Biology

Model Set - 2

Academic Year: 2020-2021 Marks: 70
Date: April 2021
Duration: 3h

1. The question paper is divided into four sections.
2. **Section A**: Q. No. 1 contains Ten multiple-choice type of questions carrying One mark each.
3. **Section A**: Q. No. 2 contains Eight very short answer type of questions carrying One mark each.
4. **Section B**: Q. No. 3 to Q. No. 14 contains Twelve short answer type of questions carrying Two marks each. **(Attempt any Eight)**.
5. **Section C**: Q. No.15 to Q. No. 26 contains Twelve short answer type of questions carrying Three marks each. **(Attempt any Eight)**.
6. **Section D**: Q.No. 27 to Q. No. 31 contains Five long answer type of questions carrying Four marks each. **(Attempt any Three)**.
7. Figures to the right indicate full marks.
8. For each MCQ, the correct answer must be written along with its alphabet. e.g., (a) ..... / (b) .... / (c) .... / (d) ..... Only first attempt will be considered for evaluation.

Q. 1 | Select and write the correct answer:

1.i In human beings 45 chromosomes/single X/XO abnormality causes

1. Down's syndrome
2. Klinfelter's syndrome
3. Turner's syndrome
4. Edward's syndrome

1.ii The word chromosome was coined by

1. Benda
2. Waldeyer
3. Robert Hooke
4. T.H.Morgan

1.iii Find out the example in which due to absence of respiratory pigment transport of respiratory gases does not takes place.

1. Cockroach
2. Scoliodon
3. Frog
4. Human

1.iv The erythropoeitic tissue in adult is mainly found in _____.

1. kidney
2. liver
3. red bone marrow
4. spleen

1.v _____ is a mineralocorticoid secreted by Adrenal gland.

1. Aldosterone
2. Cortisol
3. Corticoid
4. Androgen

1.vi Degeneration of dopamine producing neurons in the CNS causes _____ disease.

1. ADHD
2. Alzheimer's
3. Parkinson's
4. Fever

1.vii Carcinoma is cancer of _____ cells.

1. Epithelial
2. Connective tissue
3. Bone
4. Blood

1.viii Wheat -Atlas 66 has high contents of _____.

1. protein
2. vitamin
3. carbohydrates
4. Fats

1.ix Polar bears show hibernation during _____.

1. winter
2. summer
3. rainy season
4. favourable conditions

1.x Dodo bird, stellar sea cow and passenger pigeon are few examples of extinction due to _____.

1. habitat loss
2. hunting
3. Alien species invasion
4. overexploitation

Q. 2 | Answer the following:

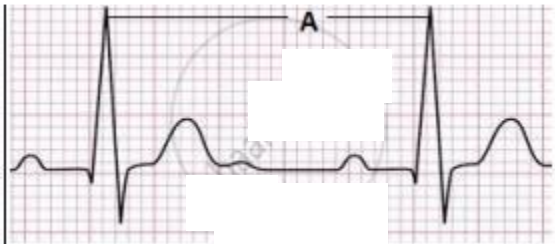
2.i How many linkage groups are present in Drosophila melanogaster?

Ans. 4 linkage groups are present in Drosophila melanogaster.

2.ii What is the reason for the 21st trisomy?

Ans. 21st Trisomy occurs due to non-disjunction or failure of separation of chromosomes (autosomes) during gamete formation.

2.iii Identify 'A' from the following ECG.



Ans. 'A' represents the 'RR interval' in the given ECG.

2.iv What is the function of the red nucleus?

Ans. Near the centre of the midbrain is a mass of grey matter scattered within the white matter. It is called the red nucleus. It plays an important role in controlling posture and muscle tone, modifying some motor activities, and motor coordination.

2.v What is the role of Taq-polymerase in PCR technology?

Ans. Taq-polymerase helps in polymerization of DNA molecules in PCR technology.

2.vi What is plasmid?

Ans. Plasmid is a circular, double stranded, self-replicating, extra-chromosomal DNA molecule.

2.vii Define 'Ecological succession'

Ans. The gradual and predictable changes in the species composition of a given area are called ecological succession.

2.viii A medicinal plant Rauwolfia vomitoria shows variations in concentration of reserpine from location to location. What type of level of biodiversity is this?

Ans. Variations in concentration of reserpine in Rauwolfia vomitoria from location to location is a type of 'Genetic diversity'.

Q. 3 | Attempt any Eight:

Mention significance of fruit and seed formation.

Ans. Significance of seed and fruit:

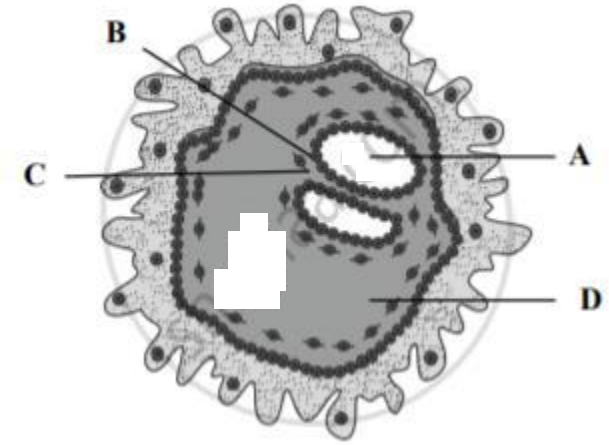
i. Fruits provide nourishment to the developing seeds.
ii. Fruits protect the seeds in immature conditions.
iii. Seeds serve as important propagating organs (units) of plants.
iv. Seeds and fruits develop special devices for their dispersal and thus help in the distribution of the species.

Q. 4 Give an account of polyembryony.

Ans. Polyembryony:

i. Polyembryony is the occurrence of more than one embryo in a seed which consequently results in the emergence of multiple seedlings.
ii. The additional embryos result from the differentiation and development of various maternal and zygotic tissues associated with the ovule of the seed.
iii. In adventive polyembryony, an embryo develops directly from the diploid cell of nucellus and integuments as in Citrus.
iv. In cleavage polyembryony, zygote proembryo sometimes divides (cleaves) into many parts or units. Each unit then develops into an embryo.

Q. 5 Identify the parts labelled in the given diagram.



Ans. A - Amniotic Cavity; B – Ectoderm; C – Mesoderm; D - Coelom.

Q. 6 Write a note on sex linkage.

Ans.

1. **Complete sex linkage:**
   a. It is exhibited by genes located on non-homologous regions of X and Y chromosomes.
   b. They inherit together because crossing over does not occur in nonhomologous regions.

c. Examples of X-linked traits are haemophilia, red-green colour blindness, myopia (near sightedness) and for Y-linked are hypertrichosis, etc.

2. **Incomplete sex linkage:**
   a. It is exhibited by genes located on homologous regions of X and Y chromosomes.
   b. They do not inherit together because crossing over occurs in homologous regions.
   c. Examples of X-Y linked traits are total colour blindness, nephritis, retinitis pigmentosa, etc.

Q. 7 Explain Avery, McCarty, and MacLeod's experiment in detail.

Ans.

1. Avery, Macleod, and McCarty (1944) purified DNA, RNA, proteins (enzymes), and other materials from heat-killed S-type and mixed them with R-type to see which ones could transform living R-types to S-types.
2. Only those mixed with DNA were transformed into S-type bacteria.
3. They also discovered that protein-digesting enzymes (proteases) and RNA-digesting enzymes (RNases) did not affect transformation. This indicated the transforming substance was neither a protein nor RNA.
4. DNA digested with DNase inhibited transformation, suggesting that DNA caused the transformation.

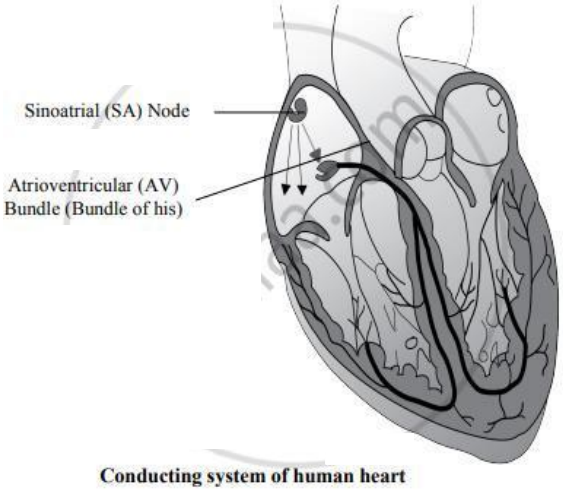
Q. 8 Describe modern man.

Ans. Modern man (Homo sapiens):

1. It includes all the human beings existing today on the earth (modern man).
2. Their fossils were discovered in Africa.
3. The cranial capacity of Homo sapiens is 1450 cc.
4. They had an erect posture.
5. Homo sapiens developed distinct races and developed cave art about 18000 years ago.

Q. 9 Draw diagram of conducting system of human heart. Label SA node and bundle of His.

Ans.



Conducting system of human heart

Q. 10 How a portal vein differs from normal vein?

Ans. Hepatic portal vein differs from normal veins in that it starts as capillaries from one organ and branches into some intermediate organ (e.g. liver), before taking the blood towards the heart.

Q. 11 'Injury to the medulla oblongata causes sudden death' Explain.

Ans.

i. Medulla oblongata is a part of brain stem which controls involuntary vital functions like heartbeat, respiration, vasomotor activities and peristalsis.
ii. Thus, injury to medulla oblongata may disrupt these vital functions and cause sudden death.

Q. 12 Name two bacteria which are responsible for fermenting dough of idli, dosa.

Ans. Leuconostoc and Streptococcus species of bacteria are responsible for fermenting dough of idli, dosa.

Q. 13 For production of edible vaccines plants are used. Explain this any one example.

Ans. 'Melt in the mouth' vaccines can be administered by placing them under tongue that delivers it into the blood stream.

Example- Potatoes, tomatoes, bananas, soybeans, alfalfa and cereals are the most common foods proposed for edible vaccine delivery

Q. 14 With the help of any one example explain Alien species invasion as one of the causes of Biodiversity losses.

Ans. When a new species gets introduced into any ecosystem accidentally or intentionally, there are chances that it proves harmful for existing species. Sometimes, it can lead to extinction of local species.

In such a case, it is called as invasive species. One of the major reasons of such a harmful effect of alien species is lack of local predator.

i. Introduction of predator fish - Nile perch in Lake Victoria proved deleterious for 200 local species of Cichlid fish.

Q. 15 | Attempt any Eight:

Human pregnancy shows three prominent trimesters. Answer the following question based on these trimester.

1. What is morning sickness during the first trimester?
2. Name the hormone secreted in the second trimester.
3. The organ which secretes hormone in second trimester is

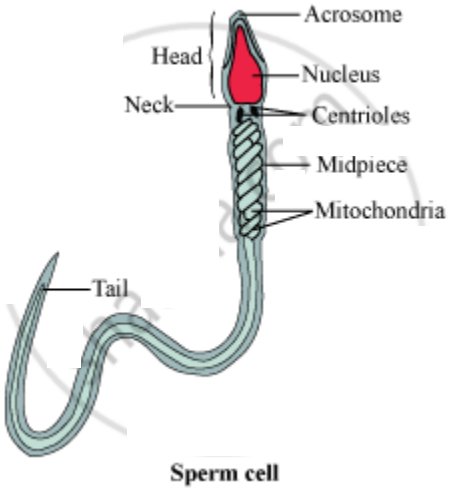
Ans.

1. Progesterone level becomes high and the menstrual cycle is suspended till the end of pregnancy and the mother's body also undergoes rapid changes. In this period, the mother experiences 'morning sickness' (nausea, vomiting, mood swings, etc.).
2. The hormone secreted during the second trimester is Progesterone.
3. The organ which secretes hormone in the second trimester is the placenta.

Q. 16 Draw a diagram of the microscopic structure of human sperm. Label the following parts in it and write their functions

(a) Acrosome
(b) Nucleus
(c) Middle piece

Ans. A. Structure of human sperm



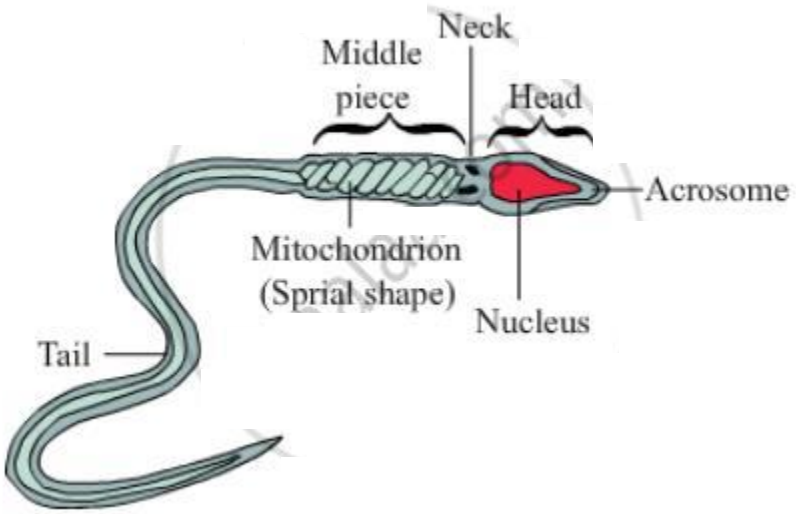
Sperm cell

Function of Acrosome-It releases various chemicals like hyaluronidase and acrosin which helps sperm in fusing with egg cell.

Function of Nucleus-It stores the genetic information. It carries 23 chromosomes, out of which one is sex chromosome (either X or Y). Thus, it is responsible for determining the sex of the individual.

Function of Middle piece-The middle piece contains several mitochondria, which produce energy for the motility of the sperm.

Ans. B.



- Head: It the flat oval part of the human sperm that contains the nucleus, containing genetic material, and acrosome, a small anterior part which is formed from Golgi complex. It secretes hyaluronidase enzyme which helps in the entry of sperm into the egg.
- Middle Piece: It is the middle, cylindrical portion of the sperm, which contains numerous mitochondria. They provide energy (ATP) to the sperm for its movement.
- Tail: It is the long, tapering structure composed of cytoplasm. It helps in the movement of the sperms inside the uterus.

Q. 17 Write a note on the morphological structure of the root.

Ans. A typical root of terrestrial plants has four regions from the apex to the base of the root. These are:

1. **Region of cell division:** This is a meristematic region which lies at the tip of the root, where the division of cell occurs.
2. **Region of cell elongation:** Cells of this region undergo elongation, as a result, the length of the root increases.
3. **Region of absorption:** This is the region for water absorption and bears root hairs. Root hairs absorb water and mineral salts from the soil. iv. Region of maturation: Cells of this region undergo maturation and form different types of tissues.

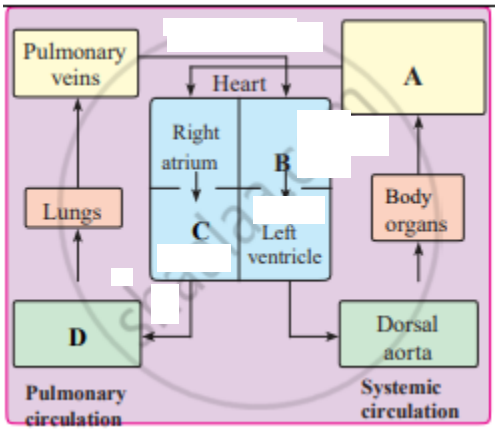
Q. 18 Write the name of _____

a. Gaseous growth hormone known to you.
b. Standard bio assay method for auxins.
c. Hormone that can overcome the requirement of vernalization.

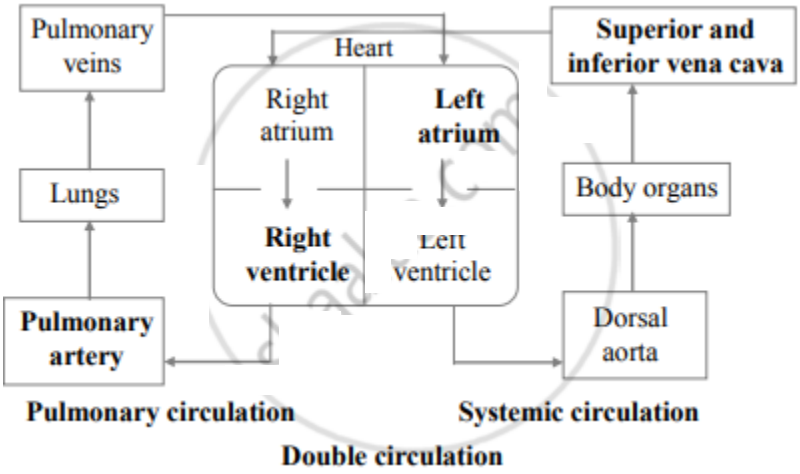
Ans.

a. Ethylene
b. Avena curvature test
c. Gibberellins

Q. 19 Draw the chart of double circulation and label A, B, C and D.



Ans.



Q. 20 Give the names of the hormones released by neurohypophysis.

A boy shows excessive thirst and micturition because of deficiency of a hormone secreted by neurohypophysis. Name the disease he is suffering from.

Ans.

i. Hormones released from the neurohypophysis are oxytocin and vasopressin.
ii. Hyposecretion of vasopressin or ADH results in diabetes mellitus which would be the cause of excessive thirst and micturition in the boy.

Q. 21 Distinguish between

Cerebrum and Cerebellum.

Ans.

Sr. No.	Cerebrum	Cerebellum
1.	It is the largest part of the brain	It is the second largest part of the brain
2.	Cerebrum is the part of forebrain.	Cerebellum is the part of hindbrain.
3.	The cerebrum co-ordinates the functions of the sensory and motor areas.	It is an important centre which maintains body equilibrium, posture, balancing orientation, moderation of voluntary movements, etc.

Q. 22 When the ELISA test was conducted on an immune-suppressed person, he tested positive for a pathogen.

a. Identify the disease the patient is suffering from.
b. Name the causative entity.
c. Mention the cells of the body that are attacked by the pathogen.

Ans.

a. The patient is suffering from AIDS.
b. The causative entity is Human Immunodeficieny Virus.
c. T4 lymphocytes are attacked by the pathogen.

Q. 23 Write chemical reactions to represent Methanogenesis.

Ans. Methanogenesis is last stage in which anaerobic Methanogenic bacteria like Methanobacterium, Methanococcus convert acetate, H_2 and CO_2 into Methane, CO_2 and H_2O and other products.

i. 12mol CH_3COOH $12CH_4 + 12CO_2$ (Acetic acid) Methane
ii. 4mol $H.COOH$ $CH_4 + 3CO_2 + 2H_2O$ (Formic acid)
iii. $CO_2 + 4H_2$ $CH_4 + 2H_2O$

Q. 24 What is Recognition sequence? Explain in brief.

Ans.

i. The sequences recognized by restriction enzymes are 4 to 8 nucleotides long and characterized by a particular type of internal symmetry is known as recognition sequence.
ii. When the sequence is read in opposite direction (3' to 5' or 5' to 3') it is identical/ same. For e.g. consider the particular sequence recognized by the enzyme EcoRI. 3' - _____ CTTAAG_____ 5' 5'_____ GAATTC _____ 3'
iii. Restriction enzymes either cut straight across the DNA in the region of palindrome to give blunt ends or cuts producing short, single stranded projections at each end of DNA to produce, cohesive or sticky ends or staggered ends.

Q. 25 Explain the role of any three abiotic factors affecting the environment.

Ans. The abiotic factors of an ecosystem are temperature, water, light and soil.

i. Temperature:

a. It is considered the most ecologically relevant environmental factor.
b. Average temperature on land varies from subzero levels in polar areas and high altitudes, upto 50ºC in tropical deserts in summer.

ii. Water:

a. Availability of water is an important factor affecting the organisms. The productivity and distribution of plants are also dependent on availability of water.
b. Chemical composition, temperature and pH of the water are some important factors for the survival of aquatic organisms.

iii. Light:

a. Sunlight is only source of energy for the entire ecosystem. Plants use light to perform photosynthesis.
b. Many species of small plants (herbs and shrubs) growing on forest floor are adapted to perform photosynthesis optimally under very low light conditions because they are constantly overshadowed by tall trees.

Q. 26 What are 'pioneer species'? Give two examples of them.

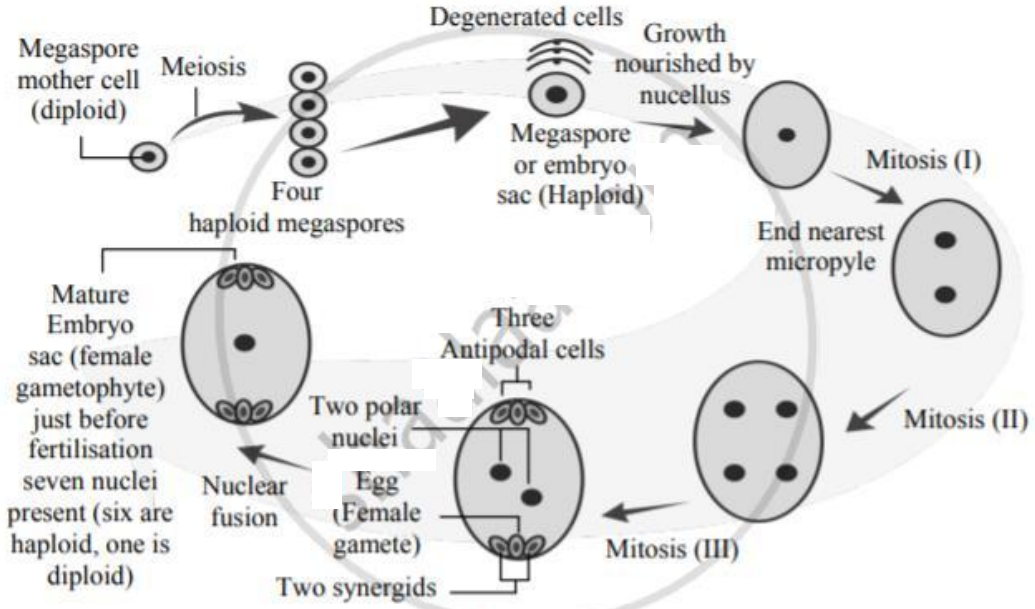
Ans. The species which invade a bare area and initiate the succession are called pioneer species.

Examples of pioneer species:

i. Crustose lichens are pioneer species on rocks.
ii. Small phytoplanktons are pioneer species in aquatic habitat.

Q. 27 | Attempt any Three:

Describe the development of female gametophyte of angiosperms with the help of diagram.
Ans.



Development of female gametophyte

i. The diploid Megaspore mother cell undergoes meiosis to form a linear tetrad of haploid cells i.e. megaspore.
ii. The upper three megaspores degenerate and the lowest one towards the centre of the nucellus remains functional. It acts as the first cell of the female gametophyte.
iii. The functional megaspore undergoes three successive, free nuclear mitotic divisions.
iv. Thus a total of eight nuclei is formed, four of which are located at each pole.
v. One nucleus from each pole migrates towards the centre and are called polar nuclei.
vi. Three nuclei towards micropylar end constitute egg apparatus.
vii. The Egg apparatus consists of the large central, haploid egg cell and two supporting haploid synergid cells.
viii. Synergid shows hair-like projections called filiform apparatus, which guide the pollen tube towards the egg.
ix. Antipodal cells are a group of three cells present at the chalazal end.
x. The two haploid polar nuclei of a large central cell fuse to form a diploid secondary nucleus or definitive nucleus, just prior to fertilization.
xi. This seven-celled and eight nucleated structure is called an embryo sac.
xii. Since the embryo sac develops from a single megaspore, it is described as monosporic development.
xiii. In angiosperms, the development of female gametophyte is endosporous i.e. within the megaspore.
xiv. The female gametophyte is colourless, endosporic and is concealed in the ovule enclosed by the ovary.

Q. 28 Short Answer Question:

Write a note on applications of DNA fingerprinting.

Ans.

1. In forensic science, DNA fingerprinting is used to solve problems of rape and some complicated murder cases.
2. DNA fingerprinting is used to find out the biological father or mother or both, of the child, in case of disputed parentage.
3. DNA fingerprinting is used in the pedigree analysis in cats, dogs, horses and humans.

Q. 29 Long answer question.

By taking industrial melanism as one example. Explain the concept of natural selection.

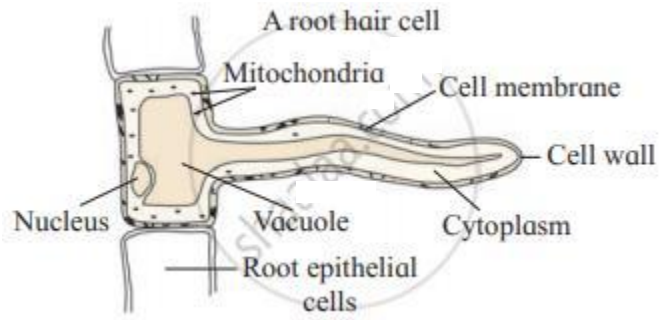
Ans.

1. Natural selection encourages those genes or traits that assure the highest degree of adaptive efficiency between the population and its environment.
2. Industrial melanism is one of the best examples of natural selection.
3. In Great Britain, before industrialization (1845) grey white-winged moths (Biston betularia) were more in number than black-winged moth (Biston carbonara).
4. These moths are nocturnal and during the day time they rest on a tree trunk.
5. White-winged moths were camouflaged (hide in the background) well with the lichen-covered trees that helped them to escape from the predatory birds.
6. However, the black-winged moth resting on lichen-covered tree trunks were easy victims for the predatory birds and their number was reduced.
7. During the industrial revolution, large number of industries came up in Great Britain.
8. The industries released black sooty smoke that covered and killed the lichens growing on a tree and turn the tree black due to pollution.
9. This change became an advantage to the black-winged moths that camouflaged well with the black tree trunks and their number increased
10. The white-winged moths however became victims to predatory birds due to which their number reduced. Thus, natural selection has resulted in the establishment of a phenotypic trait in the changing environmental conditions.

Q. 30 Long answer question.

Describe structure of root hair.

Ans.



1. Root hair is a cytoplasmic extension (prolongation) of epiblema cell.

2. Each root hair may be approximately 1 to 10 mm long and tube-like structure.

3. It is colourless, unbranched, short-lived (ephemeral), and very delicate.

4. It has a large central vacuole surrounded by a thin film of cytoplasm, plasma membrane, and thin cell wall, which is two-layered.

5. Outer layer is composed of pectin and the inner layer is made up of cellulose.

6. Cell wall of a root hair is freely permeable but the plasma membrane is selectively permeable.

Q. 31 Write full form of

a. IAA
b. IBA
c. NAA
d. 2,4-D

Ans.

i. Indole -3- acetic acid
ii. Indole butyric acid
iii. Naphthalene acetic acid
iv. 2,4-Dichloro phenoxy acetic acid