

Sr.No. 34030

E

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.....

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

Name

OMR Answer Sheet No.....

.....
Signature of the Invigilator

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PART 'A'

4.

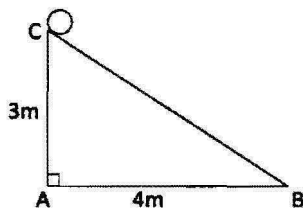
1. A cart wheel rolls along a straight line. If the distance covered is equal to the diameter of the wheel, what is the angle through which the wheel has turned?

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?

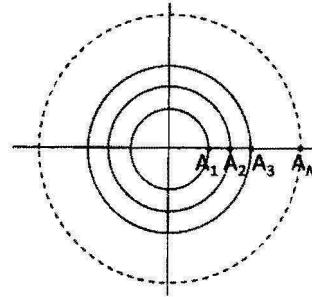
1. 1
2. 2
3. 3
4. 0

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

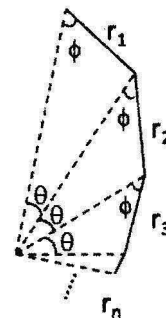
1. $\left(\frac{5}{\pi}\right)$ cm
2. $\left(\frac{5}{\pi}\right)$ m
3. $\left(\frac{10}{\pi}\right)$ cm
4. 10 cm



A set of concentric circles of integer radii $1, 2, \dots, N$ 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.

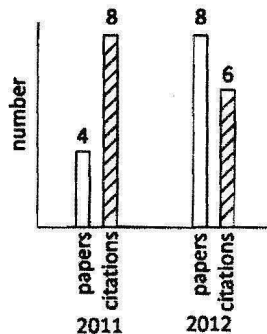


The figure above shows an infinite series of triangles, in which $r_1 > r_2 > r_3 \dots$. What is the total length of the solid line segments in the figure?

1. $\frac{r_1}{r_2} + \frac{r_2}{r_3} + \dots$
2. $\frac{r_1^2}{r_1 - r_2}$
3. $\frac{r_2^2}{r_1 + r_2}$
4. $\frac{r_1 - r_2}{r_1^2}$

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

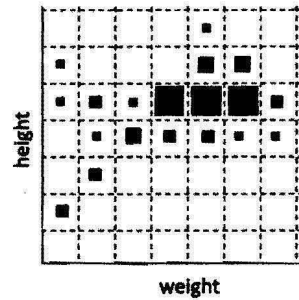
7.



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



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: $30^\circ \text{ N}, 45^\circ \text{ E}$
 B: $30^\circ \text{ N}, 135^\circ \text{ W}$
 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'

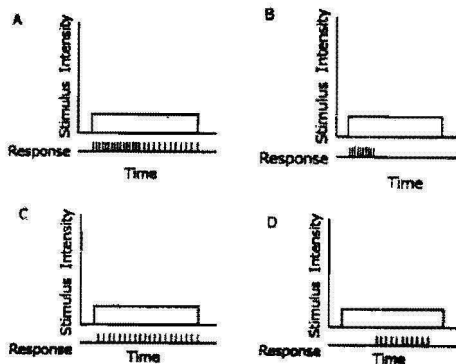
21. The interaction energy between atom A and B is $\sim 400 \text{ kJmol}^{-1}$.
The type of interaction between them is
 1. $\pi - \pi$.
 2. covalent.
 3. ion-dipole.
 4. hydrogen bond.
22. Which one of the following bases has the largest hydrogen bonding possibility?
 1. Adenine
 2. Guanine
 3. Cytosine
 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. $\text{N}_2 > \text{Ethanol} > \text{H}_2\text{O} > \text{Glucose} > \text{Ca}^{+2} > \text{RNA}$
 2. $\text{H}_2\text{O} > \text{Glucose} > \text{Ethanol} > \text{N}_2 > \text{Ca}^{+2} > \text{RNA}$
 3. $\text{Ca}^{+2} > \text{RNA} > \text{N}_2 > \text{Ethanol} > \text{H}_2\text{O} > \text{Glucose}$
 4. $\text{Ethanol} > \text{RNA} > \text{Ca}^{+2} > \text{H}_2\text{O} > \text{Glucose} > \text{N}_2$
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:
- $$ced9 \longrightarrow ced4 \longrightarrow ced3$$
- 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.

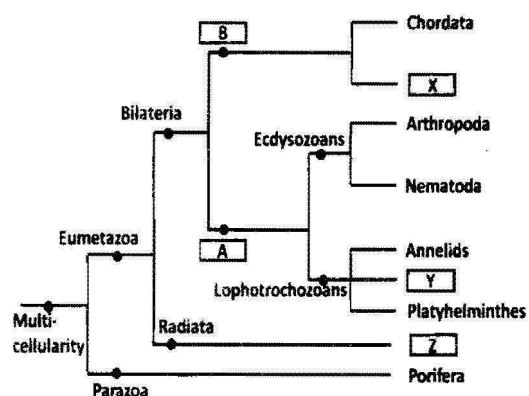
49. A *cis-trans* complementation test is carried out to identify
1. if two mutations are allelic in nature.
 2. if two genes interact with one another
 3. the number of genes influencing a phenotype.
 4. to understand the dominance/recessive relationships between alleles.

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.

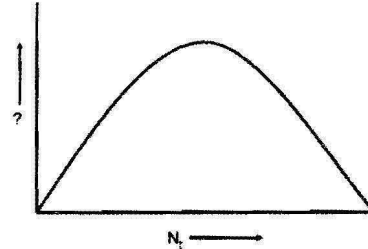
51. Given below is an evolutionary tree.



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. $dN/dt \cdot \frac{1}{N}$
 4. K
57. Annual weeds of arable lands are classified as
1. phanerophytes.
 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 → Encocelomates → 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

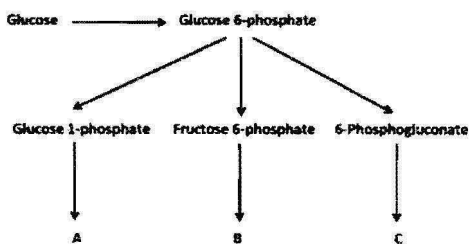
60. Which of the following diseases **does not** leave any paleontological evidence?
1. Tuberculosis
 2. Arthritis
 3. Rickets
 4. Cholera
61. Greater male investment in the care of offspring is most likely to lead to
1. a lek system.
 2. stronger female choice.
 3. reverse sexual dimorphism.
 4. run-away 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 B₁₂.
 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. KYAAKFK

72. 100 ml of 0.1 M sodium acetate solution has a pH of 8.90. To this solution 1000 μ l of 1M acetic acid ($pK_a = 4.76$) 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:

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

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?

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

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 ΔC_p (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 1 μ m/s, 0.05 μ m/s and 0.005 μ m/s, respectively. 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 Katapin 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.

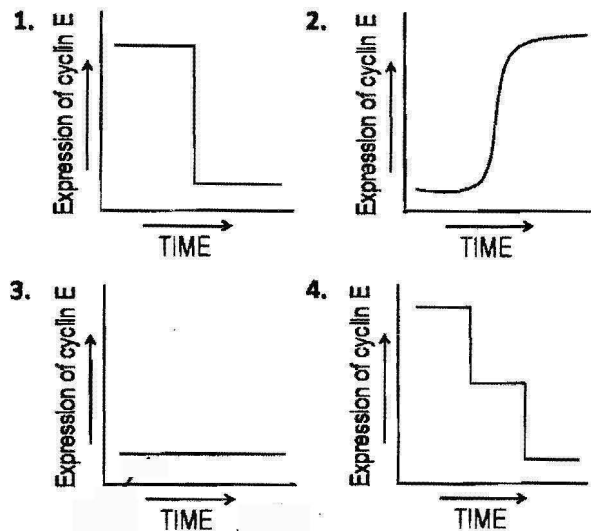
A. In the absence of glucose, lactose is used after a lag period of about three times as long as the lag period for glucose utilization.
 B. The presence of hydrocarbons does not affect the lag period for the utilization of lactose.
 C. The utilization pattern for all hydrocarbons is similar to that 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?

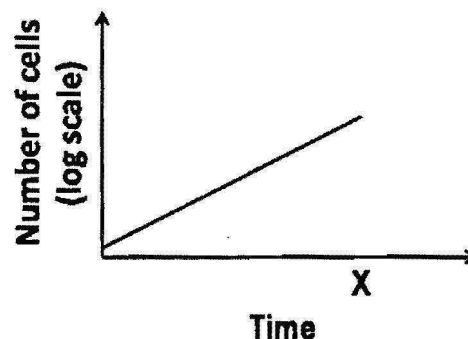
1. Diauxie
 2. End point repression

3. Catabolite repression
 4. Transcription attenuation

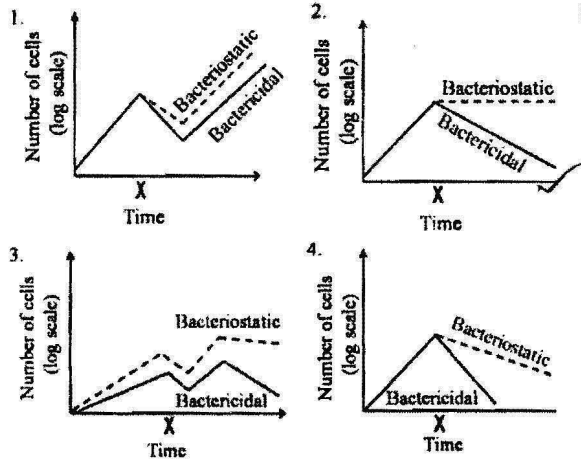
81. Cell cycle is regulated by various cyclins and cyclin dependent kinases (CDK). On receiving mitotic stimuli, cyclin D, the first cyclin expressed, binds with existing CDK4 to form the active cyclin D-CDK4 complex. This in turn phosphorylates retinoblastoma protein (Rb) which activates E2f to further 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 cyclin 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?

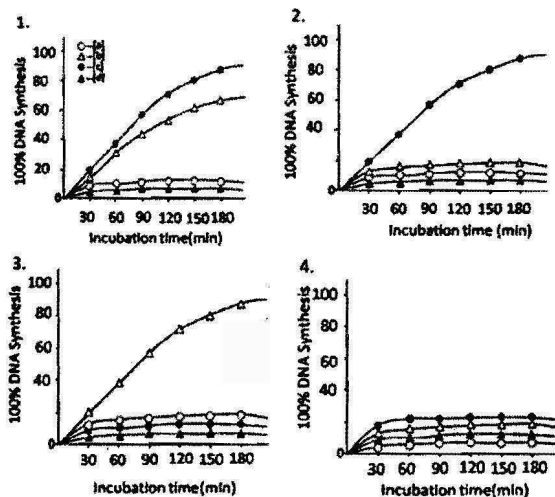


83. In a cell free extract containing DNA polymerase I, Mg^{2+} , dATP, dGTP, dCTP and dTTP (3H), the following DNA molecules were added:

- Single stranded closed circular DNA molecule containing 824 nucleotides.
- 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.
- Double stranded linear DNA molecule containing 1578 nucleotides having free-3'-OH group at both ends.
- 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:

- damage bypass
- damage reversal
- damage removal

Many repair proteins are isolated like

- DNA methyltransferase
- DNA glycosylase
- DNA polymerase IV

Which one of the following represents the correct combination?

- (i) – (a), (ii) – (b), (iii) – (c)
- (i) – (b), (ii) – (c), (iii) – (a)
- (i) – (c), (ii) – (a), (iii) – (b)
- (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:

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

Possible interpretation of the above results are:

- RNA polymerase can loosely bind to any part of the genome but its affinity becomes strong only when it reaches the promoter.
- Binding of RNA polymerase to non-promoter regions of the genome leads to the generation of various non-coding regulatory RNAs.
- Non-coding RNAs are generated from mRNA coding genes due to aberrant transcription initiation and termination.
- 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:

- A and B
- B and D
- A and D
- B and C

86. Aminoacyl tRNA synthetases face two important challenges:

- they must recognize the correct set of tRNAs for a particular amino acid.
- 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:

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

Which of the following is correct?

- A and B
- A and C
- B and C
- 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:

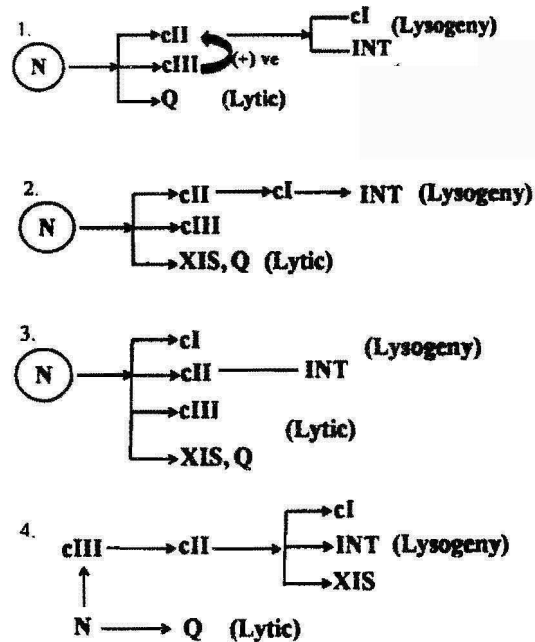
- mRNA of all proteins, except those of Hsps, undergoes degradation during heat shock.
- Cap-dependent translation of most mRNAs is affected during heat shock due to denaturation of cap binding protein, eIF-4E.
- Translation initiation of Hsp mRNAs takes place through their internal ribosome entry sites (IRES)
- 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?

- A and D
- B and C
- C and D
- 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.

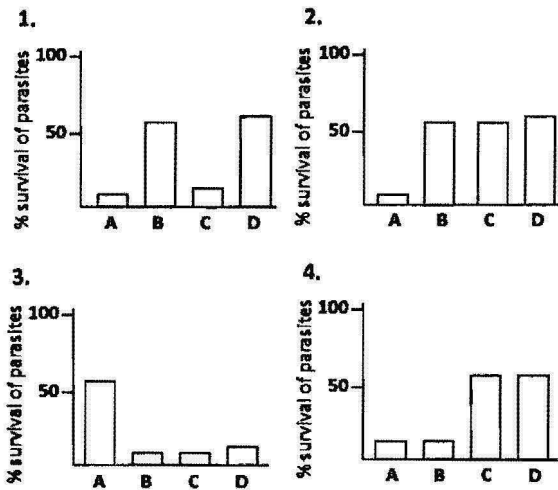
Which one of the following diagrams represents the control mechanism correctly?



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.

- IFN- γ .
- IFN- γ +AMT, a potent iNOS inhibitor.
- IFN- γ + apocyanin, a NADPH oxidase inhibitor.
- 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

- loss of binding affinity of receptor A due to mutation in the extracellular domain.
- loss of binding affinity of receptor B due to mutation in the extracellular domain.
- mutation in the tyrosine kinase domain rendering it inactive.
- 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?

- A and B
 - B and C
 - C and D
 - 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?

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

- VE-cadherin acts as coreceptor for VEGF (vascular endothelial growth factor) – mediated signal transduction in endothelial cells.
- VE-cadherin is important for desmosome formation and interaction of intermediate filaments.
- 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

- decoy receptor activity.
- anti-proliferative activity.
- cellular defense activity against immune-cytotoxic killing.
- 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?

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