

Section A

1.

(d) Endosperm

Explanation:
Endosperm
2.

(b) Pseudomonas

Explanation:
Pseudomonas
3.

(c) Zero

Explanation:
Zero
4.

(b) B-cells are fused with myeloma cells.

Explanation:
B-cells are fused with myeloma cells.
5.

(a) Lesser interspecific competition

Explanation:
Lesser interspecific competition is not generally seen in biodiversity hotspots.
6.

(b) Fertilized egg of frog

Explanation:
Fertilized egg of frog
7.

(d) DNA fingerprinting

Explanation:
DNA fingerprinting
8.

(b) 3

Explanation:
In DNA molecules nitrogenous base of complementary strands binds with hydrogen bonds. In cytosine and guanine there are 3 hydrogen bonds and in adenine and thymine, the number of hydrogen bond is 2.
9.

(d) Cleistogamy

Explanation:
Cleistogamy

10.

(b) The parents are heterozygous

Explanation:

A diploid organism is heterozygous at a gene locus when its cells contain two different alleles of a gene.

Pedigree chart of a family shows that both male and female children carry the traits for free and attached ear lobes. Hence, the parents are heterozygous for the above-given trait.

11.

(d) Switching ON and OFF of the operon

Explanation:

In lac operon, lactose is the substrate for enzyme beta-galactocidase and it regulates switching ON and OFF of the operon.

Hence, lactose is called the inducer.

12.

(d) Molecular size and Molecular weight

Explanation:

Molecular size and Molecular weight

13. **(a)** Both A and R are true and R is the correct explanation of A.

Explanation:

Mutations are sudden unpredictable inheritable departures from the normal type without any intermediate stage. Discontinuous variations form the basis of the mutation theory of evolution which was proposed by De Vries (1902).

14.

(b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.

Explanation:

Assertion and reason both are correct statements but reason is not correct explanation for assertion.

15. **(a)** Assertion and reason both are correct statements and reason is correct explanation for assertion.

Explanation:

Assertion and reason both are correct statements and reason is correct explanation for assertion.

16. **(a)** Both A and R are true and R is the correct explanation of A.

Explanation:

Both A and R are true and R is the correct explanation of A.

17. (i) Acetobacter aceti species is used for the mass production of Acetic Acid, the main component in vinegar. During the fermentation process of vinegar production, the bacteria, Acetobacter aceti is used to act on wines and ciders resulting in vinegar with Acetic acid.

(ii) Clostridium butylicum produces butyric acid

18. A - Insects. They are the most species-rich taxonomic group in the animal kingdom, making up more than 70 per cent of the total species found on earth. Insects are found in almost all types of habitats.

B - Fish. Among the vertebrates, fish form the largest group including both freshwater and seawater fish.

19. (A) - Plasmid, (B) - Nucleoid

Plasmid is used as vector to transfer the gene of interest in the host cell.

20. A- Leydig's cell

B- Sertoli cell

C- Spermatogenesis (Formation of sperms)

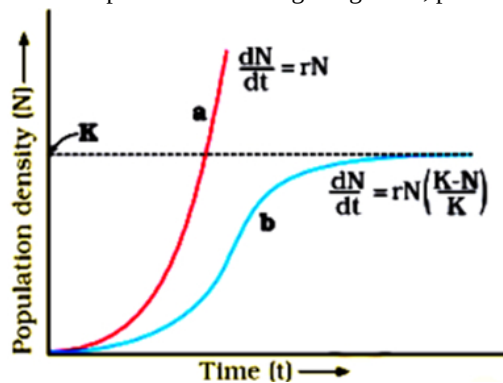
D- Spermiogenesis (Transformation of spermatid into sperm)

21. a. The above equation describes the exponential or geometric growth pattern of a population (Figure) and results in a J-shaped curve when we plot N in relation to time.

b. r = intrinsic rate of natural increase

c. Population growth curve a

- i. When responses are not limiting the growth, plot is exponential,
- ii. When responses are limiting the growth, plot is logistic, K is carrying capacity



- d. The resource, availability will be unlimited for this type of growth in a given population.

OR

Predators are prudent in nature because predators over exploit its prey then the later might become extinct and following it the predators will also get extinct.

Section C

22. Drawbacks of use of enzymes in Biotechnology:

- i. Extraction and purification of enzymes are not only laborious but also highly expensive.
- ii. Enzymes are not stable and are quite fragile.
- iii. Enzymes are denatured at a slightly higher temperature than room temperature.
- iv. Changes in pH deactivate the enzymes.
- v. Enzymes are influenced by a number of organic solvents, exposure to air or protein poisons. However, there is no alternative to enzymes.

23. i. 'a' is Trophoblast. It forms chorionic villi and foetal part of the placenta.

ii. It gets differentiated into ectoderm and endoderm.

iii. In the inner cell mass.

24. a) Brijmohan was not aware of the inheritance pattern for haemophilia. He thought that the disease shall be expressed among his grandchildren.

b) Scientific attitude, deep understanding and practical application of the subject. She was focussed having convincing ability.

c) Haemophilia is a sex linked recessive inherited disease. The gene is located on the X chromosome. Human male has only one sex chromosome (44A + XY). Rajiv is not haemophilic since he does not have the gene on his X chromosome. There remains no chance for him to pass on any haemophilic gene to the next generation.

d) No there remains no fear if they are married, provided the girl is not a carrier of haemophilia. If the girl is a carrier, then the chance for the son to be haemophilic is 50%.

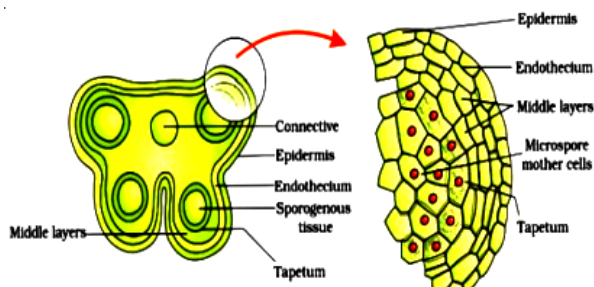
25. a. X - Insects

Y - Molluscs

b. X - makes most species rich taxonomic group

More than 70% of the total

26.



OR

Cell divisions increase the number of cells in the developing embryo, while cell differentiation helps a group of cells to undergo certain modifications to form specialised tissues and organs to form an organism.

At many stages of embryogenesis, if cell differentiation does not occur, the embryo cannot develop into a new organism. It will only remain like a mass of cells.

27. **Decomposition:** It is a process in which decomposers break down complex organic matter into inorganic substances like carbon dioxide, water and nutrients and the process is called decomposition. Dead plant remains such as leaves, bark flower and raw material of animals, including fecal matter, constitute detritus, which is the raw material for decomposition. The important steps in the process of decomposition are fragmentation, leaching, catabolism, humification and mineralization.
- (a) **Fragmentation:** Detritivorous like earthworm breakdown detritus into smaller particles. This process is called fragmentation.
- (b) **Leaching :** By this process water soluble inorganic nutrients go down into the soil horizon and get precipitated as unavailable salts.
- (c) **Catabolism :** Bacterial and fungal enzymes degrade detritus into simpler inorganic substances. This process is called as catabolism.
- (d) **Humification :** It leads to accumulation of a dark coloured amorphous substance called humus which is highly resistant to microbial action and undergoes decomposition at an extremely slow rate. Being colloidal in nature it serves as a reservoir of nutrients.
- (e) **Mineralization:** The humus is further degraded by some microbes and release of inorganic nutrients occur by the process of mineralization.
28. **In vitro fertilisation (IVF):** It is the fertilisation of the egg outside the body of female in almost, similar conditions as that in the body.
- In vivo fertilisation:** It is the method of sexual reproduction in which the fusion of gametes takes place within the body of the female. Sperms are deposited by natural coitus or by artificial insemination.

Section D

29. i. They worked with bacteriophage, i.e. viruses that infect bacteria. These viruses were used because during infection they transfer their genetic material into bacteria.
- ii. They used two types of culture media, containing ^{35}S and ^{32}P , so as to compare that which one out of DNA and proteins gets transferred from virus to bacteria and act as genetic material.
- iii. A blender and centrifuge were used to open up the bacterial cells and viral particles, so, that genetic material could be visualised.

OR

They concluded that DNA is the genetic material that is passed from virus to bacteria.

30. i. RNA interference (RNAi)
- ii. Tobacco plant
- iii. Meloidogyne incognita (nematode)

OR

Agrobacterium tumefaciens vector.

Section E

31. Industrial Melanism is an adaptation, where the moths living in the industrial area developed melanin pigments to match their body to the tree trunk that were covered with black soot. Before industrialization, in Great Britain, it was observed that there were more white winged moths. However, after industrialization the white coloured lichen covered the tree trunks. In that background the white winged moths survived but the dark coloured moths were eaten by predators. During the post industrialization periods the tree trunks became dark due to industrial smoke and soots. Under such conditions, the white winged moths did not survive due to predators and dark winged moths survived. In areas where industrialization did not occur, the count of moths were low. Thus, industrial melanism supports evolution by natural selection.

OR

- i. In picture A there is a melanic moth and a white-winged moth on a tree trunk in an unpolluted area that is before industrialization. In picture B there is a melanic moth and a white-winged moth on a tree trunk in a polluted area that is after industrialization.
- ii. *Biston betularia*
- iii. Directional or progressive selection.
32. Gene therapy is a collection of methods that allows the correction of a gene defect that has been diagnosed in a child/embryo. Here genes are inserted into a person's cells and tissues to treat a disease. The first clinical gene therapy was given in 1990 to a 4 -year old girl with adenosine deaminase (ADA) deficiency. This enzyme is crucial for the immune system to function. The disorder is caused due to the deletion of the gene for adenosine deaminase. In some children ADA deficiency can be cured by bone marrow transplantation: in others, it can be treated by enzyme replacement therapy, in which functional ADA is given to the patient by injection. But the problem with both of these approaches that they are

not completely curative. As a first step towards gene therapy, Lymphocytes from the blood of the patient are grown in a culture outside the body. A functional ADA cDNA (using a retroviral vector) is then introduced into these lymphocytes, which are subsequently returned to the patient. However, as these cells are not immortal, the patient requires "periodic infusion of such genetically engineered Lymphocytes. However, if the gene isolate from marrow cells producing ADA is introduced into cells at early embryonic stages, it could be a permanent cure.

OR

- i. Insulin was extracted earlier from the pancreas of slaughtered pigs and cattle animals Insulin obtained from these sources caused some allergy or some other reactions to the foreign protein.
- ii. Steps involved in insulin production by the Eli Lilly company are as follows:
 - a. DNA sequences corresponding to the two polypeptide, A and B-chains of insulin were synthesized in vitro.
 - b. They were introduced into plasmid DNA of E. coli.
 - c. This bacterium was cloned under suitable conditions.
 - d. The transgene was expressed in the form of polypeptides A and B, secreted into the medium.
 - e. They were extracted and combined by creating disulphide bridge to form human insulin.

- iii. Differences between insulin produced by rDNA and insulin produced by pancreas are as follows:

Insulin produced by rDNA	Insulin produced by the pancreas
It has A and B polypeptides.	It has three polypeptides. A, B and C-chains before maturing called the prohormone.
It directly synthesizes the mature hormone.	It undergoes processing to form mature and functional hormone.

33. i. A normal cell has the ability to contact inhibition which inhibits its division after contact with other cells. When this ability is lost in a cell, it becomes cancerous.
- ii.
 - a. Biopsy: It's a piece of the suspected tissue is cut into thin section stained and studied.
 - b. Histopathology: It's a piece of suspected tissue is examined under a microscope by a pathologist.
 - c. MRI: It uses strong magnetic fields and non-ionising radiations, accurately detect pathological and physiological changes in the tissues.
- iii. Two methods that are possibly cure cancer are radiotherapy and chemotherapy.

OR

A tumor is the uncontrolled and unregulated proliferation of cancerous cells to form masses of cells which can expand irregularly. Tumors are of two types:

- i. **Benign tumor (Non-malignant tumor):** They normally remain confined to their original location and do not spread to other parts of the body thus causing little damage. Most tumors are of this type and do not give rise to cancer i.e. non-cancerous.
- ii. **Cancerous tumor (Malignant tumor):** These are a mass of neoplastic proliferating cells. It begins as a small tumor growth at first, grows slowly in the start and more rapidly later on. The tumor ultimately spreads to the adjacent tissues. Later on, cancerous cells separate from the original site and migrate through the blood to the other sites and where they divide and redivide to form a **secondary tumor**. As these cells actively divide and grow, they also starve the normal cells by competing for vital nutrients. Cells sloughed from such tumors reach distant sites through blood, and wherever they get lodged in the body, they start a new tumor there. This property called metastasis is the most damaging property of malignant tumors.