

**Association of Teachers in Biological Sciences**  
**NATIONAL STANDARD EXAMINATION IN BIOLOGY 2013-2014**

Date of Examination : 24th November 2013

Time 15.00 to 17.00 Hrs

Q. P. Code No. 

3
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3
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7
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THREE
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THREE
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SEVEN
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**INSTRUCTION TO CANDIDATES**

1. On the answer sheet, fill up all the entries carefully in the space provided, **ONLY In BLOCK CAPITALS**. Use only **BLUE of BLACK BALL PEN** for making entries and marking answer. Incomplete / incorrect / carelessly. Filled information may disqualify your candidature.
2. Write the Q.P. Code no. mentioned above on YOUR answer sheet (in the space provided). Otherwise your answer sheet will NOT be examined.
3. The question paper has 80 multiple choice question. Each question has 4 options, out of which only one is correct. Choose the correct answer and mark a cross in the corresponding box on the answer sheet as shown below.

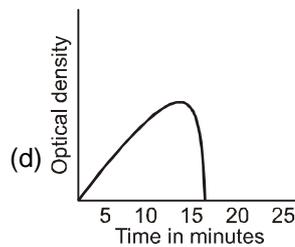
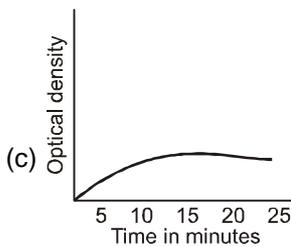
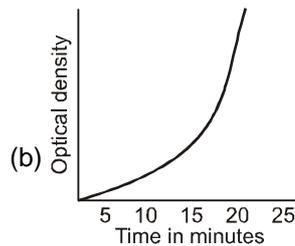
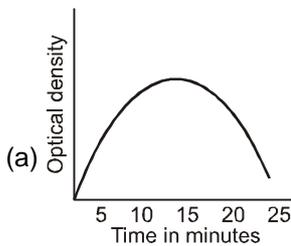
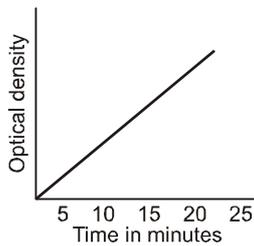
Q.	a	b	c	d
22			X	

4. A correct answer carries 3 marks and 1 mark will be deducted for each wrong answer.
5. All rough work may be done on the blank sheet provided at the end of the question paper.
6. **PLEASE DO NOT MAKE ANY MARKS OTHER THAN (X) IN THE SPACE PROVIDED ON THE ANSWER SHEET.** Answer sheets are evaluated with the help of a machine. Due to this, **CHANGE OF ENTRY IS NOT ALLOWED.**
7. Scratching or overwriting may result in wrong score. **DO NOT WRITE ANYTHING ON THE BACK OF ANSWER SHEET.**
8. Use of a nonprogrammable calculator is allowed.
9. The answers / solutions to this question paper will be available on our website - [www.iapt.org.in](http://www.iapt.org.in) by 30th November 2013.

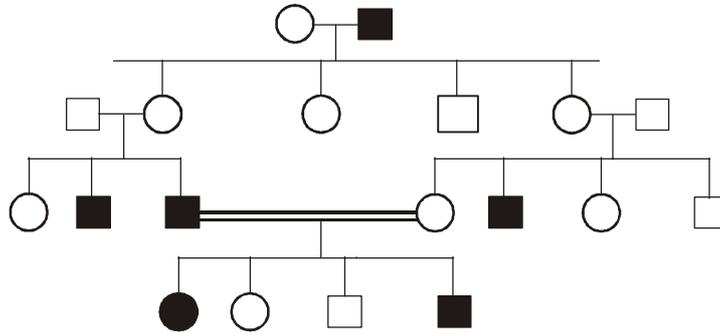
**CERTIFICATES & AWARDS**

- (i) Certificates to top 10% students of each centre.
- (ii) Merit certificates to statewise Top 1% students.
- (iii) Merit certificate to Nationwide Top 1% students.
10. **Result sheets** and the “**centre top 10%**” certificates of NSEB are dispatched to the Professor in charge of the centre. Thus you will get your marks from the Professor in charge of your centre by January 2014 end.
11. 300 (or so) students are called for the next examination - Indian National Biology Olympiads (INBO) Individual letters are sent to these students ONLY.
12. Gold medals may be awarded to TOP 35 students in this entire process
13. No queries will be entertained in this regard.

1. Though the cud chewing animals mostly feed on fibrous foods which low on fats. sufficient fatty acids are produced and absorbed from the gastrointestinal tract. This is due to the :
- interconversion of food in the liver.
  - fermentation by bacteria in pregastric region.
  - enzyme catalyzed processes in the duodenum.
  - processes mediated by commensal bacteria in the rectum.
2. Ram was studying anatomy of young roots of maize, mangolia, pine and money plant. He forgot to label the slides. If he finds only sieve cells without sieve tubes and companion cells, this slide has to be of:
- Pine
  - Money plant
  - magnolia
  - Maize.
- Sol.** Basically gymnosperms like pine do not bear sieve tube and companion cells.
3. The function of transport of nutrients and respiratory gases within the body is carried out by water in all the following **except**:
- sponges
  - jelly fishes
  - holothurians
  - cuttle fishes
4. In an experiment, substrate was incubated with an enzyme to obtain a coloured product. When colour intensity was measured every 5 minutes using a colourimeter, the following graph was obtained.



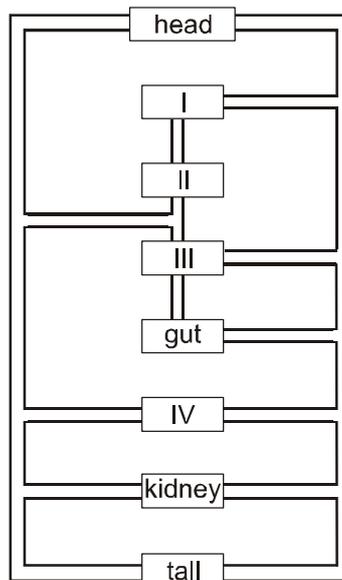
5. The type of inheritance represented in the pedigree given below is:



- (a) autosomal dominant (b) mitochondrial inheritance  
(c\*) X-linked recessive (d) X-linked dominant

**Sol.** It represents X-linked recessive trait.

6. A researcher clips pinnae of 20 rabbits trapped in a section of forest and releases them. After a fortnight he traps 28 rabbits in the same section of forest and notices 4 of them with clipped pinnae. His estimate of rabbit population in the sector of the forest should be:
- (a) 2240 (b) 560 (c) 140 (d) 112
7. In the accompanying diagrammatic representation of blood vascular system, organs represented by I, II, III and IV respective are:



- (a) Heart, gills, trunk, liver. (b) Turnk, liver, gills, heart.  
(c) Heart, liver, gills, trunk. (d) Gills, heart, liver, trunk.

8. Water potential ( $\psi$ ) plays important role in water absorption and conduction from soil to leaf. Under which condition the process will go on smoothly?

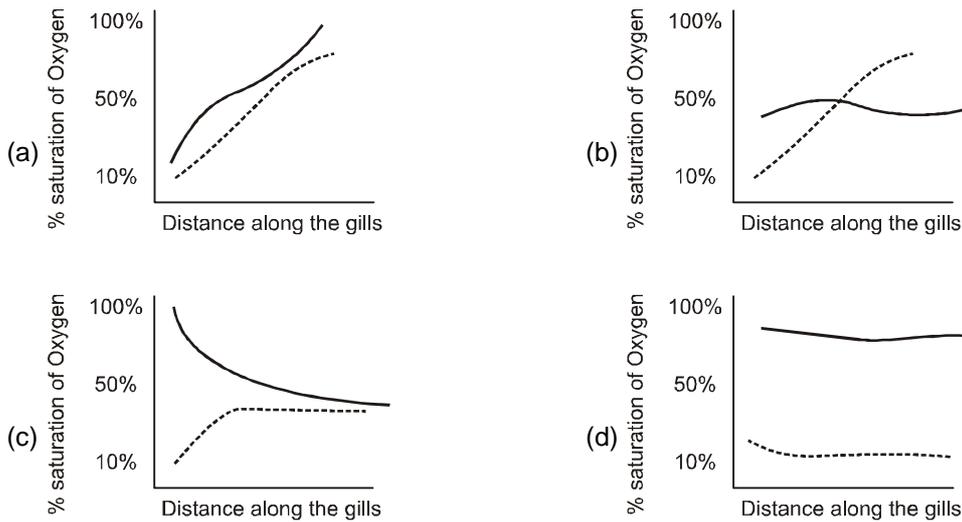
- (a\*)  $\psi_{\text{atmosphere}} < \psi_{\text{leaf}} < \psi_{\text{root}} < \psi_{\text{soil}}$  (b)  $\psi_{\text{atmosphere}} > \psi_{\text{leaf}} > \psi_{\text{root}} > \psi_{\text{soil}}$   
(c)  $\psi_{\text{atmosphere}} = \psi_{\text{leaf}} = \psi_{\text{root}} = \psi_{\text{soil}}$  (d)  $\psi_{\text{atmosphere}} < \psi_{\text{leaf}} = \psi_{\text{root}} > \psi_{\text{soil}}$

**Sol.** Movement of water takes place from high water potential to low water potential.

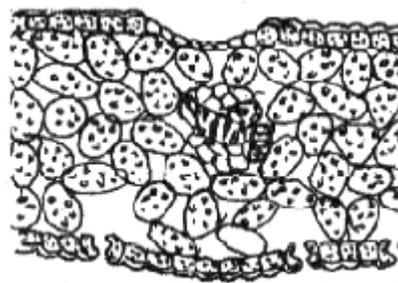
9. The graph below represents the countercurrent exchange mechanism that take place in fish gills to maximize gas exchange.



What would happen if concurrent mechanism countercurrent exchange mechanism?

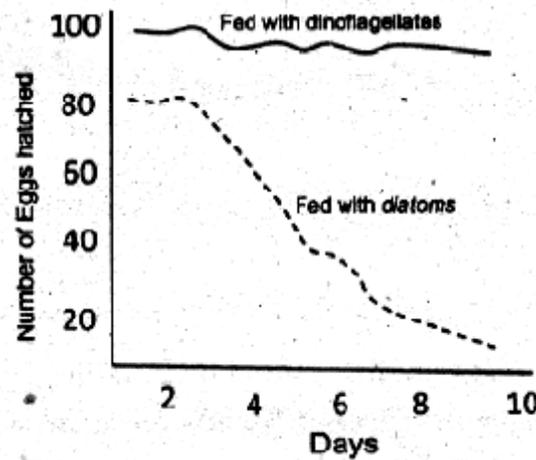


10. Which of these intercellular junction in mucosal cells of internal lining of intestine allows direct passage of solute from one cell to another?  
 (a) Gap junctions      (b) Plasmodesmata      (c) Desmosomes      (d) Tight junctions
11. The cross section of pinna of leaf in the accompanying diagram indicates that the plant must be growing in a habitat with :



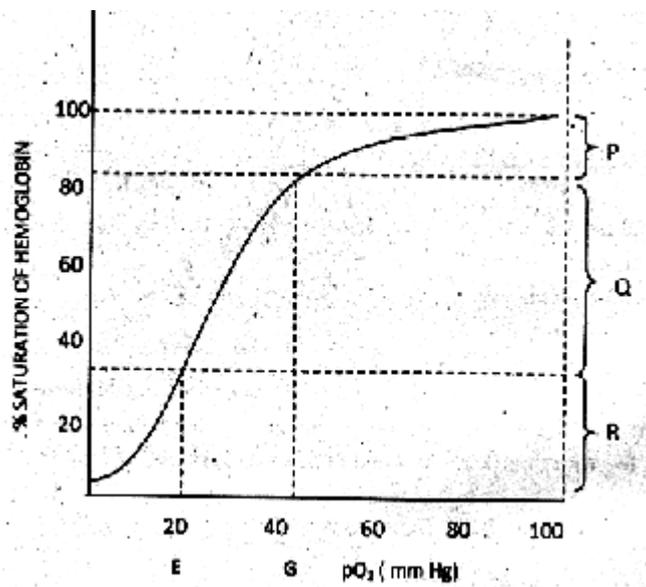
- (a) abundant light and moisture.  
 (b) abundant light but less moisture.  
 (c) less light and abundant moisture  
 (d) less light and less moisture.

12. In an experiment, one population of copepod females was fed with diatoms while another one was fed with dinoflagellates and number of eggs hatched was monitored for 10 days.



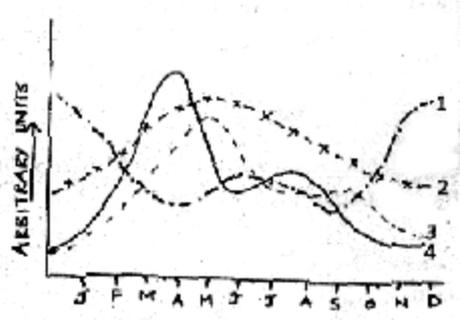
The graph indicates that:

- (a) diatoms are killing female copepods.
  - (b) diatoms are useful for sustaining copepod populations.
  - (c) older female copepods produce less viable eggs.
  - (d) the diatoms are toxic for eggs.
13. Which of the following tissue can be observed after bioling a piece of pinewood in nitric acid for 15 minutes?
- (a) Transfusion tissue
  - (b) Xylem vessels
  - (c\*) Xylem tracheids
  - (d) Phloem parenchyma
- Sol. Because xylem tracheids are lignified.
14. Following graph represents oxyhemoglobin dissociation curve. Point E and G represent venous  $O_2$  pressure during exercise and resting state respectively. How much total percentage of oxygen is unloaded in tissue during exercise?

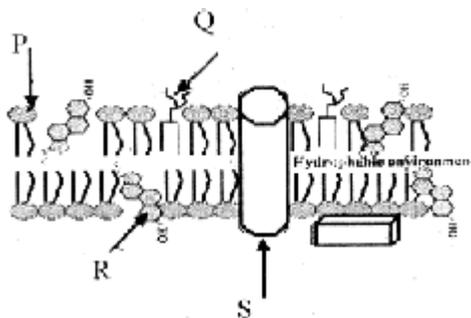


- (a) R
- (b) Q
- (c) P+Q
- (d) P+Q+R

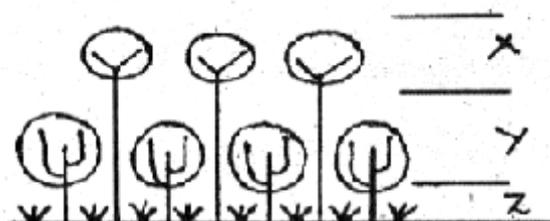
15. In the accompanying diagram distribution of variable like light intensity(L), nutrient availability(N), primary producers(P) and consumers(C), over 12 months in a year has been shown. The lines marked 1 to 4 correspond to:



- (a) N,L,P,C                      (b) L,P,N,C                      (c) P,C,L,N                      (d) C,P,N,L
16. In a given diagram of cell membrane, which letter represents a molecule of cholesterol?

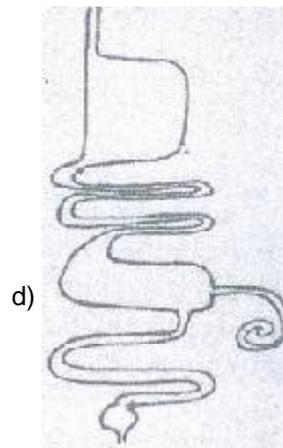
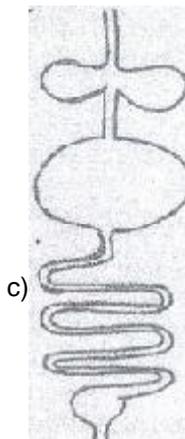
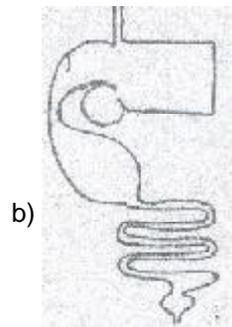
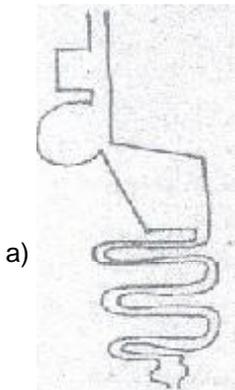


- (a) P                                      (b) Q                                      (c) R                                      (d) S
17. Green manure involves growing leguminous plants and plowing them in. It ensures enrichment of soil since :
- (a) root nodules on them add nitrogen salts.
  - (b) legumes grow faster and accumulates phosphate.
  - (c) legumes incorporate higher amount of potassium.
  - (d) all of the above.
18. The major limiting factors for photosynthesis in a plant community shown in the accompanying diagram at levels X,Y,Z respectively are:



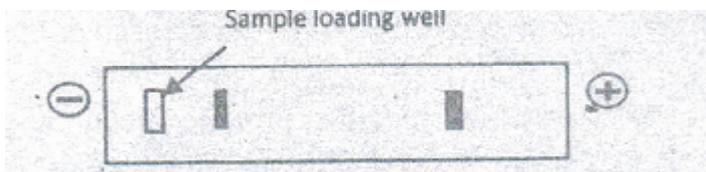
- (a) temperature, light intensity and carbon dioxide.
- (b) carbon dioxide, temperature and light intensity.
- (c) light intensity, carbon dioxide and temperature.
- (d) carbon dioxide, light intensity and temperature.

19. Denitrification is a process carried out by microbes in which nitrates are reduced to molecular nitrogen. This process is predominant in:
- desert
  - bog
  - leached soil
  - tilled farm
20. In the absence of bile; what would be the status of digestion in the duodenum?
- Only lipids will not be digested though proteins and carbohydrates will get digested.
  - Digestion of all kinds of food will be incomplete.
  - All enzymes except pepsin will be denatured due to acidic pH of chyme.
  - Nucleic acids will not be digested while other biomolecules will be digested.
21. Which of the accompanying diagrams pertain to the animals with the post gastric symbiotic digestion?



22. If a branch of day neutral plant is grafted on along day plant exposed to light for less than the critical period:
- graft as well as mother plant will flower.
  - graft as well as mother plant will remain vegetative.
  - graft will bear flowers while mother plant will not.
  - graft will not flower while mother plant will.
23. Transpiration is an energy consuming process. Spraying anti-transpirants in flowering stages may prove advantageous but it is not advantageous in vegetative stages since it will have a direct effect on:
- photosynthesis resulting in stunted plant.
  - translocation of food through phloem.
  - absorption and translocation of minerals.
  - synthesis and accumulation of florigen.

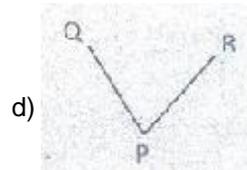
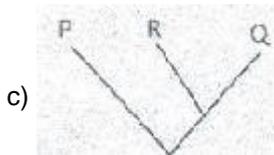
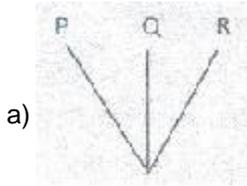
24. Due to leakage, the bags of biennial variety of grain in a warehouse got wet: So as to prevent it from rotting, the bags were transferred to adjacent cold storage for a fortnight. When inspected, the Stains were found to have dried completely. On sowing, the harvest could be obtained in the same year instead of the next year. This must have been due to:
- genetic mutation
  - vernalization
  - production of ethylene in wet grains
  - accumulation of dormancy hormones.
25. Glucose is a high threshold substance and gets reabsorbed from ultra filtrate during urine formation. After consuming a lot of sweets, urine of the otherwise healthy person also shows presence of glucose. This proves that reabsorption of glucose:
- varies from time to time.
  - is time independent.
  - is concentration dependent.
  - is energy intensive
26. A nucleic acid extracted from animal liver is loaded and run on agarose gel. After staining it shows following pattern.



If the remaining sample is treated with RNase and loaded in gel what result would you

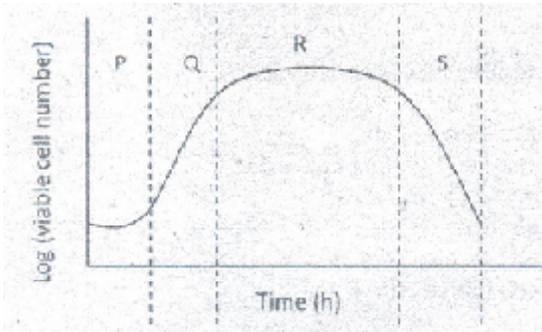
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27. Evolutionary relationship can be established by studying genetic makeup of organisms. Suppose organisms P, Q and R have similar ancestral origin but the sequence of bases in DNA may differ to some extent at certain place as shown below. How will you put them in a cladogram on the basis of their genetic differences?  
 P : CAAGCTA  
 Q : ATAGCTT  
 R : AAACCTA



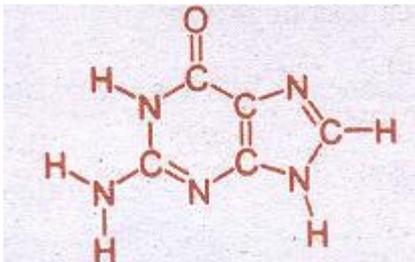
28. To study the ability to secrete a specific protein, cells were homogenized mechanically and organelles were separated by centrifugation. Which organelle should be used for further investigation?  
 a) Microsome  
 b) Peroxisome  
 c) Lysosome  
 d) Ribosome
29. Which of the following statements about cholesterol in animal cell membrane are correct:  
 i) It reduces membrane fluidity at moderate temperature.  
 ii) It prevents membrane gelling at low temperature by disrupting close packing of phospholipids.  
 iii) It prevents kinking of unsaturated hydrocarbon at all temperatures.  
 iv) It promotes kinking of unsaturated tails of phospholipids at low temperature.  
 a) i, ii and iv  
 b) i, iii and iv  
 c) i, ii and iii  
 d) i and ii
30. Elaborate courtship behaviour helps in preventing inter-specific breeding constituting: temporal barrier.  
 a) temporal barrier  
 b) pre-zygotic reproductive barrier.  
 c) post-zygotic reproductive barrier.  
 d) physiological barrier.
31. Tilling is a common agricultural practice. In which of the following ways is it helpful?  
 a) It improves soil-aeration  
 b) It improves soil micorrhizal content  
 c) It improves organic matter of the soil  
 d) All the above.
32. In an aquatic ecosystem, a student observed that the lowest tier of the biomass pyramid was much narrower than the rest. The main producers of this ecosystem most likely are:  
 a) single-celled protists  
 b) aquatic plants  
 c) grasses  
 d) all the above.

33. A typical growth curve for a bacterium is shown in the diagram.

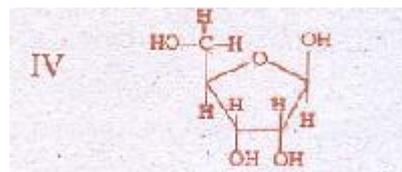
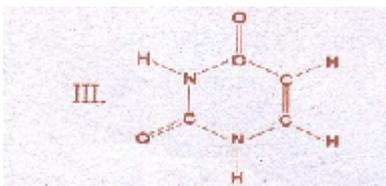
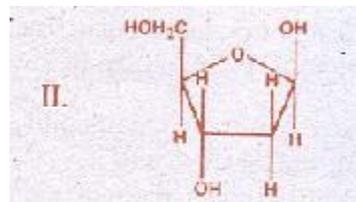
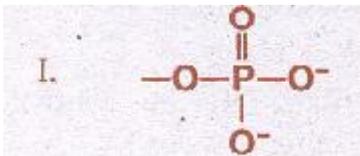


- In which of the following phases, the total cell count will increase while the viable count will remain same?
- P
  - Q
  - R
  - S
34. Epididymis is the part of male reproductive tract and produces glycoproteins that coat the sperm. It also secretes a variety of substances such as sialic acid. These functions
- mitochondria
  - microsomes
  - golgi bodies
  - lysosomes
35. Which of the following respiratory parts/ surfaces are associated with capillary beds ?
- Spiracles
  - Tracheae of invertebrates
  - Tracheae of vertebrates
  - Skin of earthworms.
36. Gut fluid from a tunicate was collected and subjected to biochemical analysis. Results are shown in the brackets following the analysis:
- 10.c.c. fluid+10 c.c. 1 % starch → Fehling test (+)
  - 10.c.c. fluid+10 c.c. 1 % starch→ boiling →Fehling est (-)
  - 10.c.c. fluid+10 c.c. 1 % glycogen→ Fehling test (+)
  - 10.c.c. fluid+10 c.c. 1 % glycogen →boiling→Fehling test (-)
  - 10.c.c. fluid+10 c.c. 1 % maltose →Fehling test (-)
  - 10.c.c. fluid+10 c.c. 1 % maltose → boiling→Fehling test (-)
- Which of the following conclusions is most appropriate ?
- The gut fluid is rich in carbohydrate content.
  - The gut fluid contains disaccharide digesting enzymes.
  - The gut fluid contains proteolytic enzymes.
  - The gut fluid contains amylolytic enzymes.
37. A few major discoveries in cell biology are listed
- Schleiden and Schwann proposed the cell theory.
  - Leewenhoek discovered bacteria.
  - Golgi stained cells with silver nitrate, discovered golgi apparatus.
  - First transmission electron microscope was developed.
- The correct chronological order of these events starting with the earliest event is
- I, II, III, IV
  - II, III, I, IV
  - II, I, III, IV
  - II, I, IV, III.

38. Given the fact that pluripotent stem cell can be induced to differentiate by environmental signals. Which of the following is true?  
 a) Even differentiated cells retain their ability to differentiate into other cell type -when given appropriate chemical signals.  
 b) Only totipotent cells can differentiate into any cell type.  
 c) Only early embryonic cells are totipotent and pluripotent stem cells have limited capability to differentiate into different cell types.  
 d) All the above
39. All of the following statements are true for the typical eukaryotic cell cycle EXCEPT:  
 (a) The S phase is far removed from cell division.  
 (b\*)  $G_1$  occurs after the S phase.  
 (c) The shortest phase in terms of time is usually M.  
 (d) Many of the enzymes necessary for DNA replication are typically produced during  $G_1$ .
- Sol.  $G_1$  occurs before the S phase
40. Which of the following represents the correct order of electron flow during photosynthesis"  
 a) Chlorophyll to NADPH to water  
 b) Water to NADPH to chlorophyll  
 c) Chlorophyll to water to NADPH  
 d) Water to chlorophyll to NADPH
41. Which of the following pairs is mismatched?  
 a) Spliceosome-removal of introns  
 b) Transposase - insertion of DNA segments into DNA  
 c) DNA polymerase - makes a molecule of DNA from a DNA template  
 d) RNA polymerase - makes a molecule of RNA from an RNA template
42. The structure of guanine is given below



To which of the following Guanine will have to bind to form RNA nucleotide?



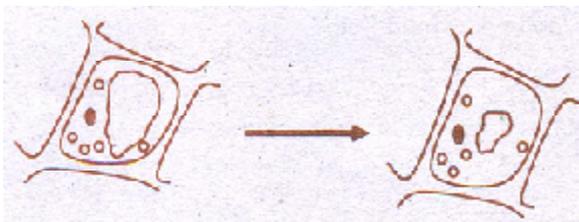
Options:

- a) I, II and III only
- (b\*) I and IV only
- c) III, IV and V only
- d) I or III only

**Sol.** Basically RNA nucleotide is made up of ribose sugar and phosphate group.

- 43.** To study the changes in the shape of moving amoebae isolated from a pond sample, one would use:
- a) Transmission electron microscope with unstained specimen.
  - b) Dissecting microscope with fixed specimen.
  - c) Bright field microscope with fixed specimen.
  - d) Phase contrast microscope with unstained specimen.
- 44.** A plant growing in marshy saline areas have certain adaptations to help them sustain in such soils. One such adaptation is that these plants accumulate  $\text{Na}^+$  and  $\text{Cl}^-$  ions and transport them to the leaves. Which of the following are consequences of this adaptation?
- A. It helps in making the water potential of leaves less negative.
  - B. It helps reduce the transpirational loss of water.
  - C. It helps in increasing uptake of water by the roots.
  - D. It helps in making the leaves more succulent
- Options:
- a) A and C
  - b) A and B
  - c) B and C
  - d) C and D
- 45.** The evolutionary strategy is termed as 'r' for those species that live in unstable environments and produce large number of offspring. Which other characteristic correlates with this life strategy?
- a. Large size of organisms
  - b. A prolonged period of parental care
  - c. Long life expectancy
  - d. Early maturity.
- 46.** Cystic fibrosis is an autosomal recessive disorder. Shyma's parents do not suffer from the disorder but he has a brother who is suffering from cystic fibrosis. What is the probability that Shyam is a carrier ?
- a)  $1/4$
  - b)  $1/2$
  - c)  $2/3$
  - d)  $3/4$

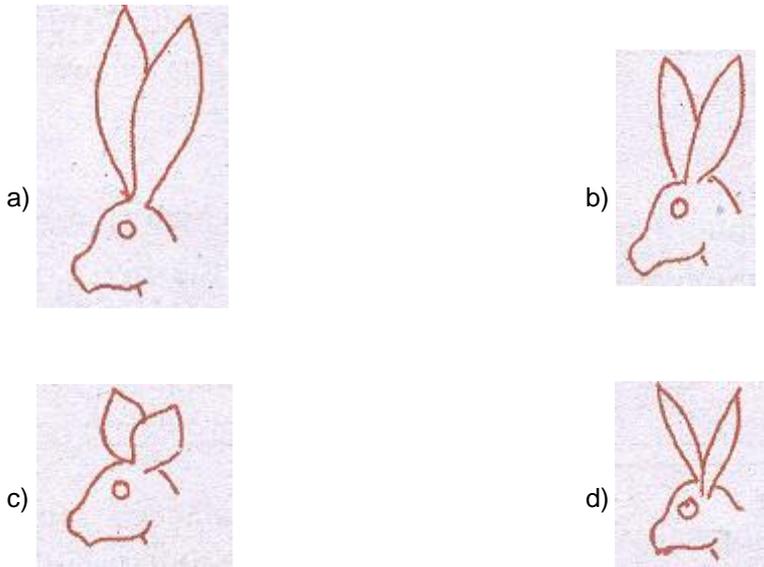
- 47.** The changes in a plant cell when it is transferred from solution P to solution Q are shown in the figure below.



Solutions P and Q most likely are :

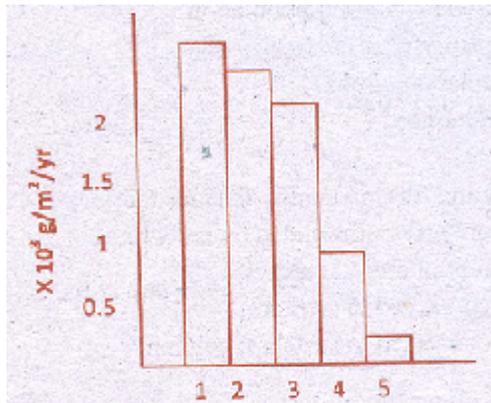


54. Accompanying pictures show the closely related species inhabiting environments varying mainly in temperatures. Which of them seems to be from the warmest habitat ?

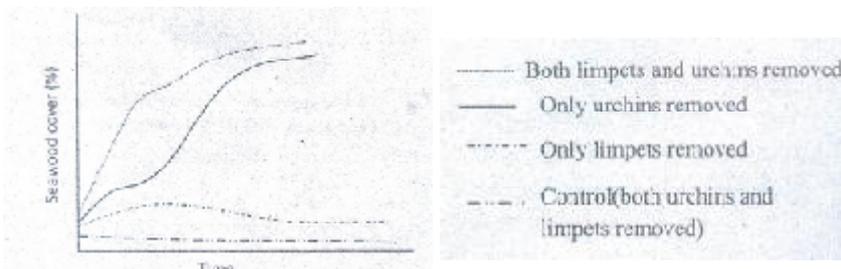


**Sol.** According to Allen's rule the animals of colder areas have short extremities like nose, ear than warmer areas.

55. Average primary production ( $\text{g/m}^2/\text{yr}$ ) of the following has been depicted in the accompanying diagram.  
 i. Tropical rain forests ii. Tundra iii. Swamps iv. Taiga v. Coral reef  
 Match these with the columns from 1 to 5



- a) v, i, iii, iv, ii  
 b) i, v, iv, iii, ii  
 c) ii, iv, iii, v, i  
 d) iv, i, iii, iv, ii
56. Study the diagram of seaweed cover in presence and absence of limpets and urchins. Which of the following statements is appropriate?



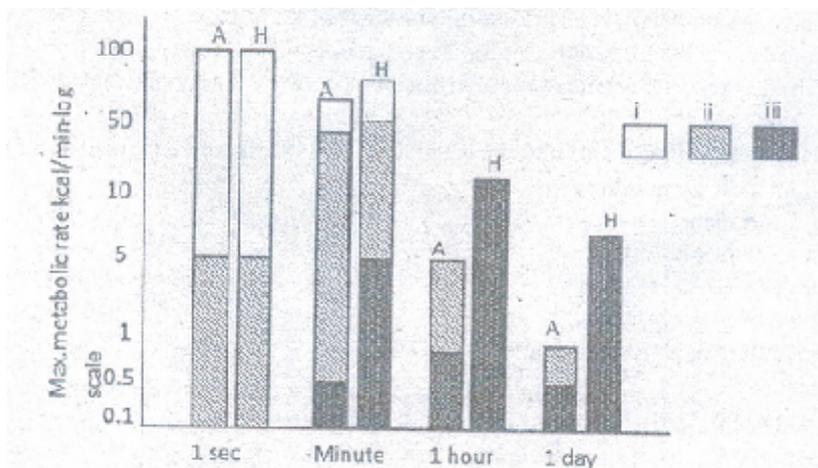
- a) Neither limpets nor urchins influence seaweed cover.
- b) Limpets and urchins both influence seaweed cover but the influence of limpets is higher.
- c) Limpets and urchins both influence seaweed cover but the influence of limpets is
- d) Only urchins seem to influence seaweed cover .

57. All  $\text{Ca}^{2+}$  in the physiologically. balanced salt solution, in which a nerve muscle . preparation was kept, had got precipitated. On stimulating the nerve you would expect:
- a) stronger contraction of skeletal muscle.
  - b) no contraction of skeletal muscle
  - c) muscle going into titany
  - d) contraction of skeletal muscle after a time lapse

58. If all the septa in the body of an earthworm were thick, muscular and non- porous, which of the following processes would have been impaired?
- a) Excretion and osmoregulation
  - b) Exchange of respiratory gases
  - c) Circulation of blood
  - d) Locomotion

59. Floating ribs are named so since they are
- a) the only ribs surrounded by body fluid
  - b) without intercostal muscles
  - c) not connected to sternum
  - d) not connected to vertebral column

60. The bars in accompanying diagram compare an ectotherm (alligator) and endotherm. (humans) of-same body weight for their maximum potential metabolic rate and source of ATP. What would i, ii, iii respectively be the sources of ATP?

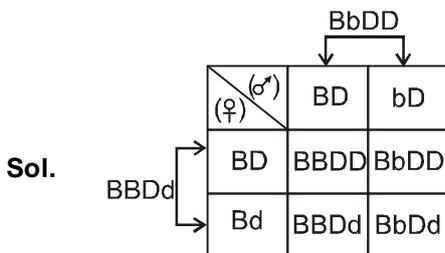


- a) Aerobic respiration , glycolysis, existing cellular
- b) Existing cellular, glycolysis, aerobic respiration
- c) Glycolysis, existing cellular, aerobic respiration
- d) Glycolysis, aerobic respiration ,existing cellular

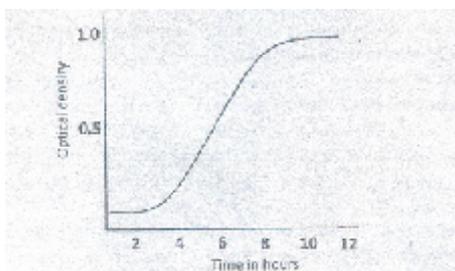
61. For sedentary / semi sedentary and tree living animals, the most suited type or symmetry has been:
- a) asymmetry and symmetry respectively.
  - b) radial and bilateral respectively.
  - c) bilateral and spherical respectively.
  - d) bilateral for both.

62. When there is sepsis (pus [ormation), lymph nodes close to region swell. This is due to the fact that:
- a) the leucocytes are degraded in lymph nodes.
  - b) pathogens easily invade lymph nodes.
  - c) lymph nodes form and store leucocytes.
  - d) release of histamines leads to inflammation of lymph nodes.

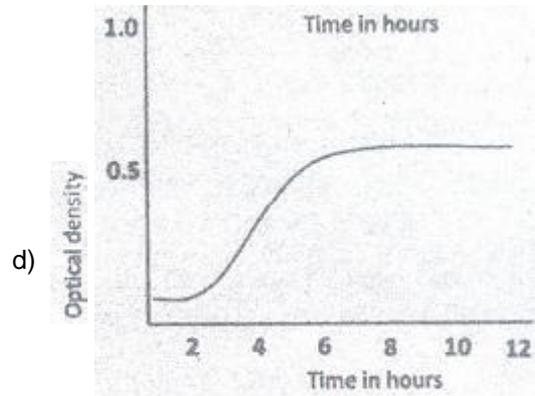
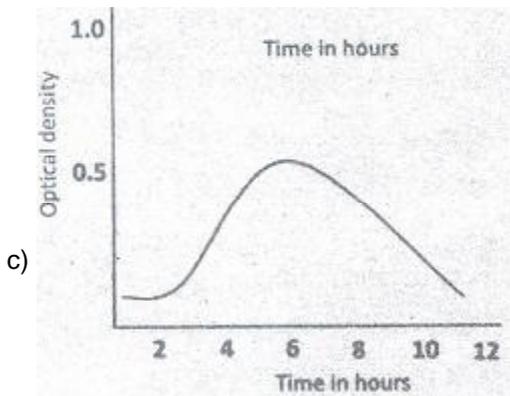
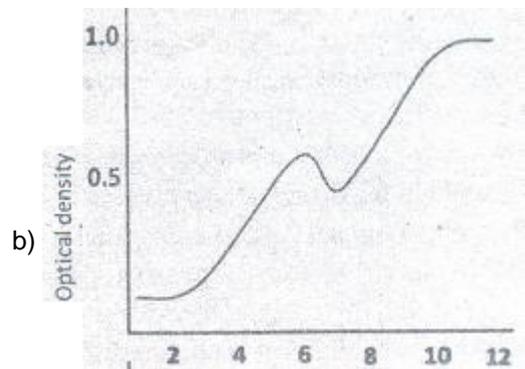
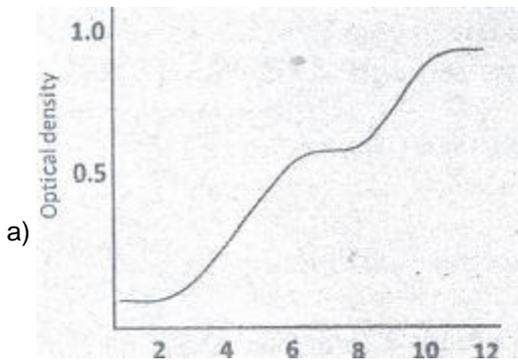
63. Continuous staring causes profuse secretion of tears. The most appropriate explanation for this is:  
 a) It protects the cornea from damage due to desiccation.  
 b) Strain on muscles of eyelids leads to contraction of tear glands.  
 c) It causes capillaries to dilate leading to profuse secretion of tears  
 d) The dust particles entering the eye irritate the tear glands causing their hyperactivity.
64. Neuroglial cells contain large amount of lipids. Choose the correct functions the cells from those given below.  
 i) Electric insulation,  
 ii) Thermal insulation  
 iii) Mechanical cushioning  
 iv) Effective synapsing ,  
 v) Effective blood brain barrier.  
 a) i, ii and v  
 b) ii, iii and iv  
 c) ii, iv and v  
 d) i, ii and iii
65. A bacterium growing on an agar surface divides. Most bacteria are not very motile on solid surface. The progeny of bacteria remain very near to the location of original bacterium. If 10 cells are plated and a cell takes 30 minutes to multiply then number of colonies visible, next day would be  
 a) 10  
 b)  $10^2$   
 c)  $10^4$   
 d)  $10^8$
66. An organism with the genotype BbDD is mated to one with the genotype BBdd. Assuming independent assortment of these two genes, write the genotype of possible offspring from this cross and calculate the probability of each genotype occurring.  
 a)  $1/16$  BBDD,  $1/2$  BbDD,  $1/4$  BBdd,  $1/4$  BbDd  
 b\*)  $1/4$  BBDD,  $1/4$  BbDD,  $1/4$  BBdd,  $1/4$  BbDd  
 c)  $1/4$  BBDD,  $1/4$  BBdd  
 d)  $1/2$  BBDD,  $1/2$  BbDD,  $1/2$  BBdd,  $1/2$  BbDd.



67. A standard bacterial growth curve at 37° C is shown below.



A student inoculated a bacterial culture in a flask containing culture medium and incubated the flask at 37° C for 6 hours, He then kept the flask at 4° C for a couple of hours and then re- incubated it at 37° C for further period. The most probable growth curve that these bacteria would show is:



68. In Linnaean system, each animal species is placed in a taxonomic hierarchy with seven levels. The level in the middle (4<sup>th</sup>) is order. It contains:
- a single species.
  - all the genera of a family.
  - only certain families.
  - all the classes of a phylum
69. Fish gills are:
- only respiratory in function.
  - only excretory in function.
  - osmoregulatory in function.
  - All the three are correct.
70. The blood pressure inside capillaries connected to the arterioles and venules is 32 mm Hg and 7mm Hg respectively. What will be the pressure of interstitial fluid?
- 22mmHg
  - 0mmHg
  - 7mmHg
  - 32mmHg
71. Which of the ecological parameters, when represented graphically, show inverted pyramid?
- Pyramid of number in pond ecosystem.
  - Pyramid of number in parasitic ecosystem
  - Pyramid of biomass in pond ecosystem
  - Both b and c.



78. A drug 'Paclitaxel' interferes with the breakdown of micro tubules and stabilizes them. This drug is also used in cancer therapy. Which of the following stages will be severely affected when animal cell is treated with this drug?  
 a) Prophase                      b)  $G_0$                       c) Anaphase                      d) Cytokinesis
79. Consider a cat population of 100, in which 84 are black and 16 are white. Black trait is dominant over white. What will be the number of heterozygote in this cat population?  
 a) 16                      b) 36                      c) 48                      d) 84
80. A short fragment of DNA was analyzed for various mutations. When comparison between normal and mutated types was done, following gel pattern was observed for two individuals A and B. Most probable type of mutation in these individuals is:  
 a) deletion in A and Inversion in B.  
 b) deletion in A and duplication in B.  
 c) inversion in 'A and deletion in B.  
 d) duplication in A and deletion in B.

