

CBSE Board Paper Solution-2020

Class	: XII
Subject	: Biology
Set	: 1
Code No	: 57/3/1
Time allowed	: 3 hours
Maximum Marks	: 80

General Instructions :

Read the following instructions very carefully and strictly follow them :

- (i) Question paper comprises five sections – **A, B, C, D** and **E**.
- (ii) There are **27** questions in the question paper. **All** questions are compulsory.
- (iii) **Section A** – Questions no. **1** to **5** are multiple choice questions, carrying **1** mark each.
- (iv) **Section B** – Questions no. **6** to **12** are short-answer questions type-I, carrying 2 marks each.
- (v) **Section C** – Questions no. **13** to **21** are short-answer questions type-II, carrying 3 marks each.
- (vi) **Section D** – Questions no. **22** to **24** are short-answer questions type-III, carrying 3 marks each.
- (vii) **Section E** – Questions no **25** to **27** are long-answer questions, carrying 5 marks each.
- (viii) Answers should be brief and to the point.

- (ix) *There is no overall choice in the question paper. However, an internal choice has been provided in **two** questions of 1 mark, **one** question of **2** marks, two questions of 3 marks and **three** questions of 5 marks. Only one of the choices in such questions have to be attempted.*
- (x) *The diagrams drawn should be neat, proportionate and properly labelled, wherever necessary.*
- (xi) *In addition to this, separate instructions are given with each section and question, wherever necessary.*

SECTION A

Note:- Choose the correct option from the choices given in each of the following questions :

- 1) Introduction of an alien DNA into a plant host cell is achieved by making them**
- (A) Competent with bivalent ions**
 - (B) Using microinjections**
 - (C) Using gene gun**
 - (D) Using lysozymes and chitinase**

[1]

Answer:

- (C) Using gene gun

Explanation:

Alien DNA can be introduced to host cell by both microinjections and gene gun methods. From these two methods, gene gun method is suitable for plant host cells. In gene gun method, cells are bombarded with high velocity DNA coated gold or tungsten micro-particles.

2) One of the ex situ conservation methods for endangered species is

- (A) Biosphere reserves**
- (B) National parks**
- (C) Cryopreservation**
- (D) Wildlife sanctuaries**

[1]

Answer:

(C) Cryopreservation

Explanation:

Cryopreservation is an ex situ method as it involves the conservation of endemic plants or animals in liquid nitrogen at -196°C .

OR

2) Ozone gas is continuously formed in the stratosphere by

- (A) Action of UV rays on nascent oxygen**
- (B) Reaction of oxygen with water vapour**
- (C) Action of UV rays on molecular oxygen**

(D) Action of UV rays on water vapour

[1]

Answer:

(C) Action of UV rays on molecular oxygen

Explanation:

Ozone gas is continuously formed in the stratosphere by the action of UV rays on molecular oxygen. The degradation of ozone molecule into oxygen molecule and nascent oxygen also takes place continuously in the stratosphere to maintain the balance between the production and degradation of ozone in the stratosphere.

3) Intense lactation in mothers acts as a natural contraceptive due to the

- (A) Suppression of gonadotropins**
- (B) Hypersecretion of gonadotropins**
- (C) Suppression of gametic transport**
- (D) Suppression of fertilization**

[1]

Answer:

(A) Suppression of gonadotropins

Explanation:

Intense lactation in mothers acts as a natural contraceptive due to the suppression of gonadotrophins.

During lactation, the amount of oestrogen produced by the lactating mother is very less than normal which restricts the process of ovulation. Therefore, no menstrual cycle occurs in the intense lactation.

4) The principle of vaccination is based on the property of

(A) Specificity

(B) Diversity

(C) Memory

(D) Discrimination between 'self' and 'non-self'

[1]

Answer:

(C) Memory

Explanation:

The principle of vaccination is based on the property of memory. In vaccination, attenuated pathogen is supplied into the normal healthy body. By vaccination, the healthy human body produces antibodies along with memory B-cells and T-cells. When vaccinated person later attacked by the same pathogen, the existing memory B-cells and T-cells recognise the antigen and destroys the pathogen by producing antibodies and lymphocytes.

OR

4) Opioids act as

(A) Depressants

- (B) Pain Killers
- (C) Euphoria providers
- (D) Stimulants

[1]

Answer:

(A) Depressants

Explanation:

Opioids are the special drugs that binds with the specific opioid receptors present in our central nervous system and gastrointestinal tract. They are generally depressant and they work by slowing down the body functions.

5) Nematode specific genes were introduced into the tobacco host plant by using the vector

- (A) Plasmid
- (B) Bacteriophage
- (C) pBR 322
- (D) *Agrobacterium*

[1]

Answer:

(D) *Agrobacterium*

Explanation:

Nematodes specific genes were introduced into tobacco plant by using the vector *agrobacterium*. Nematode-

specific genes were introduced into the host plants using agrobacterium to produce both sense and antisense RNA in the host cells. The parasite cannot survive in the transgenic host thus, prevents the plants from getting attacked.

SECTION B

6) *Spirulina* is a rich source of proteins. Mention the two ways by which large scale culturing of these microbes is possible.

[2]

Answer:

The two ways by which large scale culturing of these microbes is possible are:

1. In starch containing solution, such as potato processing plants
2. In sewage and animal manure medium

7) How does EcoRI specifically act on DNA molecule? Explain.

[2]

Answer:

ii. They are sterile and unable to reproduce.

9) Name and explain the technique that can be used in developing improved crop varieties in plants bearing female flowers only.

[2]

Answer:

Bagging method is used in developing improved crop varieties in plants bearing female flowers only.

In the bagging method, the buds of female flowers are bagged before opening. When the stigma matures and becomes receptive, the stigma is dusted with desired pollens and flower is re-bagged again.

OR

9) When are the non-flowering plants said to be homothallic and monoecious; and heterothallic and dioecious? Give an example of each.

[2]

Answer:

When both male and female reproductive parts are present on the same plant, the non-flowering plants are called homothallic and monoecious.

When both male and female reproductive parts are present on the different plants, the non-flowering plants are called heterothallic or dioecious.

10) Mention the kind of interaction mycorrhizae exhibit. How is *Glomus* in mycorrhizal association beneficial to the plants?

[2]

Answer:

Mycorrhizae exhibit symbiotic interaction in which both the organisms (fungi and roots of higher plants) are benefitted.

Glomus absorbs phosphorus from the soil and passes it to the plant. It also helps in providing resistance against root bore pathogens, tolerance to pathogens, salinity and drought. It also helps in overall growth of plants.

11) Given below is the segment of a DNA strand. Write its complementary strand and the RNA strand that can be transcribed from the DNA molecule formed.

5' TAC CGT GAC GTC 3'

[2]

Answer:

5' TAC CGT GAC GTC 3'

3' ATG GCA CTG CAG 5' (Complementary Strand)

↓ (Transcription)

5' UAC CGU GAC GUC 3' (RNA Strand)

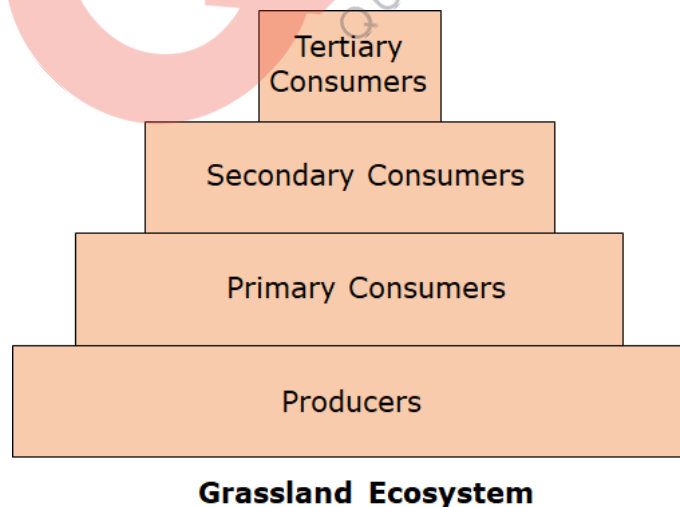
12) Name the type of Ecological Pyramid that can exist as upright as well as inverted. Explain how does it happen.

[2]

Answer:

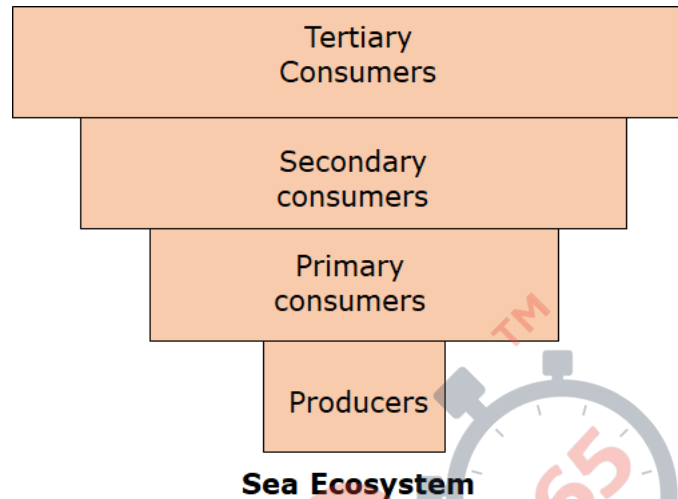
The ecological pyramid that can exist as upright as well as inverted is pyramid of biomass.

In grassland ecosystem, the number or the biomass of the producers is more as compared to consumers of successive higher levels.



In sea ecosystem, the number or the biomass of the producers is less as compared to the consumers of

successive higher levels resulting in an inverted pyramid. The pyramid of biomass in sea is usually inverted because the biomass of fishes far exceeds that of phytoplankton.



SECTION C

13) "Cotton bollworms enjoy feeding on cotton plants, but get killed when feed on Bt cotton plant." Justify the statement.

[3]

Answer:

Bt cotton is the genetically modified plant created by genetically altering the cotton genome to express a microbial protein from the bacterium *Bacillus thuringiensis*. It produces the toxin crystals that normal cotton plant would not produce. The toxin is coded by a gene *cryIAC* (*cry*). Upon ingestion by a specific population of the organisms, it dissolves the gut lining and leads to

the death of the organism. For example, the proteins encoded by the genes *cryIAC* and *cryIIAb* present in Bt cotton plant kills the cotton bollworms.

OR

13) (a) Mention the cause of ADA deficiency in humans.

(b) How is gene therapy carried out to treat the patients suffering from this disease?

(c) State the possibility of a permanent cure of this disease.

[3]

Answer:

(a) In humans, ADA deficiency is caused due to the deletion of the gene for enzyme adenosine deaminase.

(b) ADA deficiency can be treated by gene therapy. In this method, lymphocytes from the blood of the patient are grown in a culture outside the body. Then, by using a retroviral vector, a functional ADA cDNA is introduced into these lymphocytes, which are successively returned to the patient's body.

(c) ADA deficiency can be cured permanently, if the adenosine deaminase producing isolated genes

from the marrow cells are introduced into the cells at early embryonic stages.

- 14) (a) Differentiate between intrauterine insemination and intrauterine transfer.**
(b) Mention one positive and one negative application of amniocentesis.

[3]

Answer:

(a)

Intrauterine Insemination	Intrauterine Transfer
In this process, sperms are placed inside the uterus of a woman to ease the fertilisation.	In this process, embryos are placed into the uterus of a woman to establish the pregnancy.

(b) Positive application of amniocentesis - It is used to test the presence of certain genetic disorders, like haemophilia, and also to determine the survivability of the foetus.

Negative application of amniocentesis - It is used for the sex-determination which results in an increased threat of female foeticides.

- 15) Explain the solutions found by Ahmed Khan, a Bengaluru based plastic sack manufacturer,**

after realising the problems created by plastic wastes.

[3]

Answer:

Ahmed Khan, a plastic sack manufacturer in Bangalore, has been producing plastic sacks for 20 years. He realized that plastic waste was a huge problem and should be recycled. His company developed polyblend, a fine powder of recycled modified plastic. It is used to lay the roads by mixing it with bitumen.

In collaboration with R. V. College of Engineering and the Bangalore City Corporation, he proved that mixture of polyblend and bitumen enhanced the water repellent properties of the bitumen and helped to increase the life of the road three times. In Bangalore, more than 40 kms of road has already been laid by the year 2002.

16) Mention the chemical nature of an antibody and name the type of cells they are produced by. Write the difference between active and passive immune responses on the basis of antibodies.

[3]

Answer:

Antibodies are globular plasma proteins produced by B cells of the immune system.

The difference between active and passive responses is that the active response or immunity is developed due to the production of antibodies inside the body, whereas passive immunity is developed when the antibodies are provided from outside.

OR

16) Name the cells that act as HIV factory in humans when infected by HIV. Explain the events that occur in these infected cells.

[3]

Answer:

Macrophages act as HIV factory in the human body when infected by HIV.

After entering into the body of a person, the virus enters into macrophages, where the RNA genome of the virus replicates to form viral DNA with the help of the enzyme reverse transcriptase. This viral DNA is then incorporated into the DNA of the host cell and it directs the infected cells to produce virus particles. Thus macrophages continue to produce virus.

17) (a) Why is the collection of white winged moths and dark winged moths made in England between 1850 – 1920 considered a good example of natural selection?

(b) "Evolution is based on chance events in nature and chance mutations in organisms." Justify the statement.

[3]

Answer:

- (a)** In a collection of moths made in 1850s in England, it was observed that there were more white-winged moths on trees than dark-winged. However, in the collection carried out from the same area after industrialisation, i.e., in 1920, there were more dark-winged moths in the same area, i.e., the proportion was reversed. It is because during post-industrialisation period, the tree trunks became dark due to industrial smoke and soot. Under this condition, the white-winged moth did not survive due to their easy visibility to predators, but the dark-winged moth survived. This showed that in a mixed population, those that can better-adapt, survive and increase their population size. Hence, this is a good example of natural selection.
- (b)** Evolution is not a predictable directed process in sense of determinism. It is rather based on chance events and mutations occurring in nature and organisms respectively. For example, excessive use of pesticides and antibiotics may lead to appearance of resistant organisms in a span of

months and years but not centuries. This shows that evolution is not a directed process, it is a stochastic process based on chance events in nature and chance mutation in organisms.

18) (a) Compare the mechanism of sex determination in humans with that of honey bees, with respect to chromosome number.

(b) How is the gamete formation comparable in the above two cases?

[3]

Answer:

(a) In honey bee, the mechanism of sex determination is of the XO type in which females have a pair of X-chromosomes besides autosomes, whereas the males have a single X-chromosome.

On the other hand, in humans, XY type of sex determination is seen where both male and female have same number of chromosomes. Males bear autosomes plus XY, while female have autosomes plus XX.

(b) In both the cases two different types of gametes are produced by the males. In honey bees, the gametes produced by males will be either with or without X chromosome. However, in humans, the

gametes produced by males will have either X chromosome or Y chromosome.

19) Differentiate between the pattern of inheritance in humans of the blood diseases, haemophilia and thalassemia.

[3]

Answer:

Haemophilia	Thalassemia
It is a genetic disorder in which blood clotting ability get impaired due to the defect in one of the blood clotting factors. It leads to spontaneous bleeding on injury.	It is a type of an inherited autosomal recessive disorder in which abnormal haemoglobin is synthesised that decreases the oxygen carrying capacity of blood. As a result, devastation of blood cells takes place that causes anaemia.
It is an X- linked recessive disorder and is more common in males than in females.	There are two types of thalassemia, i.e., alpha thalassemia (production of α -globin chain affected) and beta thalassemia (β -globin chain affected).

Males can inherit this disease from heterozygous carrier mother and such males become infertile.	If both the parents are carriers of this disease, the individual has 25% chance of inheriting the disease.
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20) Identify i, ii, iii, iv, v and vi in the following table:

No.	Organism	Bioactive molecules	Use
1	<i>Monascus purpureus</i>	i	ii
2	iii	iv	Antibiotic
3	v	Cyclosporin A	vi

[3]

Answer:

No.	Organism	Bioactive molecules	Use
1	<i>Monascus purpureus</i>	i. Cyclosporin A	ii. Blood-cholesterol lowering agent
2	iii. <i>Streptococcus</i>	iv. Streptokinase	Antibiotic
3	v. <i>Trichoderma polysporum</i>	Cyclosporin A	vi. Immunosuppressive agent in organ transplant

21) (a) Write the scientific name of methanogen bacteria. Where are these bacteria

generally found? Explain their role in biogas production.

(b) Name the components of biogas.

[3]

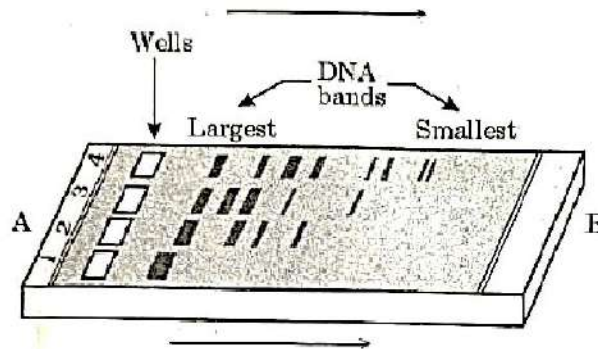
(a) The scientific name of methanogen bacteria are *Methanobacterium*. These bacteria are generally found in the anaerobic sludge and also in the rumen of cattle. These bacteria anaerobically break down the organic waste and produce methane containing biogas as an energy product.

(b) The components of biogas are:

- i. Methane (CH_4)
- ii. Carbon dioxide (CO_2) and
- iii. Small amount of hydrogen sulphide (H_2S) and hydrogen (H_2)

Section D

22) Given below is the diagram representing the observations made for separating DNA fragments by Gel electrophoresis technique. Observe the illustration and answer the questions that follow.



- (a) Why are the DNA fragments seen to be moving in the direction A→B?
- (b) Write the medium used on which DNA fragments separate.
- (c) Mention how the separated DNA fragments can be visualised for further technical use.

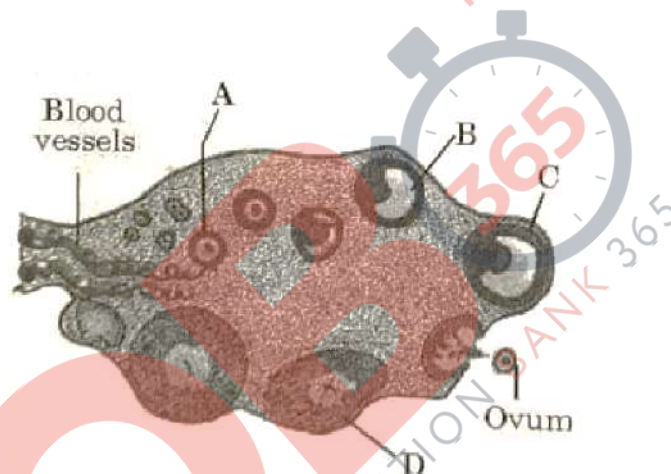
[3]

Answer:

- (a) In the process of gel electrophoresis, as the gel runs, the smallest pieces of DNA move towards the positive end of the gel, while the largest pieces of DNA remain near the wells. In the given illustration, B is the positive end of the gel. DNA fragments, being negatively charged, move towards the positive end. Thus, DNA fragments are moving in the direction A to B.
- (b) In the process of gel electrophoresis, agarose gel is used as the medium on which DNA fragments separate.

- (c) The separated DNA fragments are stained with a dye called ethidium bromide (EtBr). After staining, DNA fragments can be visualised under the UV radiation, as ethidium bromide shows fluorescence under the UV light.

23) Study the transverse section of human ovary given below and answer the questions that follow.



- (a) Name the hormone that helps in the growth of A → B → C.
- (b) Name the hormone secreted by A and B.
- (c) State the role of the hormone produced by D.

[3]

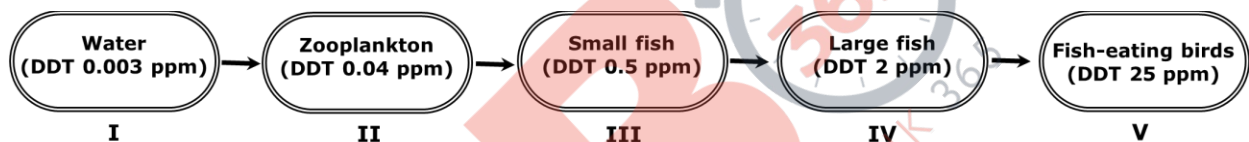
Answer:

- (a) Follicle stimulating hormone (FSH) helps in the growth of A → B → C.

(b) Estrogen is secreted by A and B.

(c) Progesterone is secreted by "D" i.e. corpus luteum. It maintains the endometrium of the uterus.

24) Indiscriminate use of chemicals, pesticides and weedicides by humans are polluting our water bodies, which in turn are harming the living organisms. Study the flow chart and answer the questions based on it.



(a) Why does the concentration of DDT seem to be considerably high in the top consumer?

(b) How would the organisms at the highest level be affected?

(c) Name the phenomenon observed.

[3]

Answer:

(a) DDT is a toxic substance which cannot be excreted or metabolised by an organism. Therefore, it gets accumulated in the body of the organism and can be passed on to the next trophic level.

This phenomenon in which the concentration of a toxicant increases at successive trophic levels is called biomagnification.

Thus, in the given flow chart, the concentration of DDT seems to be considerably high in the top consumer due to biomagnification.

- (b) The presence of DDT in high concentrations in birds causes a disturbance in the metabolism of calcium. This results in eggshell thinning and premature egg breaking. Eventually, bird populations may decline.
- (c) Biomagnification

SECTION E

25) (a) According to ecologists, tropical regions in the world account for greater biological diversity. Justify.

(b) Why are habitat loss and alien species invasion considered as the causes of biodiversity loss? Explain with the help of an example of each.

[5]

Answer:

(a) According to ecologists, biological diversity is greater in tropical regions due to the following reasons:

- 1.** In the past, temperate regions were subjected to frequent climatic changes such as glaciations. However, tropical regions have remained relatively undisturbed for millions of years. This constant environment allowed species to diversify over millions of years without any environmental disturbances.
- 2.** Tropical regions are less seasonal, relatively more constant and predictable in terms of the environment. This helps in greater species diversification over time.
- 3.** Tropical regions receive more solar energy throughout the year. This significantly contributes to higher productivity and thus, greater diversity.

(b) The large varieties of plant and animal species that constitute our biosphere are dwindling at an alarming rate. This is largely due to human activities and interventions with natural phenomenon. The reasons for considering habitat loss and alien species as the cause of biodiversity loss are enlisted below:

- 1.** Habitat loss: Human activities have been largely responsible for the loss of existing habitats resulting in a very sharp decline in biodiversity. For example, the Amazon rain forest, which harbours a large variety of species across the globe, is being cut at a very rapid pace to cultivate *soya beans* or for

conversion into grassland for raising cattle for beef production.

- 2.** Alien species invasion: When an alien species is introduced in an ecosystem intentionally or unintentionally, at times, it turns invasive. This invasion results in the decline or extinction of indigenous species. For example, the introduction of Nile perch into Lake Victoria resulted in the extinction of over 200 species of cichlid fish in the lake.

OR

- 25) (a) What is an ecological succession?**
(b) Differentiate between primary and secondary succession. Why is secondary succession faster than primary succession? Explain with suitable examples.
(c) What are pioneer species? Give examples of pioneer species in Xerarch and Hydrarch successions respectively.

[5]

Answer:

- (a)** Ecological succession refers to the gradual and fairly predictable changes in the composition of species of a certain area. During ecological succession, some species colonise a particular area and their population increases while the population of other species decreases or they

disappear. It is of two types, namely, primary succession and secondary succession.

- (b)** Primary succession occurs in areas like bare rock, lava, and newly created reservoir or pond. These areas lack soil. The formation of fertile soil in these areas takes place over a span of several hundred to thousand years. However, secondary succession occurs in the areas that were once inhabited by biological communities. These areas include abandoned farmlands, cut or burned forests, and lands that have been flooded. The fertile soil is present in these areas. Thus, no time is invested in soil formation so, secondary succession is faster than primary succession.

The differences between primary and secondary succession are tabulated below:

Primary succession	Secondary succession
It occurs in the areas where no living organisms ever existed.	It occurs in the areas where natural biotic communities have been destroyed due to natural disturbances.
Initially, the soil is absent during primary succession.	Some soil or sediment is present.
It is a slow process.	It is faster than primary succession.

- (c)** The species that invade a bare area are known as pioneer species. Its common example is Lichen.

Later, these species help in the growth of very small plants, which are ultimately succeeded by bigger plants.

Succession of plants in dry areas is called Xerarch succession while in wetter areas is called Hydrarch succession. The examples of pioneer species in Xerarch and Hydrarch succession are lichen and phytoplankton, respectively.

26) (a) Name the type of DNA that forms the basis of DNA fingerprinting and mention two features of this DNA.

(b) Write the steps carried out in the process of DNA fingerprinting technique, and mention its application.

[5]

Answer:

(a) DNA fingerprinting is a quick way to compare the DNA sequences of any two individuals. **Satellite DNA** forms the basis of DNA fingerprinting. The main features of this DNA are:

- 1.** It forms a large portion of the human genome but does not code for any proteins.
- 2.** It shows a high degree of polymorphism and is an important tool in forensic applications.

(b) Steps carried out in the process of DNA fingerprinting are as follows:

- 1.** Isolation of DNA.

2. Digestion of DNA with the help of restriction endonucleases.
3. Separation of DNA fragments by the process of electrophoresis.
4. Transferring of separated DNA fragments to synthetic membranes like nylon or nitrocellulose.
5. Hybridisation using labelled satellite DNA (also called VNTR) probe.
6. Detection of hybridised fragments by autoradiography.

Applications of DNA fingerprinting are:

1. In paternity issues since polymorphisms are inherited from parents to children.
2. In forensic crime analysis (using blood, hair-follicle, skin, saliva, semen, etc.).
3. In population genetics to analyse variation within the population.
4. In conservation biology to study the genetic variability of endangered species.
5. In evolutionary biology to compare DNA extracted from fossils to present-day animals or humans.

OR

26) Explain the role of different genes in a *lac* operon, when in a 'Switched On' state.

[5]

Answer:

In bacteria and humans, *lac* operon (lactose operon) is required for lactose transport and metabolism. In *lac* operon, regulatory genes and a common promoter regulate a polycistronic structural gene.

The genes present in a *lac* operon are:

1. Regulatory gene (the *i* gene) – It synthesises the repressor of the operon.
2. Structural genes:
 - a. *z* gene – It synthesises beta-galactosidase which helps in the hydrolysis of lactose into glucose and galactose.
 - b. *y* gene – It codes for permease, which makes the cell permeable to beta-galactosidase.
 - c. *a* gene – It helps in the synthesis of transacetylase.

The operon is switched on in the presence of lactose. Lactose acts as an inducer. It binds to the repressor (encoded by *i* gene), allowing RNA polymerase to bind to the promoter. This initiates transcription and the products of structural genes (beta-galactosidase, permease and transacetylase) are synthesised.

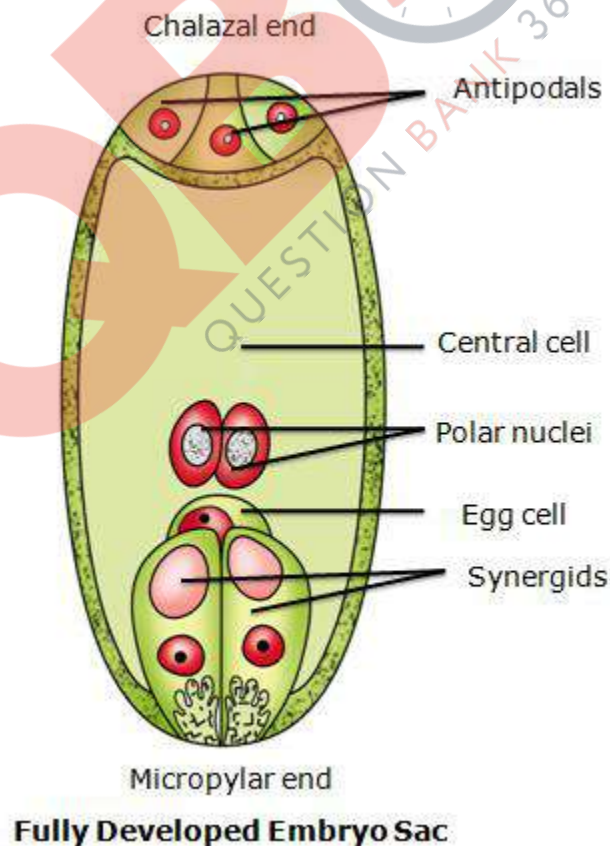
27) (a) Draw a diagram of a fully developed embryo sac of an angiosperm. Label its chalazal end and any other five parts within the embryo sac.

- (b) Why does the development of an endosperm precede that of the embryo in angiosperm?
- (c) Number of chromosomes in an onion plant cell is 16. Name the cells of the embryo sac having 16 and 24 chromosomes formed after fertilisation.

[5]

Answer:

(a)



- (b) In angiosperms, the development of an endosperm precedes embryo development. This is because the developing embryo requires nutrition for its growth and development. This nutrition is provided by the endosperm.
- (c) Number of chromosomes in an onion plant cell ($2n$) is 16. This implies that the number of chromosomes in the gametes (n) is 8.

Zygote is formed by the fusion of a male gamete and an egg cell, so it will have $2n$ number of chromosomes.

$$2n = 2 \times 8 = 16$$

An endosperm is formed by triple fusion, that is, the fusion of a male gamete and polar nuclei. Therefore, an endosperm has $3n$ number of chromosomes.

$$3n = 3 \times 8 = 24$$

Thus after fertilization, the zygote and endosperm will have 16 and 24 chromosomes, respectively.

OR

27) Describe the events that occur after fertilisation of an ovum till implantation in a human female.

[5]

Fertilisation refers to the process of fusion of an ovum and a sperm. Fertilisation of the ovum results in the formation of a diploid zygote.

- 1.** The zygote undergoes various mitotic divisions while moving towards the uterus through the isthmus of the oviduct.
- 2.** These divisions results in the formation of 2, 4, 8 and 16 daughter cells. These are known as blastomeres.
- 3.** The embryo having 8 to 16 blastomeres is referred to as morula. As morula moves further into the uterus, it undergoes continuous division and gets transformed into blastocyst.
- 4.** In the blastocyst, blastomeres are arranged in the following way:
 - a. They form an outer layer, which is called trophoblast.
 - b. An inner cell mass gets attached to the trophoblast.
- 5.** The blastocyst gets attached to the endometrium of the uterus through the trophoblast layer and the inner cell mass gets differentiated as the embryo.
- 6.** Once the blastocyst is attached, the cells of the uterus divide rapidly to cover the blastocyst. This embedding of the blastocyst in the endometrium is called implantation.

