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PAPER CODE : B224

# Aakash

Medical | IIT-JEE | Foundations

(Divisions of Aakash Educational Services Limited)

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Time : 120 Minutes

## Answers & Solutions

Marks : 240

*for*

### NATIONAL STANDARD EXAMINATION IN BIOLOGY (NSEB) 2018-19

#### INSTRUCTIONS TO CANDIDATES -

1. On the answer sheet, make all the entries carefully in the space provided **ONLY** in **BLOCK CAPITALS** as well as by properly darkening the appropriate bubbles.

**Incomplete/ incorrect/ carelessly filled information may disqualify your candidature.**

2. On the answer sheet, use only **BLUE** or **BLACK BALL POINT PEN** for making entries and filling the bubbles.
3. Question paper has 80 multiple choice questions. Each question has four alternatives, out of which **only one** is correct. Choose the correct alternative and fill the appropriate bubble, as shown.

Q. No. 22     a         c     d

4. A correct answer carries 3 marks whereas 1 mark will be deducted for each wrong answer.
5. Any rough work should be done only in the space provided.
6. No candidate should leave the examination hall before the completion of the examination.

(ONLY ONE OUT OF FOUR OPTIONS IS CORRECT)

Choose the correct answer :

- A proper illumination is necessary to observe details of specimen mounted on a slide while using compound light microscope. It is achieved with the help of mirror. The correct path of light during microscopic observation is :
  - Light source → Mirror → Condenser lens → Iris diaphragm → Objective lens → Specimen → Eye piece lens → Eye
  - Light source → Mirror → Iris diaphragm → Condenser lens → Specimen → Objective lens → Eye piece lens → Eye
  - Light source → Condenser lens → Mirror → Iris diaphragm → Specimen → Objective lens → Eye piece lens → Eye
  - Light source → Mirror → Iris diaphragm → Specimen → Condenser lens → Objective lens → Eye piece lens → Eye

**Answer** (b)

**Sol.** The correct path followed by ray of light in a compound light microscope is :

Light source → Mirror → Iris diaphragm → Condenser lens → Specimen → Objective lens → Eye piece lens → Eye

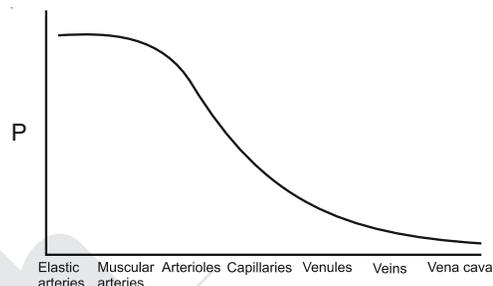
- Rohit's teacher gave him a freshly prepared slide of a vertical section of some unknown plant sample, to observe. Rohit found some non-lignified cells which were longitudinally elongated and tapering at both the ends. These ends were overlapping with next cells. The cells showed clustered perforations which were distributed uniformly over the cell surface. There were no chloroplasts in these cells. The specimen most likely represented : \_\_\_\_\_
  - Stem of Gymnosperm
  - Leaf of monocot
  - Root of dicot
  - Sporophyte of hornwort

**Answer** (a)

**Sol.** Longitudinally elongated cells with tapering ends, overlapped with each other and with perforations are features of sieve cells. Since sieve cells are found in gymnosperms thus given slide belong to stem of gymnosperms.

Angiosperm root and stem both will have lignified cells.

- Human circulatory system is made up of complex network formed by arteries, arterioles, capillaries, venules and veins. The graph given below shows variation in parameter 'P' against different types of blood vessels. 'P' represents :



- Vessel diameter
- Total cross sectional area of vessels
- Average blood pressure
- Velocity of blood flow

**Answer** (c)

**Sol.** We know that total cross-sectional area of the vessels increases from nearly 4.5 cm<sup>2</sup> in the aorta to 4500 cm<sup>2</sup> in the capillaries which means maximum (total) cross-sectional area in capillaries. Vessel diameter decreases from aorta to capillaries but increases from capillaries to vena cava. Velocity of blood flows decreases when blood reaches capillaries but then increases in vena cava. Average blood pressure in medium sized arteries falls very slightly but falls rapidly in small arteries and arterioles and further in vena cava.

- During one study on rate of decomposition, litterbag experiment was carried out on three tree species P, Q and R from same forest. In this experiment, 30 litterbags were filled with 5.0 gms of senescent leaf litter for each tree. These bags were made of fine mesh to allow decomposers to access litter but do not let the decomposing material to fall out. These bags were buried in the litter layer of the forest. During a year, five bags of each species were removed at 6 intervals and their contents were dried and weighed. At the end of the experiment, the percent of mass remaining was found to be 75%, 50% and 45% respectively for given three species. The most appropriate reason for this difference is :
  - The moisture content of leaves of 'R' species must be higher than others
  - The lignin content in 'P' is maximum among all three species.

- (c) The difference in types of decomposers involved in process leads to variation in rate of decomposition
- (d) The mass of dead decomposers also added in case of species 'P'.

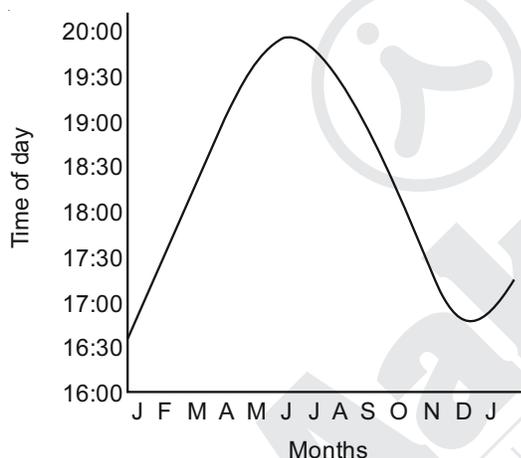
**Answer** (b)

**Sol.** Chemical composition of detritus is a determining factor for decomposition process.

Detritus with high lignin or tannin (complex organic compounds) content shows slow decomposition rate.

Since remaining mass of P after decomposition is highest i.e. 75% thus its lignin content is maximum.

5. Southern flying squirrel '*Glaucomys volans*' shows variation in their daily activity period throughout the year. As shown in the graph, the time of the day when squirrel becomes active varies considerably.



The reason is :

- (a) The squirrel starts its daily activity with nightfall
- (b) The delayed activity period in April-July corresponds to breeding season
- (c) Higher temperature during day time in spring season leads to late beginning of activities
- (d) The activity starts early at the beginning of the year due to more availability of food

**Answer** (c)

**Sol.** Graph shows that squirrel becomes active with sunset, since time of sunset increases from winter to summer. Thus, higher temperature during day time in spring season leads to late beginning of activities.

6. Following statements are made about Non-coding DNA. Mark the statement that is **INCORRECT**.
- (a) Non-coding DNA can be transcribed into functional non-coding RNA molecules.
  - (b) Non-coding DNA can contribute towards evolution of Genome

- (c) Non-coding DNA may predispose individual to cancer
- (d) Non-coding DNA can be the causative agent of Tuberculosis

**Answer** (d)

**Sol.** Causative agent of Tuberculosis is *Mycobacterium*, not the non-coding DNA.

7. While cloning a Eukaryotic gene in Prokaryotic expression vector
- (a) Gene of interest is inserted in a cloning vector with active prokaryotic promoter
  - (b) mRNA of gene of interest is inserted in a cloning vector with active prokaryotic promoter
  - (c) cDNA of gene of interest is inserted in a cloning vector with active prokaryotic promoter
  - (d) Gene of interest is inserted in a cloning vector with active prokaryotic enhancer sequence

**Answer** (c)

**Sol.** cDNA also called complementary DNA is inserted in expression vector as it lacks introns. Splicing is not possible in prokaryotic expression vectors.

8. The number and types of vertebrae in a few mammals are tabulated below:

Type of vertebrae	Number of vertebrae		
	Animal I	Animal II	Animal III
Cervical	1	7	7
Thoracic	7 (abdominal)	12	13
Lumbar		5	6
Sacral	1	5	4
Caudal	0	4	30

Animals I, II and III most likely are :

- (a) I : Human II : Frog III : Rat
- (b) I : Frog II : Human III : Rat
- (c) I : Human II : Rat III : Frog
- (d) I : Frog II : Rat III : Human

**Answer** (b)

**Sol.** The vertebral formula in frog (Animal I) is  $C_1A_7S_1Ca_0$

The vertebral formula in human (Animal II) is  $C_1T_{12}L_5S_5Ca_4$

The vertebral formula in rat (Animal III) is  $C_7T_{13}L_6S_4Ca_{30-36}$

[ C : Cervical, T : Thoracic, L : Lumbar, ]  
Ab: Abdominal  
[ S : Sacral, Ca : Caudal ]

The Atlas is the only cervical vertebrae in frog. The next seven vertebrae are abdominal vertebrae, which is the large sacrum with two strong transverse processes that join with ileum. The last vertebra is the long and highly modified urostyle.

Hence, Animal I, II and III are frog, human and rat respectively.

9. Taq DNA polymerase is routinely used in PCR, what is its unique property?
- Taq DNA polymerase can polymerize ss DNA in  $5' \rightarrow 3'$  direction.
  - Taq DNA polymerase can polymerize ss DNA in  $3' \rightarrow 5'$  direction.
  - Taq DNA polymerase does not denature at high temperatures.
  - Rate of DNA replication is much higher in presence of Taq DNA polymerase.

**Answer** (c)

**Sol.** – Taq DNA polymerase is a specialised thermostable enzyme isolated from the thermophilic bacterium *Thermus aquaticus*. It has both  $5' \rightarrow 3'$  polymerase and exonuclease activity which is not a unique feature as this property is also found in other DNA polymerases.

- Rate of DNA replication is much lower in presence of Taq DNA polymerase w.r.t. DNA polymerase III of prokaryotes.
- Taq DNA polymerase is routinely used in PCR as it works in the range  $90 - 94^\circ\text{C}$  during primer extension step.

10. In the famous experiments by Griffith, heat-killed smooth (S) strain of *Pneumococci* were mixed with the non-virulent rough (R) strain of *Pneumococci* and then injected into healthy mice (Experiment 1). In further experiments, the filtrate obtained by homogenizing the heat-killed smooth strain was treated with three different enzymes and then mixed with the nonvirulent R strain. These mixtures were injected into healthy mice to study the effect. (Experiments 2 – 4).

The results of these experiments are given in the table below.

Experiment	Heat-killed S strain treated with	Effect on mice after injecting the mixture of Heat-killed treated S and the non virulent R strain
1	No enzyme	Mouse died
2	Enzyme M	Mouse remained healthy
3	Enzyme N	Mouse died
4	Enzyme O	Mouse remained healthy

M, N and O could be

- DNAase; RNAase; Protease
- Protease; DNAase; RNAase
- DNAase; Protease; Nuclease
- Lipase; DNAase; Protease

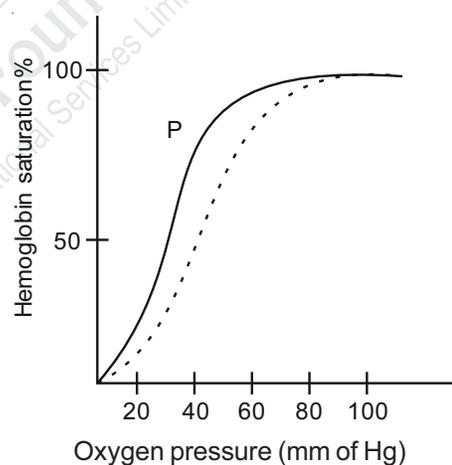
**Answer** (c)

**Sol.** Enzyme M should be DNase as treatment of heat killed S strain with DNAase enzyme digests the DNA and transformation stops and mouse remains healthy.

Enzyme N should be protease as it does not have any effect of DNA and transformation occurs.

Enzyme O should be nuclease as its action on DNA stops the transformation and mice dies.

11. Oxygen-hemoglobin saturation curve can be obtained by plotting the amount of oxyhemoglobin present at different partial pressures of oxygen. The dashed line indicates the oxygen saturation curve obtained for a healthy individual (body temperature  $37^\circ\text{C}$  and blood pH 7.4).



In which of the following conditions, will the curves P be obtained?

- pH 7.2 and temperature:  $37^\circ\text{C}$
- pH 7.6 and temperature:  $20^\circ\text{C}$
- pH 7.2 and temperature:  $40^\circ\text{C}$
- pH 7.4 and temperature:  $40^\circ\text{C}$

**Answer** (b)

**Sol.** – High  $p\text{O}_2$ , low  $p\text{CO}_2$ , less  $\text{H}^+$  concentration, high pH and low temperature are the various factors which favour formation of oxyhaemoglobin complex and shift the curve towards left side.

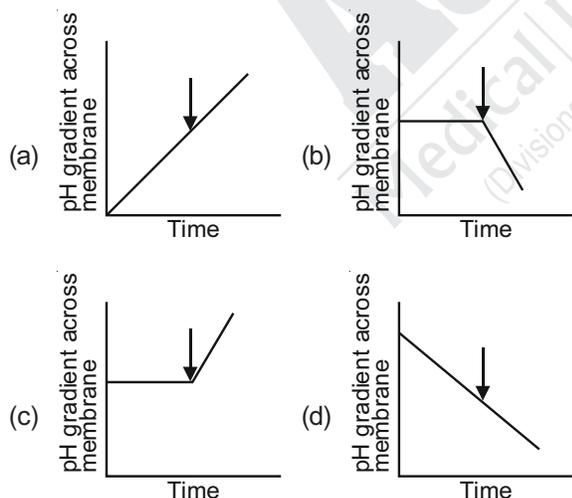
So, curve P will be obtained when the pH shifts from 7.4 to 7.6 and temperature shifts from  $37^\circ\text{C}$  to  $20^\circ\text{C}$ .

12. Which of the following is the property of a Stem cell?
- They can differentiate into all possible types of cells and are found only in embryonic tissue.
  - They can differentiate into other types of cells and they are capable of dividing and renewing themselves for long periods.
  - Stem cells are unspecialized and they cannot be grown in laboratory conditions.
  - All the above.

**Answer** (b)

**Sol.** Stem cells are not exclusively found in embryonic tissues. Adult stem cells have been found in bone marrow, skin, liver etc. These cells can differentiate into other type of cells. Stem cells can be cultured in laboratory conditions in specialised nutrient broths.

13. In an experiment to study the effect of a certain compound 'X', actively respiring plant cells were treated with 'X' after some time of the start of the experiment. The pH gradient across the mitochondrial membrane was monitored throughout the experiment. Compound X was known to specifically target mitochondrial ATP synthase and lead to complete inhibition of the enzyme. Which of the following graphs would be the expected outcome of this experiment? The arrow in the graph indicates the time of addition of compound 'X'.



**Answer** (c)

**Sol.** When ATP synthesis is blocked by compound X, protons cannot flow into the matrix through the  $F_0F_1$  complex. With no path for the return of protons to the matrix and the continued extrusion of protons driven by the activity of the respiratory chain a large proton gradient, hence a large proton motive force builds up.

14. Colorimetry has widest applications in biological sciences. While measuring the growth (rate) of a bacterial culture, which phenomenon is taken into consideration?

- Absorption of light by the bacterial media.
- Absorption of a specific wavelength of light by the bacterial cells.
- Scattering of light by the bacterial cells.

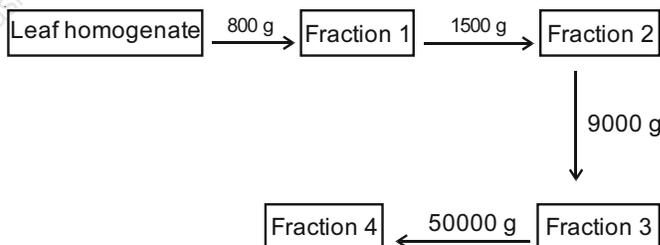
Mark the correct option.

- i and ii
- ii and iii
- i only
- iii only

**Answer** (b)

**Sol.** In spectrophotometer, cell growth is measured by measuring the absorbance of cell suspensions. This principle is based on the fact that small molecules scatter light proportionate to their concentration. Cells are composed of a variety of organic compounds (DNA, proteins, lipids and carbohydrates). Light interacts with these molecules in different ways: reflection, absorption, transmission and scattering. A bacterium absorbs light at specific wavelength (600 nm).

15. Ananya wanted to isolate and study organelles involved in packaging and transporting of proteins to various locations in a cell. Her colleague had carried out the following experiment: she ground a piece of spinach leaves and carried out differential centrifugation. A scheme of the protocol she followed along with the centrifugation speed (in g) at every step is given below:



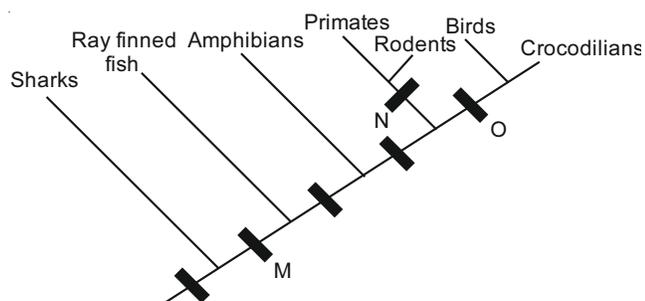
The fraction that would give Ananya the fraction of the organelle of her interest would be:

- 1
- 2
- 3
- 4

**Answer** (d)

**Sol.** Golgi helps in packaging and sorting of materials. At various speeds of centrifugation, it separates the cell and their components. It separates as follows.  
 500 - 1000 g → **Nuclear fraction** which includes nucleus, intact cells and tissue debris.  
 Upto 10,000 g → **Mitochondrial fraction** which includes mitochondria, lysosomes and peroxisomes.  
 Upto 10,0000 g → **Microsomal fraction** which includes E.R, golgi and plasma membrane.

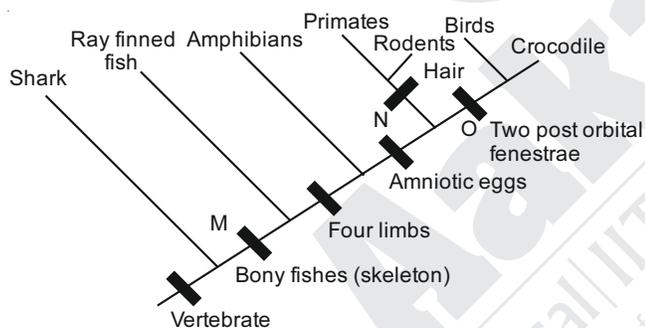
16. Classification of a few animals is shown in the cladogram. The characters M, N and O respectively represent:



- (a) Vertebrae, sweat glands, amniotic egg.  
 (b) Bony skeleton, hair, eggs with shell.  
 (c) Vertebrae, amniotic egg, feathers.  
 (d) Notochord, four legs, amniotic eggs.

**Answer** (b)

**Sol.**

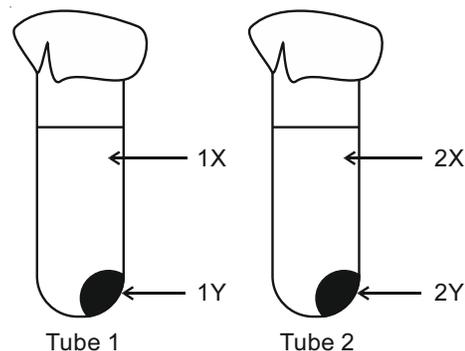


M, N and O are bony skeleton, hair and eggs with shell respectively.

17. In an experiment to test the component of a bacteriophage that might be the hereditary material that enters a bacterial cell to direct the assembly of new viruses, the following two experiments were performed:

**Experiment 1:** Virus were labeled with radioactive phosphorus ( $^{32}\text{P}$ ) → labeled virus were allowed to infect unlabeled bacteria → mixture was agitated to detach viruses from bacterial cells → centrifugation was carried out to form bacterial pellet while viruses remained in the supernatant as indicated in tube 1.

**Experiment 2:** Virus were labeled with radioactive sulfur ( $^{35}\text{S}$ ) → labeled virus were allowed to infect unlabeled bacteria → mixture was agitated to detach viruses from bacterial cells → centrifugation was carried out to form bacterial pellet while viruses remained in the supernatant as indicated by tube 2.



Radioactive  $^{32}\text{P}$  and  $^{35}\text{S}$  are expected to be found maximally in which of the following parts of the tubes?

- (a) 1X and 2X  
 (b) 1Y and 2X  
 (c) 1Y and 2Y  
 (d) 1X and 2Y

**Answer** (b)

**Sol.** Radioactive  $\text{P}^{32}$  will incorporate in DNA of virus so it will be found in pellet (1 Y) i.e. at the bottom of test tube in experiment 1.

While radioactive  $\text{S}^{35}$  will incorporate in protein of virus so it will be found in supernatant (2x) because protein capsid remain outside the host.

18. Pure water seems to be colorless in visible region of the electromagnetic spectrum. This is because

- (a) When a beam of visible light falls on it, the energy spectrum does not cause any change in the molecule.  
 (b) No energy is absorbed.  
 (c) Water molecules lack chromophore.  
 (d) All of the above.

**Answer** (b)

**Sol.** Water molecules are unable to absorb too much energy. Therefore, when visible light pass through the water, it is unable to absorb too much of visible light energy. Therefore difference between the energies of the two quantum states of water is very less, and thus water seems to be colourless.

19. A living, colorless, unstained organism can be best viewed using :

- (a) Brightfield light microscope  
 (b) Darkfield light microscope  
 (c) Fluorescent microscope  
 (d) Scanning electron microscope

**Answer** (a)

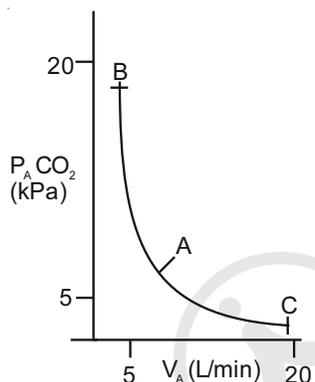
**Sol.** Brightfield light microscope is a multipurpose instrument and can be used for live unstained materials as well as preserved and stained materials.

Dark field microscope - to detect mainly cellular organelles such as nuclei, vacuoles, mitochondria etc.

Fluorescent microscope - for antibodies

Scanning electron microscope - for study of dried specimens coated with metals.

20. The graph depicts the relationship between alveolar ventilation and partial pressure of carbon dioxide in alveolar air. Regions AB and AC respectively represent



- (a) Acidosis and alkalosis
- (b) Acidosis and hypoventilation
- (c) Alkalosis and hyperventilation
- (d) Alkalosis and hypoventilation

**Answer** (a)

**Sol.** Region A to B represents increasing  $p\text{CO}_2$  which increases  $\text{H}^+$  concentration and decrease in pH causing acidosis. Region A to C represents hyperventilation, decreasing  $p\text{CO}_2$  so causing respiratory alkalosis due to decrease in  $\text{H}^+$  concentration. This results in increased pH because  $\text{H}_2\text{CO}_3$  dissociates to  $\text{H}_2\text{O}$  &  $\text{CO}_2$ .

21. Some bacteria form a slimy, viscous layer covering the cell wall. This layer is known as capsule. These capsules are beneficial to the bacteria because

- (i) They attract other bacteria to form colonies
  - (ii) They enable bacteria to stick to the surface.
  - (iii) Capsules contain water which protects the bacteria against desiccation
- (a) (i) and (ii) only
  - (b) (ii) and (iii) only
  - (c) (iii) only
  - (d) (i), (ii) and (iii)

**Answer** (b)

**Sol.** Capsule enable bacteria to attach to the surface and as it contains water, it protects the bacteria against desiccation. Capsule does not attract bacteria to form colonies.

22. Green world hypothesis suggests that despite many primary consumers feeding on plants, the terrestrial ecosystems maintain their greenery. The herbivores are able to consume only a small part of plant biomass because of several inhibiting factors. Some of the factors are listed below:

1. Plants have defences against herbivores
2. Abiotic factors limit herbivore feeding
3. Disturbances in breeding cycle limit herbivore feeding
4. Intraspecific competition limits herbivore feeding

Which of the following is true?

- (a) Statements 1, 2 and 3 are the inhibiting factors
- (b) Statements 1, 2 and 4 are the inhibiting factors
- (c) Statements 1, 3 and 4 are the inhibiting factors
- (d) Statements 2, 3 and 4 are the inhibiting factors

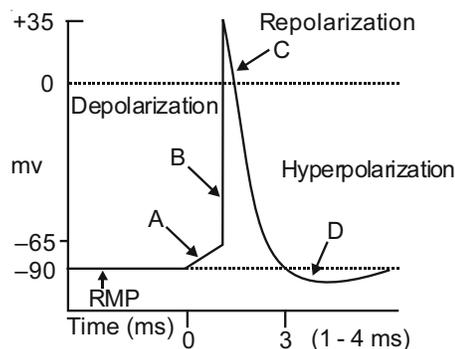
**Answer** (b)

**Sol.** According to 'Green World hypothesis' herbivores are able to consume only a small part of plant biomass because Intra & inter specific competition limit herbivore feeding.

Abiotic & biotic factors limit herbivore feeding.

Plants have defences against herbivores.

23. Match the alphabets (A, B, C and D) with the events (i, ii, iii and iv) seen during action potential.



- (i) Voltage gated  $\text{K}^+$  channels remain open after the potential reaches resting level.
- (ii) Closure of  $\text{Na}^+$  and opening of  $\text{K}^+$ , voltage gated channels.
- (iii) Local potential change, depolarization to threshold.
- (iv) Opening of voltage gated  $\text{Na}^+$  channels.

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

**Answer (b)**

**Sol.** A represents local potential change depolarisation to threshold value.

B represents depolarisation during which opening of voltage gated  $\text{Na}^+$  channels occurs.

C represents repolarisation during which closure of  $\text{Na}^+$  and opening of  $\text{K}^+$  voltage gated channel occurs

D represents hyperpolarisation, during which voltage gated  $\text{K}^+$  channels remain open after the potential reaches resting level.

24. The first groups of animals to develop a lung adequate to support their respiratory requirements without use of supplementary organ for gaseous exchange were

- (a) Amphibians                      (b) Reptiles  
(c) Mammals                        (d) Aves

**Answer (b)**

**Sol.** Amphibians can breathe through gills, skin and lungs based on stage of life and habitat. Reptiles were the first animals to develop lungs to support respiratory requirements without supplementary organs. Birds require air sacs and mammals evolved later.

25. An angiosperm 'A' and a gymnosperm 'G' have 100 chromosomes in the cells of their meristem. What would be the correct number of chromosomes in the endosperms of the seeds of A and G?

- (a) A = 300; G = 300      (b) A = 200; G = 200  
(c) A = 100; G = 300      (d) A = 300; G = 100

**Answer (\*)**

**Sol.** In angiosperms endosperm is  $3n$ , whereas in gymnosperms endosperm is  $n$ .

A meristematic cell of angiosperm or gymnosperm is diploid ( $2n$ )

$2n = 100$  (given)

$n = 50$

Ploidy of endosperm in  $\left\{ \begin{array}{l} \text{Angiosperm} = 3n = \\ \quad \quad \quad \quad \quad 3 \times 50 = 150 \\ \text{Gymnosperm} = n = 50 \end{array} \right.$

Ploidy of endosperm in angiosperm & gymnosperm is 150 & 50 respectively.

**\* All options are incorrect.**

26. With respect to keratin, which of the following is **NOT** a correct statement?

- (a) It is the structural protein of hair, wool, nails, claws, beaks and feathers  
(b) It is a component of vertebrate skin  
(c) It is a globular protein that protects animal body from external injuries  
(d) Its hardness vary with the degree of cross linking by disulphide bridges between neighbouring chains

**Answer (c)**

**Sol.** Keratin is a structural protein found in hair, wool, skin, nails etc. It is a component of keratinised squamous layer of vertebrate skin.

Keratin is not a globular protein, it is a fibrous protein, so statement (c) is incorrect.

27. Spina bifida is a congenital defect of the vertebral column. An increased risk of this defect is primarily associated with low level of-

- (a) Vitamin A  
(b) Vitamin B  
(c) Vitamin C  
(d) Vitamin E

**Answer (b)**

**Sol.** Vitamin B i.e. folic acid or folate deficiency increases the risk of spina bifida, a congenital defect of the vertebral column deficiency of vitamin C causes scurvy.

28. With respect to mitochondria and chloroplast which of the following statements is **NOT** true?

- (a) They possess a circular chromosome  
(b) They reproduce within the cell  
(c) They divide at the same time as the cells in which they are situated divide  
(d) They employ chemiosmotic energy transduction to fuel the biochemical reactions that take place within their structures.

**Answer (c)**

**Sol.** Mitochondria & chloroplast divide in  $G_2$  phase whereas the cells in which they are present divide in **M phase**.

29. The presence of homologous structure in two different organisms, such as radius and ulna in forelimb of a human and a bat, indicates that

- (a) Humans and bats are polyphyletic species  
(b) The evolution of human and bat is convergent  
(c) Humans and bats form a monophyletic clade  
(d) Humans and bats did not evolve from a common ancestor

**Answer (c)**

**Sol.** Monophyletic clade is a group of organisms that consists of all the descendants of a common ancestor.

The evolution of homologous structures in human and bats represent divergent evolution as they share common ancestor, thus they exemplify a monophyletic clade.

30. Tattooing is a permanent coloration of the skin in which a foreign pigment is deposited with a needle into the \_\_\_\_\_.
- (a) Epidermis                      (b) Dermis  
 (c) Hypodermis                    (d) Connective tissue

**Answer** (b)

**Sol.** Tattooing is performed by using needle, through which ink is inserted into the dermis. If the ink would be injected in epidermis a layer prone to cast off shedding (ecdysis) and the ink of the tattoo fades away. So for permanent coloration, tattooing should be performed in dermis.

31. White coat color in guinea pigs is recessive (b) to black (B). Ovary from black homozygous guinea pig is transplanted into a white ovariectomized female. If this white female is mated with a white male, the offspring will be,
- (a) Black with the genotype BB.  
 (b) White with the genotype bb.  
 (c) Black or white with genotype Bb OR bb.  
 (d) Black with the genotype Bb.

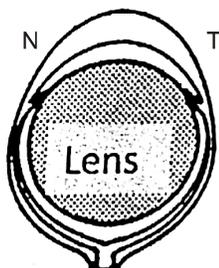
**Answer** (d)

**Sol.** White skin coat over ovariectomized female is transplanted with the ovary from black homozygous guinea pig.



All progenies = Bb (Heterozygous black with Bb genotype)

32. Schematic eye is represented in the figure. Which of the following statement is true?



- (a) It shows adaptation for acquiring maximum dim light.  
 (b) It peculiarly shows high resolution power of retina.  
 (c) It represents a typical diurnal animal.  
 (d) Small distance between the retina and lens permits projection of larger and clearer image.

**Answer** (a)

**Sol.** The given diagram shows adaptation for acquiring maximum dim light such as in nocturnal animal like owl. Greater curvature of cornea converges more light rays on lens for vision in dark (dim light).

33. A bone scan is a diagnostic tool where small amount of a radioactive tracer compound is injected intravenously and the degree of uptake of the tracer is measured by a scanning device. Normal bone tissue is identified by a consistent grey colour. Darker or lighter areas also known as “Hot spots” and “Cold spots” respectively may indicate bone abnormalities. By considering this fact, which of the following conditions would produce hot spots on X ray sheet?
- (a) Decalcified bone.  
 (b) Paget's disease (disease that disrupts displacement of old bone tissue with new).  
 (c) Bone cancer.  
 (d) Degenerative bone diseases.

**Answer** (c)

**Sol.** Hot spots are darker areas representing the abnormality in bone tissue.

Condition like tumor/cancer (abnormal proliferation of bone tissue) may produce hot spots on X-ray sheet.

Cancerous regions show enhanced blood supply and angiogenesis. Rapid uptake of radioactive tracer can be observed in region of cellular proliferation.

34. There are two forms of UV radiation, UVA (315-400 nm) & UVB (280-315 nm) that have different effects on health. Which of the following statements is true?
- (a) UVA is not absorbed by the ozone layer and is responsible for tanning.  
 (b) UVB is not absorbed by the ozone layer and is germicidal in action.  
 (c) UVA is most absorbed by ozone layer and is responsible for cataract formation.  
 (d) UVA is not absorbed by ozone layer and is responsible for sun burn and skin cancer.

**Answer** (a)

**Sol.** UV-A is not absorbed by the ozone layer but UV-B is absorbed by this layer. UV-A is responsible for tanning of skin while UV-B damages DNA and mutation may occur that causes various types of skin cancers.

35. The products of hydrolysis of chitin which is a major component of exoskeleton of insects is
- Galactosamine which is an amino sugar.
  - Glucosamine which is an amino sugar.
  - Deoxyribose sugar which is a pentose sugar.
  - Fatty acids and glycerol.

**Answer** (b)

**Sol.** In chitin, the basic unit is a nitrogen containing glucose derivative known as N-acetyl glucosamine (NAG). Glucosamine is an amino sugar.  $\beta(1,4)$  glycosidic bonds are formed in chitin which is a polymer of NAG found in exoskeleton of arthropods and fungal cell wall.

36. Select the correct match for items in part A to that in part B among the following:

**PART A**

- P. Receptor mediated endocytosis  
Q. Phagocytosis  
R. Bulk phase endocytosis/ Pinocytosis  
S. Transcytosis

**PART B**

- (i) Entry of maternal antibodies across placenta  
(ii) Entry of HIV in helper T cell  
(iii) Vital defence mechanism  
(iv) Absorptive cells of kidneys & intestine

- P-(ii), Q-(i), R-(iii), S-(iv)
- P-(i), Q-(ii), R-(iv), S-(iii)
- P-(ii), Q-(iii), R-(iv), S-(i)
- P-(iii), Q-(iv), R-(ii), S-(i)

**Answer** (c)

**Sol.** P. Receptor mediated endocytosis occurs during the entry of HIV in  $T_H$  cells as  $T_H$  cells bear  $CD_4$  receptor.

- In phagocytosis, cell engulfs foreign particles, waste material to provide defence to our body.
- Bulk phase endocytosis/pinocytosis/cell drinking occurs by the absorptive cells of kidneys and intestine.
- Entry of maternal antibodies IgG across placenta occurs through transcytosis.

37. Structural features of two types of cells; P and Q of vascular tissue of a dicot plant are given below:

P: Presence of nucleus, membrane bound organelles and large number of mitochondria.

Q: No nucleus, cytoplasm is in the form of thin layer, few small mitochondria, no ribosomes, no Golgi bodies.

Cells P and Q are:

- P-xylem parenchyma; Q-xylem tracheids
- P-companion cells; Q-phloem fibres
- P-companion cells; Q-sieve tube elements
- P-companion cells; Q-xylem parenchyma

**Answer** (c)

**Sol.** Companion cells are specialised parenchymatous cells. They retain a nucleus throughout their life. They contain a lot of mitochondria. A mature sieve tube element possesses a peripheral cytoplasm and a large central vacuole but lacks a nucleus. It does not have ribosomes and Golgi bodies.

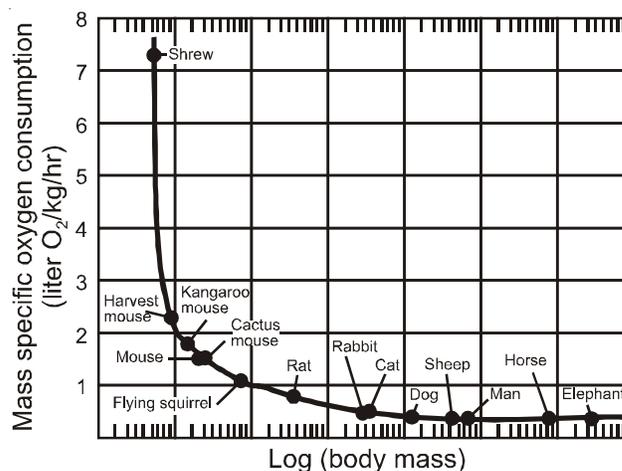
38. Kangaroo rat is a xeric vertebrate which has higher metabolic rate than lizards. It usually does not drink water. Which of the following features is NOT shown by this mammal?

- It produces highly concentrated urine.
- It shows lower basal metabolic rate than a non-desert mammal.
- It utilises metabolic water and spends the day in burrows which have temperature of  $25^\circ\text{C}$ .
- It has cutaneous permeability to absorb moisture from the damp burrows during day and from cold sand at night.

**Answer** (d)

**Sol.** In mammals like Kangaroo rat skin is lined by keratinized stratified squamous epithelium which is water proof and can not absorb water from damp burrows.

39. In the context of the following figure, which of the statements below is true?



- Mass specific metabolic rate decreases with increased activity.
- Mass specific metabolic rate increases with decreasing body mass.

- (c) Mass specific metabolic rate increases with decreased area/volume.
- (d) Mass specific metabolic rate decreases with increase in food consumption rate.

**Answer** (b)

**Sol.** Body size of an individual is inversely proportional to the basal metabolic rate.

40. In comparison to the mountain goats adapted to climbing rather than running similar-sized pronghorns that are adapted to run fast, have a 5 times greater rate of oxygen consumption. This is possible due to the following adaptations with an **exception of**:

- (a) Larger surface area in the lungs.  
 (b) Greater cardiac output.  
 (c) Larger and more abundant erythrocytes.  
 (d) Higher volume and density of mitochondria.

**Answer** (c)

**Sol.** In pronghorns, lungs have larger surface area, more cardiac output, higher volume and density of mitochondria because all are helpful to increase oxygen consumption there by explaining high BMR, but increase in size of RBCs decreases total surface area for gaseous exchange which is not possible.

41. Which of the following insects have 2 pairs of functional wings, shearing mouthparts and incomplete metamorphosis?

- (a) Butterfly                      (b) Mosquito  
 (c) Cockroach                    (d) Dragonfly

**Answer** (d)

**Sol.** • Butterfly has 2 pairs of functional wings, siphoning type of mouth parts and shows complete metamorphosis (Holometabolous condition).

- Mosquito has 1 pair of functional wings, piercing and sucking type of mouth parts and shows complete metamorphosis (Holometabolous metamorphosis).
- Cockroach has 1 pair of functional wings, biting & chewing type of mouth parts and shows gradual metamorphosis (Paurometabolous metamorphosis).
- Dragon fly has 2 pairs of functional wings, shearing (cutting) mouth parts and shows incomplete metamorphosis (Hemimetabolous metamorphosis).

42. The following is a list of events in synthesis of protein from a DNA template.

- i. mRNA attaches to the ribosome.  
 ii. The amino acid is attached to the growing polypeptide by a peptide bond.

- iii. mRNA migrates from the nucleus to the cytoplasm.  
 iv. An aminoacyl tRNA binds to its specific codon on mRNA.  
 v. mRNA is transcribed from its DNA template.

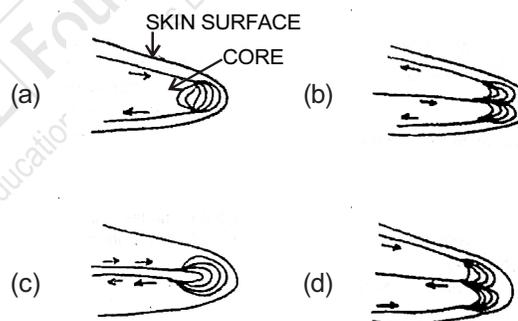
Identify the correct sequence from the following options.

- (a) v - iii - i - iv - ii              (b) v - ii - i - iii - iv  
 (c) v - iii - iv - ii - i              (d) v - iii - ii - iv - i

**Answer** (a)

**Sol.** The first step during protein synthesis begins when mRNA is available. So, first mRNA is transcribed from its DNA template in the nucleus and then it is transported to the cytoplasm from it.

43. Porpoise (*Phocaena spp.*) is a group of small toothed whales found in Polar regions. The mammals is adapted to low temperature conditions. Following four schematic diagrams show possible arrangement of blood vessels in longitudinal section of their flippers. Which one of them is the most appropriate for maintaining optimum body temperature?



**Answer** (c)

**Sol.** Porpoises found in polar regions are adapted for low temperature by preserving body heat causing peripheral vasoconstriction. Figure (c) is correct as it has functional central blood vessel and peripheral capillaries on flippers in spherical arrangement. Since sphere has minimum surface area, it minimises heat loss.

44. Birds like Albatross, spend months at sea drinking sea water. Their osmoregulation strategy includes:

- i. Excreting salts through nasal glands.  
 ii. Having uric acid as excretory material.  
 iii. Having an active ornithine cycle.

- (a) i & ii  
 (b) i & iii  
 (c) iii & iv  
 (d) ii & iv

**Answer (a)**

**Sol.** Marine birds such as albatross possess salt secreting nasal glands, which produce hypertonic solutions of NaCl in response to osmotic loads such as ingestion of sea water. The concentration of the secreted fluid is always high, several times as high as maximum urine concentration in birds. The presence of this gland must be considered a necessary adaptations to marine life in animals whose kidney cannot excrete high salt concentration. Birds are uricotelic in nature.

45. If a plant is made to grow in a solution of biogenic nutrients supplemented with cytokinins it will:

- (a) become stunted      (b) become etiolated  
(c) senescence faster    (d) become bushy

**Answer (d)**

**Sol.** Cytokinin is a growth hormone that reduces apical dominance and promotes growth of lateral branches.

This makes the plant bushy.

46. To initiate the inflammatory response, histamine that trigger dilation and increased permeability of nearby capillaries, is released by the injured cells in connective tissue called:

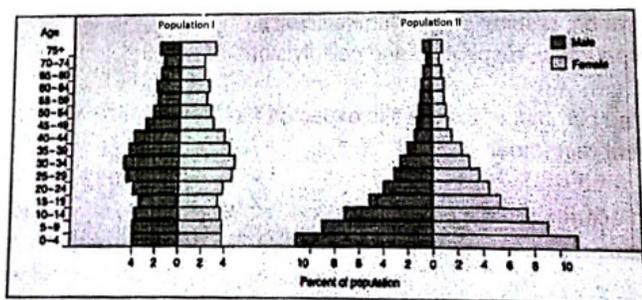
- (a) Macrophage            (b) Fibroblasts  
(c) Chondrioblasts        (d) Mast cells

**Answer (d)**

**Sol.** Mast cells are found in tissues and synthesize heparin, histamine and serotonin. Histamine is a potent vasodilators which increases permeability of blood capillaries that facilitates diapedesis of WBCs for inflammatory reaction. Macrophages are phagocytic cells derived from monocytes.

Fibroblasts are responsible for formation of matrix and connective tissue fibres. Chondroblasts are cartilage forming cells, derived from fibroblasts.

47. The two graphs given below explain percent of human population present in each age group for two different countries. The population survey has been carried out in year 1990. Which statement/s correctly describe/s the graphs?



- (a) Population I is related to poorly developed country while II is from highly developed country.  
(b) Population I shows that more births occurred during 1945 to 1964.  
(c) Population I has substantially higher percent population in age group 30-34 as compared to population II.  
(d) Population II shows that female to male ratio is substantially reduces as the age increases.

**Answer (c)**

**Sol.** Population I is a declining type of population while population II is growing type. The graph clearly shows that population I has substantially higher percent of population in age group 30 - 34 as compared to population - II.

48. Lichens are known to be very sensitive to air pollution because they :

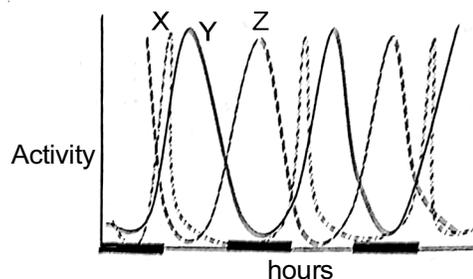
- (a) Fail to photosynthesise in high concentration of CO<sub>2</sub>  
(b) Do not produce mucilage buffer against toxic gases  
(c) Are unable to excrete toxic substances they absorb  
(d) Cannot reproduce in air polluted with suspended particulate matter

**Answer (c)**

**Sol.** Lichens are sensitive to air pollution because they are unable to excrete toxic substances they absorb during the air pollution.

49. Study of Gonyaulax polyedra, dinogragellate showed 3 peculiar diurnal cycle X, Y and Z. They respectively most likely represent:

Note that dark line in the graph indicates night



- (a) Photosynthesis, respiration and luminescence.  
(b) Cell division, photosynthesis and luminescence.  
(c) Migration, respiration and luminescence.  
(d) Reproduction, respiration and cell division.

**Answer (b)**

**Sol.** *Gonyaulax* a dinoflagellate shows photosynthesis in daytime, while it shows bioluminescence in night.

so curve Y = Photosynthesis

Z = Bioluminescence

and X = Cellular activity that can occur in day or night i.e, cell division/ reproduction

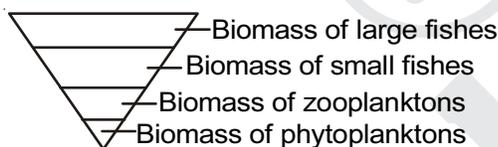
So correct option that matches correct possibilities is (b)

50. An inverted pyramid of biomass is expected for

- (a) Tropical rain forest
- (b) Grassland
- (c) Open ocean
- (d) Desert

**Answer (c)**

**Sol.** For aquatic ecosystems pyramid of biomass shows inverted pattern.



So correct answer is (c) because open ocean is the only aquatic ecosystem given in the options.

51. Assume that weight of fruit is being influenced by alleles occupying different loci and that the minimum weight of fruit is 20 g with 2 g being added by each dominant allele. If maximum weight is 36 g, how many gene loci must be involved?

- (a) 3
- (b) 4
- (c) 6
- (d) 8

**Answer (d)**

**Sol.** Phenotype minimum weight = 20 gm (due to all recessive allele),

Maximum weight = 36 gm (due to dominant allele at each loci)

Contribution of each dominant allele at each loci = 2 gm.

No. of dominant loci involved =

$$\frac{\text{maximum weight} - \text{minimum weight}}{\text{contribution of each dominant allele}}$$

$$= \frac{36 - 20}{2} = \frac{16}{2} = 8$$

Total dominant loci involved is 8.

52. On an average a climax ecosystem has more organic matter in the form of

- (a) Primary producers
- (b) Consumers
- (c) Decomposers
- (d) Dead organic biomass of all the above

**Answer (a)**

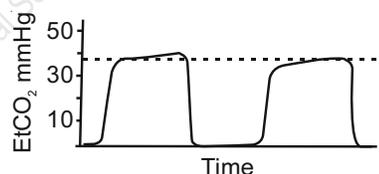
**Sol.** Climax community is characterised by

- High diversity
- High organic matter
- High humus

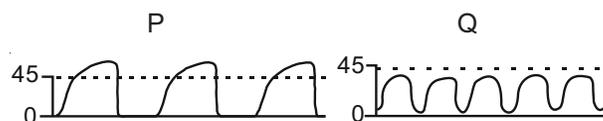
But organic matter is not in the form of dead biomass. As Biomass is measured as fresh weight or dry weight of living matter.

Since organic matter and humus is high in climax community the primary producer will also be high.

53. Carbon dioxide is a by-product of aerobic respiration. End Tidal CO<sub>2</sub> (EtCO<sub>2</sub>) is maximal concentration of CO<sub>2</sub> at the end of exhaled breath. Normal wave of exhalation is shown below.



The following types of waves P and Q respectively indicate:



- (a) Hypoventilation and bronchospasm
- (b) Hyperventilation and asthma
- (c) Bronchospasm and hyperventilation
- (d) Bronchospasm and hypoventilation

**Answer (c)**

**Sol.** Bronchospasms obstruct air ways so that CO<sub>2</sub> starts to accumulate in the body fluids causing increase in pCO<sub>2</sub> results in condition known as hypercapnoea, which is represented by waves of P type.

Hyperventilation is responsible for removal of increased CO<sub>2</sub> from body fluids causing decrease in H<sup>+</sup> concentration as sure by Q wave.

54. Endocrine glands play major role in working of ovarian cycle. Following events have to occur in specific sequence in female mammals, especially humans. The correct sequence of given events must be:

P : FSH stimulates granulosa cells to convert androgen to estrogen by aromatase action.

Q : LH stimulates theca cells of ovarian follicle to secrete androgen.

R : Estrogen promotes growth of endometrium.

S : GnRH stimulates secretion of FSH and LH from anterior pituitary cells.

- (a) P → Q → R → S
- (b) S → Q → P → R
- (c) R → P → Q → S
- (d) S → R → P → Q

**Answer** (b)

**Sol.** First event in ovarian cycle is release of GnRH from hypothalamus(S) which triggers release of FSH and LH from adenohypophysis (Q). Now LH acts on granulosa cells of ovarian follicles and promotes them to secrete androgens (P). Androgens are transformed into estrogen with the help of enzyme aromatase. Now estrogen acts on endometrium of uterus and is responsible for proliferation of its growth (R).

S → Q → P → R

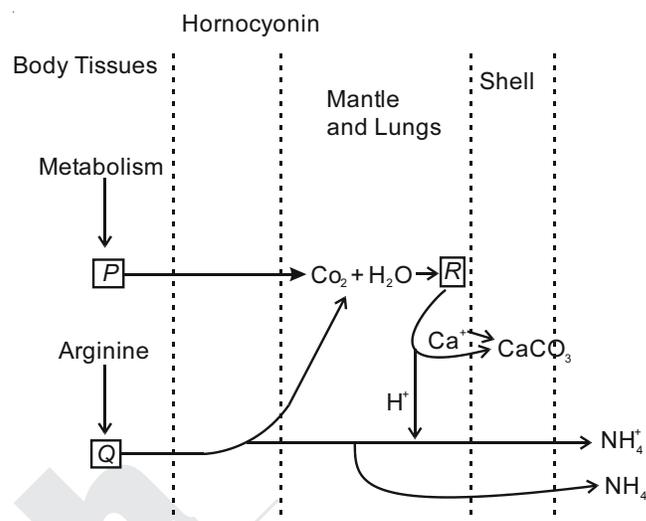
55. A toad was offered bumble bees as food. The toad got stung by the bees, subsequently the toad avoids feeding on insects with black and yellow colouration. This is an example of :

- (a) Habituation
- (b) Sensitization
- (c) Associative learning
- (d) Innate behaviour

**Answer** (c)

**Sol.** Habituation and sensitization are opposite effects Sensitization is a non-associative learning process in which repeated administration of a stimulus results in progressive amplification of response. Frog will exhibit associative learning where toad avoids feeding on insects. It's an animal behaviour in which any learning process a new response becomes associated with a particular stimulus (in this case bee sting).

56. Mechanism involved in volatilization of ammonia by land snail *Halix* is shown, P, Q and R respectively indicate:



- (a) Urea, uric acid and bicarbonate
- (b) Carbonic acid, urea and carbonate
- (c) ATP, arginase and bicarbonate
- (d) CO<sub>2</sub>, urea and carbonic acid

**Answer** (d)

**Sol.** During metabolism, production of CO<sub>2</sub> occurs which combines with water to produce carbonic acid. During urea cycle, urea is produced from arginine and further urea is broken down into NH<sub>4</sub><sup>+</sup> and CO<sub>2</sub>.

Hence,

P = CO<sub>2</sub>

Q = Urea

R = Arginine

57. Glyoxysomes are single membrane-bound cytoplasmic organelles in eukaryotes. Which of the following statements is NOT true for glyoxisomes?

- (a) Glyoxysomes are specialised type of peroxisomes.
- (b) They play a major role in the mobilisation and utilisation of stored nutrients in germinating seeds.
- (c) They are found in vertebrates liver and play a major role in converting glucose to glycogen.
- (d) They play a major role in the conversion of fatty acids into carbohydrates.

**Answer** (c)

**Sol.** In Glyoxysomes glyoxylate cycle occurs which helps in fat conversion into carbohydrates.

Glyoxysomes are absent in animals. Hence cannot find in vertebrates liver.



**Answer (d)**

**Sol.** In devonian period (~ 408 mya) – expansion of Psilopsids occurred.

In carboniferous period (~ 360 mya) – expansion of Pteridophytes occurred.

In triassic period (~ 245 mya) – Gymnosperms were dominant.

63. Which of the following statements about allosterically regulated enzymes is correct?

- (a) Activator binds to the active site of an enzyme.
- (b) Inhibitor binds to the active site of an enzyme.
- (c) Activator binds to the active sites and stabilise the active form of an enzyme.
- (d) Activator binds to the regulatory site of an enzyme and stabilizes the active form.

**Answer (d)**

**Sol.** In allosteric regulation, the activator or inhibitor binds to the regulatory/modulatory site thereby increasing or decreasing the enzyme activity respectively.

64. The following four sites (a – d) were being considered for the construction of an international airport. The species composition of the four sites are given below.

Construction on which of the sites (a, b, c and d) will not take a huge toll on biodiversity?

Site	Number of species in various categories				
	Least concern	Uncertain status	Rare	Endangered	Endemic
a	58	11	02	00	05
b	103	20	01	00	01
c	49	00	02	02	14
d	126	09	04	07	08

**Answer (b)**

**Sol.** In all the given sites a, b, c and d, the effect of habitat destruction will be less in that site where least concern species are high but rare, endangered and endemic species are least.

Thus correct answer should be 'b'

65. Which of the following features are mostly observed in self pollinating flowers?

- (i) Inconspicuous flowers.
- (ii) Presence of nectaries.
- (iii) No fragrance.
- (iv) Short style.
- (v) Versatile anthers.

- (a) i, iii and iv
- (b) only iii
- (c) ii and iv
- (d) iv and v

**Answer (a)**

**Sol.** Self pollinating flowers do not need–

- 1. Attractive, large flowers (found usually in insect pollinated flowers)
- 2. Versatile anthers (found in air pollinated flowers)
- 3. Long style (found in air pollinated flowers)

Thus features in option 'a', i.e, inconspicuous flowers, absence of fragrance and short style are found in self pollinated flowers.

66. Apoptosis can be induced in a plant organ or the whole plant by a burst of :

- (a) Gibberellins
- (b) Ethylene
- (c) Cytokinins
- (d) Auxin

**Answer (b)**

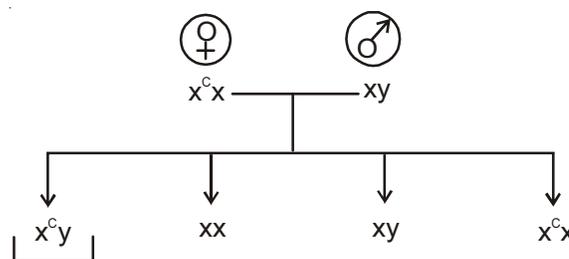
**Sol.** Apoptosis is programmed cell death (PCD) ethylene induces apoptotic cell death in plants.

67. A man with haemophilia has a daughter of normal phenotype. She marries a man who is not haemophilic. If the couple has four sons, what is the possibility that all four will be born haemophilic?

- (a)  $\frac{1}{4}$
- (b)  $\frac{1}{32}$
- (c)  $\frac{1}{16}$
- (d)  $\frac{1}{8}$

**Answer (c)**

**Sol.** The man ( $x^c y$ ) will produce normal daughter with phenotype  $x^c x$ . She is marrying to a normal male i.e.  $xy$



Haemophilic son = 50% =  $\frac{1}{2}$

Thus probability of four haemophilic son is

$$= \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{16}$$

68. If not absorbed by plants, nitrates may leach through soil into water bodies like river but ammonium ions are less likely to reach water bodies through soil because,

- (a) ammonium being a cation gets adsorbed by soil clay particles that are negatively charged.
- (b) ammonium ions react with water to form ammonia and escape.



So, long stem - axial flower and short stem with axial flower progenies in  $\approx 1 : 1$  ratio which according to question are produced in 11 and 10 respectively.

So, parental genotype was  $TtAA \times ttaa$

73. Rejection of transplant is an immune response of the type:-

- (a) B-lymphocyte mediated humoral.
- (b) Humoral, helper T lymphocytes mediated.
- (c) Cell mediated involving cytotoxic lymphocytes.
- (d) Cell mediated involving memory T lymphocytes.

**Answer (c)**

**Sol.** Graft rejection is function of T-lymphocytes, cytotoxic killer T-cells( $T_c$ ) damage foreign tissue by perforin action.

74. The percentage composition by volume of gases at various stages of respiration in humans is tabulated below.

	P	Q	R
Oxygen	16.4	20.95	13.8
Caron dioxide	4.0	0.04	5.5
Nitrogen	79.6	79.01	80.7

P, Q and R respectively represent:

- (a) Expired air, alveolar air and inspired air
- (b) Alveolar air, inspired air and expired air
- (c) Inspired air, alveolar air and expired air
- (d) Expired air, inspired air and alveolar air

**Answer (d)**

**Sol.** The percentage of  $O_2$ ,  $CO_2$  and  $N_2$  in inhaled/inspired air is 21%, 0.04% and 79% as represented in Q column. Expired air is a mixture of air being exhaled that mixes with trapped air in conducting path of respiratory system (dead space volume) as shown in column (P). Mixing of inhaled air with residual alveolar air leads to change in partial pressures of gases.

75. According to finding from the Human Genome Project, there are about 25000 genes but there are many more different polypeptides. Which of the following processes might explain the discrepancy between number of genes and polypeptides.

1. Mutations
  2. Post-translational modifications
  3. Crossing over during meiosis.
  4. Alternating splicing of RNA transcripts.
- (a) 1 & 2
  - (b) 2 & 4
  - (c) 1, 3 & 4
  - (d) 3 & 4

**Answer (b)**

**Sol.** Alternate splicing leads to formation of different polypeptides from the same genes.

Post translational modification can also make the different proteins from the same genes.

76. A wind type fruit fly(heterozygous for grey body colour and normal wings) is mated with a black fly with vestigial wings. The offspring have the following phenotypic distribution : wild type = 998; black vestigial = 994; grey vestigial = 208; black normal = 200

What is recombination frequency between the two given alleles?

- (a) 17%
- (b) 15%
- (c) 20%
- (d) 25%

**Answer (a)**

**Sol.** Among the obtained progenies

Wild type = 998  
Black vestigial = 994

{Parental combinations = 1992

Grey vestigial = 208

Black normal = 200

{Re combination or New combinations = 408

Total progeny = 1992 + 408 = 2400.

Recombination between two given genes alleles

$$= \frac{\text{New combination}}{\text{Total progeny}} \times 100$$

$$= \frac{408}{2400} = 17\%$$

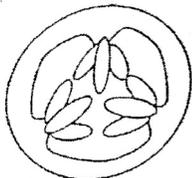
77. In an enzyme catalyzed reaction, it is possible to reverse the inhibition of a reaction by increasing the substrate concentration in which of the following case/ cases?

- (a) Competitive inhibition
- (b) Non-competitive inhibition.
- (c) Uncompetitive inhibition
- (d) Allosteric inhibition

**Answer (a)**

**Sol.** In competitive inhibition, the effect of a competitive inhibitor is reversed by increasing substrate concentration. At a sufficiently high substrate concentration, the reaction velocity reaches the  $V_{max}$  observed in the absence of inhibitor.  $K_m$  value increases in case of overcoming competitive inhibition but  $V_{max}$  remains same.

78. Anita was studying flower morphology in her school lab. She collected one flower from her school garden and dissected it. She took cross section of ovary and found that ovules were arranged inside the ovary as shown below:



She could correlate the seed arrangement in \_\_\_\_\_ fruit with the collected specimen.

- (a) Tomato                      (b) Green pea  
(c) Cucumber                (d) Bell pepper

**Answer** (c)

**Sol.** In given section placenta is parietal and such condition is found in pepo type of succulent fruit.

Tomato, bell pepper — axile placentation

Green pea — marginal placentation

Cucumber — parietal placentation and pepo fruit.

79. In an experiment, extract of brain tissue was subjected to differential centrifugation. It resulted in 5 different zones of separation, 1-5. Zone 3 was found to be rich in acetyl cholinesterase activity while zone 5 was rich in succinate dehydrogenase activity. These zone most likely respectively represent.

- (a) Myelin sheath and nuclei.  
(b) Synaptic vesicles and golgi bodies.  
(c) Mitochondria and myelin sheath.  
(d) Mitochondria and synaptic vesicles.

**Answer** (b)

**Sol.** Synaptic vesicles rupture to release acetyl choline which is degraded in synaptic cleft with the help of enzyme acetyl choline esterase. Enzyme succinate dehydrogenase is synthesized from nuclear genome within ribosome so it is found in golgi body for processing.

80. During embryo sac development in angiosperms, haploid megaspore continues to divide to form mature female gametophyte. It has 7-celled structure with 8 nuclei, where 6 nuclei are haploid and other two polar nuclei fuse to form diploid structure.

In *Lilium*, one of the two polar nuclei is triploid. Therefore, primary endosperm nucleus formed will be:

- (a) 3n                              (b) 4n  
(c) 5n                              (d) 2n

**Answer** (c)

**Sol.** If one of the polar nuclei is triploid then fusion of two polar nuclei will result into formation of (4n) nucleus and when 4n nucleus will fuse with (n) sperm it will lead to formation of 5n endosperm.

