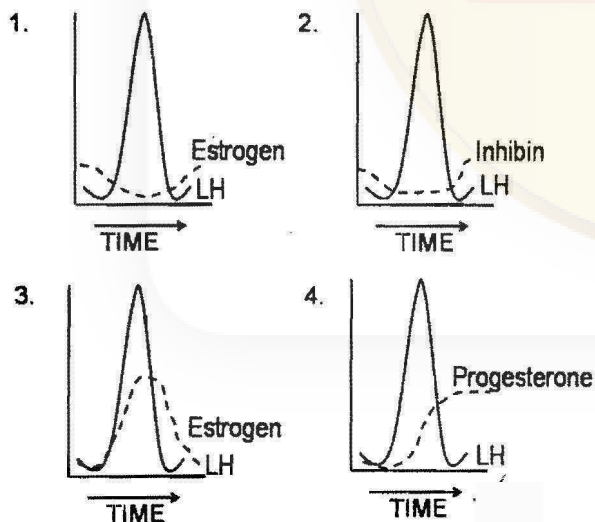
114. Which of the following representations of chromosomal arrangement in meiotic metaphase I best explains the Law of Independent Assortment?

% of cells with arrangement
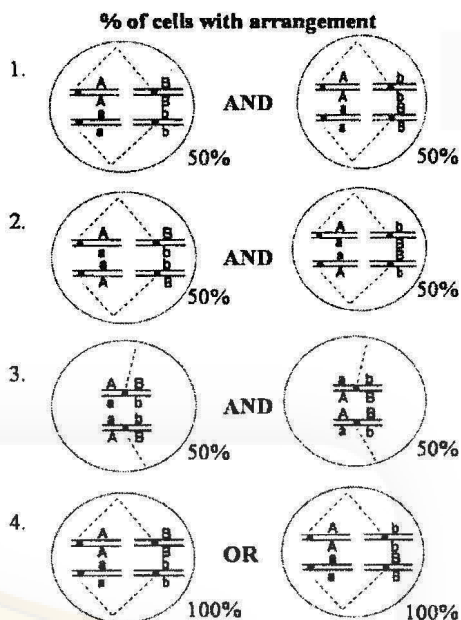
115. Which of the following statements are true for Robertsonian translocations?

A. The size of the homologous chromosome involved in translocation will differ
B. Genes on the chromosome involved in translocation will show linkage with genes with which it normally independently assorts.
C. There will be change in the physical map, but no change in the genetic map.
D. It can be identified by G-banding of chromosomes.
E. It can be identified by C-banding of chromosomes.
F. It can lead to Down syndrome

Which one of the following combinations is correct?
1. A, C and D
2. A, D and F
3. A, B, D and F
4. A, C, E and F

116. Ames test is used to evaluate mutagens in the environment. Which of the following statements about Ames test are true?
A. The mutagenic effect of a compound is tested using an auxotrophic strain of *Salmonella typhimurium*
B. The mutagenic effect of a compound is tested using *His⁻* strain of *Escherichia coli*.

C. Using appropriate strains, compounds causing base substitutions and frame shift mutations can be distinguished.

D. Liver enzymes are important as they are activated by test compound to evaluate its mutagenicity potential.

E. Many compounds may have to be converted to bioactive metabolites, which is carried out by the enzymes from the liver.

1. A, C and D
2. A, B and D
3. A, C and E
4. A and E only

117. The genetic map of three genes in *Drosophila melanogaster* is given below:
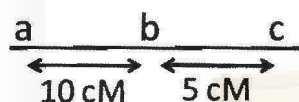
A cross, as given below is made between individuals of the genotype:

$$\frac{a^+ \quad b^+ \quad c}{a^+ \quad b^+ \quad c} \quad X \quad \frac{a \quad b \quad c^+}{a \quad b \quad c^+}$$

The female F_1 progeny are test-crossed and 1000 progeny are obtained. Assuming that there has been no double crossover, what is the expected number of progeny with the genotypes:

(A)
$$\frac{a^+ \quad b \quad c^+}{a \quad b \quad c}$$

(B)
$$\frac{a^+ \quad b^+ \quad c^+}{a \quad b \quad c}$$

(C)
$$\frac{a^+ \quad b^+ \quad c}{a \quad b \quad c}$$

Select the set which shows the correct number of expected progeny.

Set	(A)	(B)	(C)
1.	100	50	850
2.	50	25	425
3.	100	850	50
4.	0	425	75

118. The following pedigree shows the inheritance pattern of a rare recessive disorder with complete penetrance.
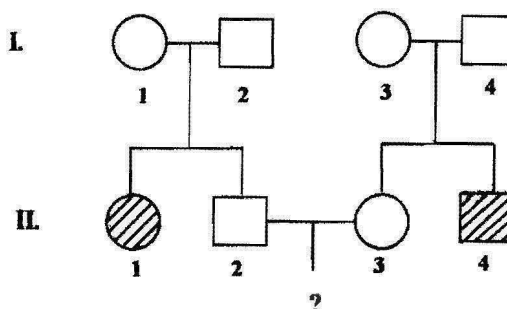
A child from marriage between individuals II-2 & II-3 will show the disorder only if the parents carry the recessive allele. What is the probability that the child will show the disorder?

1. 1/9, and the probability of the parents to carry the recessive allele is 2/3.
2. 1/4, and the probability of the parents to carry the recessive allele is 3/4.
3. 1/16, and the probability of the parents to carry the recessive allele is 2/3.
4. 1/64, and the probability of the parents to carry the recessive allele is 3/4.

119. DNA from a strain of bacteria with genotype $a^+ b^+ c^+ d^+ e^+$ was isolated and used to transform a strain of bacteria that was $a^- b^- c^- d^- e^-$. The transformed cells were tested for the presence of donated genes. The following genes are found to be co-transformed

i. a^+ and d^+
ii. b^+ and e^+
iii. c^+ and d^+
iv. c^+ and e^+

The order of genes on the bacterial chromosome is

1. $a - b - c - d - e$
2. $a - d - c - e - b$
3. $a - c - d - e - b$
4. $a - d - b - e - c$

120. Coelomates have
A. fluid filled body cavity.
B. a complete lining called peritoneum, derived from mesoderm covering the body cavity.

C. a complete lining called peritoneum, derived from ectoderm covering the body cavity.
D. Round worm as representative of this group.
E. Flat worm as representative of this group.

Select the correct combination

1. A, C and D
2. A, C and E
3. A, B and D
4. A and B

121. Most biologists agree that seaweeds are protists. Some biologists think that at least some seaweeds should be considered plants, not protists. Which of the following would support the latter one?

1. Certain seaweeds contain several kinds of specialised cells.
2. Certain seaweeds have multicellular organization.
3. Certain seaweeds are found to be prokaryotic.
4. Certain seaweeds undergo sexual and asexual reproduction.

122. Which of following shows the correct systematic hierarchy?

1. Kingdom → Phylum → Subphylum → Superclass → Class → Subclass → Cohort→Order → Suborder→ Super family→ Family → Subfamily → Genus → Subgenus → Species → Subspecies
2. Kingdom → Phylum → Subphylum → Cohort → Superclass → Class → Subclass→ Superfamily→ Family → Subfamily → Order → Suborder → Genus → Subgenus →Species → Subspecies
3. Kingdom → Phylum → Class → Order → Cohort → Family → Genus → Species
4. Kingdom → Phylum → Class → Cohort→ Family → Order → Genus → Species

123. Match the following:

	Disease		Pathogen/Causative factor
A	Creutzfeldt–Jakob	(i)	Fungi
B	Pneumocystis	(ii)	Virus
C	Legionnaires diseases	(iii)	Prion
D	Rabies	(iv)	Bacteria

1. A–iv, B – iii, C – ii, D – i
2. A–iii, B – i, C – iv, D – ii
3. A–i, B – ii, C – iii, D – iv
4. A–ii, B – iv, C – i, D – iii

124. In the following diagram, two models of succession are represented. In this diagram A, B, C and D are species and arrows indicate 'is replaced by'
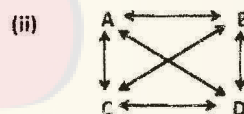
Based on the above, which statement is correct?

1. Fig.(i) represents facilitation model and Fig.(ii) represents tolerance model
2. Fig.(i) represents tolerance model and Fig. (ii) represents facilitation model
3. Fig.(i) represents facilitation model and Fig.(ii) represents inhibition model
4. Fig.(i) represents tolerance model and Fig.(ii) represents inhibition model

125. Lindeman's efficiency between trophic levels is depicted by the formula:

$$Efficiency = \frac{A}{B}$$

Where, A and B, respectively are:

1. 'assimilation at trophic level n' and 'assimilation at trophic level n – 1'
2. 'intake at trophic level n' and 'assimilation at trophic level n – 1'

3. 'assimilation at trophic level n' and 'net productivity at trophic level n – 1'
4. 'intake at trophic level n' and 'net productivity at trophic level n – 1'

126. The following matrix shows the relationship between probability of death and duration of species association.

In the above, A, B, C and D are:

1. A – Parasites, B = Parasitoids, C – Grazers, D - Predators
2. A – Carnivores, B = Herbivores, C – Parasites, D - Parasitoids
3. A – Grazers, B = Parasites, C – Herbivores, D - Parasitoids
4. A – Predators, B = Parasitoids, C – Parasites, D - Carnivores

127. An observation was made on a species experiencing three factors A, B and C in order to infer a density dependent population regulation by a factor. The following graph shows the relationship between the adverse effect of the factors in terms of number and population density.
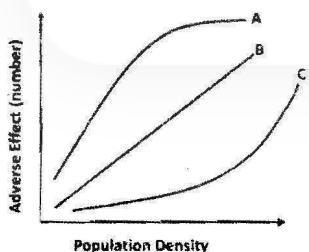
Based on the above observation, which of the following is correct?

1. A – Density independent; B = Density dependent; C – Inversely density dependent

2. A – Inversely density dependent; B = Density independent; C – Density dependent
3. A – Density dependent; B = Inversely density independent; C – Density independent;
4. A – Density dependent; B = Density independent; C – Inversely density dependent

128. Which of the following biotic provinces are part of Deccan Peninsula biogeographic zone of India?

1. Malabar Coast, Western Plateau, Eastern Plateau
2. Western Ghats, Central Plateau, Eastern Plateau
3. Central Plateau, Eastern Plateau, Chhota Nagapur
4. Central Plateau, Malabar Coast, Western Ghats

129. Which one of the following plants group combinations reflects the correct increasing order of the number of species it has?

1. Gymnosperms, Bryophytes, Algae, Angiosperms
2. Angiosperms, Algae, Gymnosperms, Fungi
3. Algae, Bryophytes, Gymnosperms, Angiosperms
4. Angiosperms, Gymnosperms, Bryophytes, Algae

130. Microevolution is the term used for changes in allele frequencies that occur over time. This occurs

A) within a population at species level
B) within a community at genus level
C) due to appearance of new genes from infections
D) due to mutation, natural selection, gene flow and genetic drift

Which of the following combinations is NOT appropriate?

1. A and C
2. A and D
3. B and C
4. B and D

131. The following genotypes were observed in a population

Genotype	Number
HH	90
Hh	60
hh	50

Which of the following is the correct frequency of H allele and what will be the expected number of HH in the given population?

1. 0.60 and 72
2. 0.80 and 96
3. 0.50 and 32
4. 0.30 and 90

132. The first vertebrate animal appeared in which of the following geological ages?

   A) Paleozoic era
   B) Mesozoic era
   C) Ordovician period
   D) Cretaceous period
   E) Mississippian epoch
   F) Paleocene epoch

Which of the following combinations give the best answer?

1. A, C and F
2. A and F
3. B, D and E
4. A and C

133. Fore limb of human and flippers of whale are embryologically homologous structures.
What does the study of homologous structures tell us about evolution?

A. This is the example of adaptive radiation, occurred due to similar group of organisms inhabiting different environments
B. This is the example of divergent evolution, occurred due to similar group of organisms inhabiting different environments
C. Similar group of organisms with mutations and variations getting naturally selected in different environments
D. This is the example of convergent evolution, occurred due to similar group of organisms inhabiting different environments

Which of the following is the correct combination?

1. A, B and C
2. A and D
3. B and D
4. Only D

134. Foster pups were presented to a primiparous rat at the mid gestation period. Which of the following behaviour will be found in the pregnant rat?

1. The rat shows maternal behaviour after a few days of presentation of pups.
2. The rat attacks and kills the pups every time they are presented.
3. The rat rejects the pups after repeated presentation.
4. The rat shows fear response for a few days.

135. Electrons are transferred from reduced co-enzymes like NADH, NADPH to pyruvic acid or its derivatives during fermentation. Those final electron acceptors are reduced to the end-products for example latic acid, propionic acid, etc. The end products depend on the particular microorganism and the substrate

| Organism		End product (s)	
A	Streptococcus	a.	Butanediol, formic acid
B.	Clostridium	b.	Lactic acid
C.	Salmonella	c.	Butyric acid, isopropanol
D.	Enterobacter	d.	Succinic acid, acetic acid

The correct match is

1. A – a, B – b. C – c, D – d
2. A – d, B – c, C – a, D – c
3. A – b, B – c, C – d, D – a
4. A – c, B – d, C – a. D – b

136. In resting cells, proteins X and Y are localized in the cytosol. Upon stimulation with lipopolysaccharide (LPS), both of them are phosphorylated and translocate to the nucleus. You have used antibodies against phosphorylated forms of proteins X and Y which are conjugated to either red, or green or blue dye. Keeping optical aberration of light in mind, which one of the following will be the best for visualizing X and Y in the nucleus by fluorescence microscopy ?

1. Anti green X and anti red Y
2. Anti red X and anti green Y
3. Anti red X and anti blue Y
4. Anti blue X and anti green Y

1. B, E and G
2. B, D and F
3. A, D and F
4. B, C and F

137. A transgenic plant is developed with the following T-DNA construct
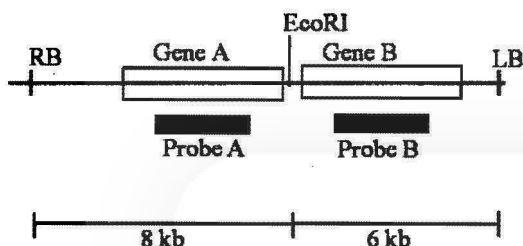

In order to analyze the nature of integration, genomic DNA digested with EcoRI was used for Southern hybridization using either probe A or B. The result obtained is as
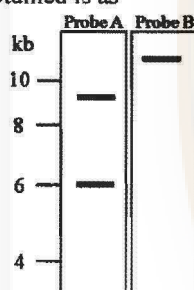

The following conclusions were made:

A. There are two copies of the T-DNA cassette integrated at one loci and a third copy at another loci.
B. There are two copies of the T-DNA cassette integrated at one loci.
C. Complete T-DNA cassette has been integrated in all cases.
D. In one T-DNA cassette there is a truncation towards the RB
E. In one T-DNA cassette there is a truncation towards the LB
F. The arrangement of the T-DNA cassettes integrated at the same loci is
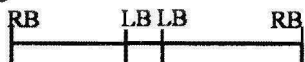
G. The arrangement of the T-DNA cassette integrated at the same loci is
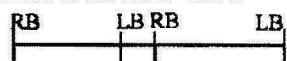
Which of the above are correct?

138. While designing an experiment for *Agrobacterium* mediated plant transformation, a student noted down the following points:

A. Ti and Ri plasmids induce crown gall and hairy root disease, respectively
B. Enzymes octopine synthase and nopaline synthase involved in the synthesis of octopine and nopaline, respectively are encoded by T-DNA.
C. All the six *vir* genes, *vir A*, *vir B*, *vir C*, *vir D*, *vir E* and *vir G* are absolutely required for virulence.
D. Almost perfect 25 bp direct repeat sequences flanking all Ti and Ri plasmids in the T-DNA region is essential for T-DNA transfer.

Which one of the following combinations of the above statement is correct?

1. A, B and C
2. B, C and D
3. A, C and D
4. A, B and D

139. The following are certain facts regarding bioremediation:

A. Biodegradable plastics are made using polyhydroxy alkanoates (PHAs) such as polyhydroxybutyrate (PHB).
B. *Pseudomonas putida* F1 bacterial strain is involved in degradation of aromatic hydrocarbon.
C. The bacterium *Deinococcus radiodurans* consume and digest toluene and ionic mercury from highly radioactive nuclear waste.
D. Bioaugmentation is a process of improving the microorganisms already existing in the system for degradation of xenobiotic compound.

Which one of the following combination of above statements is correct?

1. A, B and C
2. A, B and D
3. A, C and D
4. B, C and D

140. An unknown peptide was isolated from the leaf of a medicinal plant and purified to homogeneity. The peptide did not yield any sequence when subjected to Edman degradation. However, tryptic digest of the peptide produced a unique sequence. The mass of the intact peptide was found to be 18 Da less than that obtained from the trypsin treated sample. The possible interpretation of the above experimental results could be that the

A. the N-terminus of the peptide was blocked by acetylation or methylation.
B. the peptide was cyclic and contained at least one internal arginine or lysine residue.
C. the peptide was cyclic and contained a lysine or arginine residue at the C-terminus.
D. the peptide was cyclized by peptide bond formation between α-amino group and α-carboxyl group.

Which of the above statements is true?

1.   A and D
2.   A and B
3.   B and C
4.   B and D

141. A gene is regulated by a novel transcription factor. The following techniques may be used to identify the cis- regulatory element in the 1 kb promoter sequence of the gene where the novel transcription factor binds:
A. Bioinformatics analysis.
B. Cell based reporter assay.
C. S1 nuclease assay.
D. Electrophoretic mobility shift assay.
E. DNAse-1 foot-printing analysis.

Which one of the following can help to identify the cis element?

1.   A and B
2.   C and E
3.   D only
4.   E only

142. A protein D is encoded by a gene, which is 5 Kb long and has three Hind III restriction enzyme sites. The first one is 0.5 Kb from the transcription start site, the second one is 2.5 Kb from the first site and the third one is 0.5 Kb internal to the stop codon. The second site is polymorphic. In order to find out whether fetal cells contain the normal or the mutated gene, total genomic DNA from fetal cells was isolated, completely digested with Hind III, separated in an agarose gel, transferred to membrane and detected by a probe against the region between the second and third restriction site. Which one of the following band patterns will be obtained if the fetal cell is heterozygous?
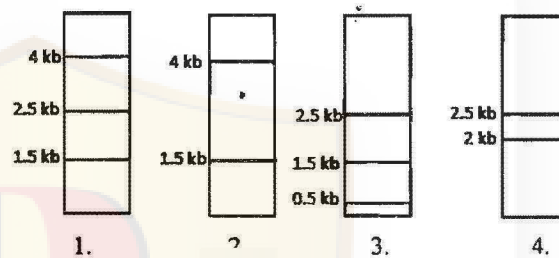
143. Given below are the experimental protocols to find out the exact location of repetitive DNA sequence in mitotic chromosome by FISH (fluorescence in situ hybridization). Which one of the protocols will give the correct result?

1.   Mitotic chromosomes were fixed on glass slide→incubated with biotinylated telomeric DNA→denatured→incubated with fluorescently labeled avidin→localization observed under fluorescence microscope.
2.   Mitotic chromosomes were fixed on glass slide→denatured→incubated with FITC labeled unrelated non- repetitive DNA sequence→ counterstained with propidium iodide→ localization observed under fluorescence microscope.
3.   Mitotic chromosomes were fixed on glass slide→denatured→incubated with biotinylated satellite DNA→ incubated with fluorescently labeled avidin→localization observed under fluorescence microscope.

4.   Mitotic chromosomes were fixed on   glass slide→incubated with repetitive   DNA sequence binding protein→   denatured→FITC labeled antibody   against the protein→localization observed under fluorescence microscope.

144. At 25°C values of $[\theta]_{222}$, the mean residue ellipticity at 222 nm, are $-33,000$ and $-3,000$ deg cm^2 $dmol^{-1}$ for a polypeptide existing in α-helical (α) and β-structure (β), respectively. If this polypeptide undergoes a two-state heat-induced $\alpha \rightarrow \beta$ transition, and a value of $[\theta]_{222} = -18,000$ deg cm^2 $dmol^{-1}$ is observed at 60°C, then this observation leads to the conclusion that the α-helix conversion to β-structure is:

1.   40%
2.   50%
3.   55%
4.   60%

145. An EEG was recorded and its power spectrum analyses were done in rats with implanted electrode for a long time. The power of the EEG waves decreased two months after electrode implantation.

This observation may be due to the following:

A. Glial cells accumulate surrounding the exposed tips of electrodes.
B. Degeneration of neurons occur surrounding the electrode tips due to metal ion deposition.
C. Coating of electrodes are destroyed with time.
D. The microsocket becomes loose with time.

Which one of the following is true?
1.   Only A
2.   A and B
3.   Only C
4.   C and D

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