

CBSE Class 12 Biology
Sample Paper 02 (2020-21)

Maximum Marks: 70

Time Allowed: 3 hours

General Instructions:

- i. All questions are compulsory.
- ii. The question paper has four sections: Section A, Section B, Section C and Section D. There are 33 questions in the question paper.
- iii. Section–A has 14 questions of 1 mark each and 02 case-based questions. Section–B has 9 questions of 2 marks each. Section–C has 5 questions of 3 marks each and Section–D has 3 questions of 5 marks each.
- iv. There is no overall choice. However, internal choices have been provided in some questions. A student has to attempt only one of the alternatives in such questions.
- v. Wherever necessary, neat and properly labeled diagrams should be drawn.

Section A

1. Which fetal membrane and part of the female reproductive system take part in the formation of the placenta in foetus?
2. Name the stage of the human embryo that gets implanted in the uterus and draw its labelled diagram.
3. In a dihybrid cross, when would the proportion of parental gene combinations be much higher than non-parental types, as experimentally shown by Morgan and his group?
4. Give the term for the changes that occur in population due to alteration in mortality, sex ratio, age groups etc.
5. Mention any two activities of animals, which get cues from diurnal and seasonal variations in light intensity.
6. What will be the possible blood groups likely to be inherited by children born to a group A mother and group B father both heterozygous for the trait?
7. Mention any two contrasting traits with respect to seeds in pea plant that were studied by Mendel.

8. Which stage of *Entamoeba histolytica* is pathogen to humans?
9. How are the two chains of protein insulin linked?
10. How is lactic acid bacteria beneficial to us other than helping in curdling the milk?
11. **Assertion:** The cross between red and white flower bearing snapdragon plants results in a pink coloured flower.
Reason: Incomplete dominance of red and white flower results into pink coloured flower.
 - a. Both assertion and reason are correct.
 - b. The assertion is correct but the reason is incorrect
 - c. The assertion is incorrect but the reason is correct.
 - d. Both assertion and reason are incorrect.

OR

- Assertion:** Chromosomes and genes both occur in pairs.
Reason: The two alleles of gene pair are located on homologous sites on homologous chromosomes.
- a. Assertion and reason both are correct
 - b. The assertion is correct but the reason is incorrect
 - c. Assertion and reason both are incorrect
 - d. The reason is not related to the assertion
12. **Assertion:** Many visitors to the hills suffer from skin and respiratory allergy problems.
Reason: Conifer trees produce a large quantity of wind-borne pollen grains.
 - a. Both Assertion and Reason are true and the Reason is the correct explanation of the Assertion
 - b. Both Assertion and Reason are true and the Reason is not the correct explanation of the Assertion
 - c. Assertion is true statement but reason is false
 - d. Both Assertion and Reason are false
13. **Assertion:** Regulation of lac operon by a repressor is referred to as negative regulation.
Reason: Lac operon is under the control of positive regulation as well.
 - a. Both assertion and reason are correct
 - b. Assertion is correct but reason is incorrect
 - c. Both assertion and reason are incorrect

d. Assertion is incorrect but reason is correct

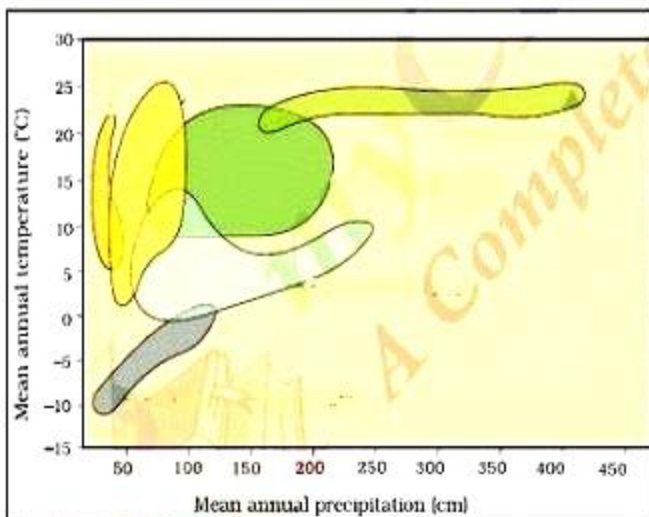
14. **Assertion:** Diversity observed in the entire geographical area is called gamma diversity.

Reason: Biodiversity decreases from high altitude to low altitude.

- a. Assertion and reason both are correct statements and reason is correct explanation for assertion.
- b. Assertion and reason both are correct statements but reason is not correct explanation for assertion.
- c. Assertion is correct statement but reason is wrong statement.
- d. Assertion is wrong statement but reason is correct statement.

15. **Read the following and answer any four questions:**

Ecology is the interactions among organisms, between the organism and its abiotic environment. Ecology at the organismic level is essentially physiological ecology which tries to understand how different organisms are adapted to their environments in terms of not only survival but also reproduction. The rotation of the planet around the Sun results in variation. These variations together with annual variation in precipitation account for the formation of major biomes such as desert, rain forest, and tundra. Regional and local variations within each biome lead to the formation of a wide variety of habitats. Major biomes of India are shown below



i. Which of the following is not a part of an organism's physical environment?

- a. Temperature
- b. Light
- c. Other organisms
- d. Humidity

ii. The variations together with annual variation in precipitation account for the

formation of major biomes is

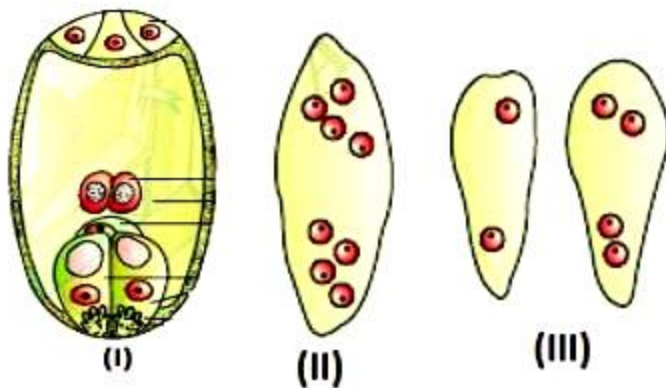
- a. temperature
 - b. precipitation
 - c. incident solar radiation
 - d. all of these
- iii. Seasonal variations on Earth occur due to its
- a. revolution around the sun and tilted axis
 - b. rotation around its own axis
 - c. due to other planets
 - d. none of these
- iv. Formation of tropical forests needs mean annual temperature and mean annual precipitation as
- a. $18 - 25^{\circ}\text{C}$ and $150 - 400\text{ cm}$
 - b. $5 - 15^{\circ}\text{C}$ and $50 - 100\text{ cm}$
 - c. $30 - 50^{\circ}\text{C}$ and $100 - 150\text{ cm}$
 - d. $5 - 15^{\circ}\text{C}$ and $100 - 200\text{ cm}$
- v. **Assertion-** Regional and local variations within each biome lead to the formation of a wide variety of habitats.
- Reason-** life exists not just in a few favourable habitats but even in extreme and harsh habitats.
- a. Both Assertion and Reason are true and Reason is the correct explanation of the Assertion
 - b. Both Assertion and Reason are true but Reason is not the correct explanation of the Assertion
 - c. The Assertion is true but the Reason is false
 - d. Both the statements are false

16. Read the following and answer any four questions:

The gynoecium represents the female reproductive part of the flower. The gynoecium may consist of a single or more than one pistil. They may be fused or maybe free. The placenta is located inside the ovarian cavity. Megasporangium (ovule) consists of a small structure attached to the placenta by a stalk called a funicle. The body of the ovules fuses with a funicle in the region called hilum. The nucleus is located in the embryo sac. the

process of formation of, megaspore from the megaspore mother cell is called megasporangium. Meiosis result in the formation of four megaspore

- i. Gynoecium with a single pistil is known as:
 - a. multicarpellary
 - b. monocarpellary
 - c. syncarpous
 - d. apocarpous
- ii. Which of the following is not part of the ovary?
 - a. Stigma
 - b. Style
 - c. Ovary
 - d. Stamen
- iii. The protective involve of the ovule is called:
 - a. integument
 - b. micropyle
 - c. chalaza
 - d. helium
- iv. Which of the following have only one ovule in the ovary?
 - a. Papaya
 - b. Watermelon
 - c. Mango
 - d. Orchids
- v. Which of the following shows the mature embryonic sac

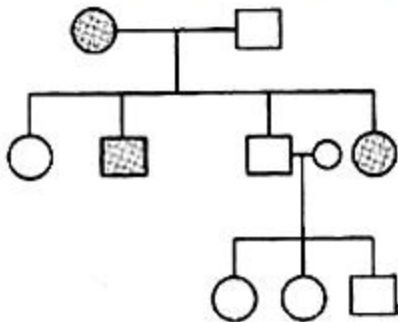


- a. Only (I)
- b. Both (I) and (II)
- c. Only (III)

d. None of these

Section B

17. What way the advent of the birth control pill have resulted in an increase in STDs?
18. In the following pedigree chart, state if the trait is autosomal dominant, autosomal recessive or sex-linked. Give reason.



19. Tobacco plants are damaged severely when infested with *Meloidogyne incognita*. Name and explain the strategy that is adopted to stop this infestation.
20. How does dsRNA gain entry into eukaryotic cell to cause RNA interference?

OR

Why are yeasts used extensively for functional expression of eukaryotic genes?

21. Name the category of virus that carries reverse transcriptase? What is the purpose of this enzyme.
22. Give the technical terms for the following:
- (1) Molecular scissors
 - (2) Molecular sieve
 - (3) Molecular glue
 - (4) Autonomous replicating circular DNA
 - (5) First isolated restriction endonuclease
 - (6) Extraction of DNA fragments from gel

OR

Explain the importance of the selectable marker, with the help of a suitable example.

23. What is red list? Give two uses of red list.
24. What is biome? Name the major biomes of India.
25. How do scientists extrapolate the total number of species on Earth?

Section C

26. Define point mutation? Give one example.
27. Would it be appropriate to use DNA probes such as VNTR in DNA fingerprinting of a bacteriophage?
28. Name and explain the two types of immune responses in humans.
29. Explain the process of splicing, capping and tailing which occur during transcription in Eukaryotes.
30. Pollen banks are playing a very important role in promoting plant breeding programme the world over. How are pollens preserved in the pollen banks? Explain how are such banks benefitting our farmer? Write any two ways.

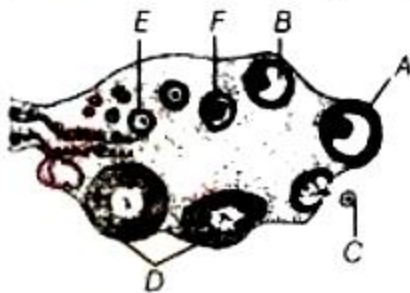
OR

Rita and her parents were watching a TV serial in the evening. During a commercial break, an advertisement flashed on the screen which was promoting the use of sanitary napkins. Rita was still watching the TV. The parents got embarrassed and changed the channel. Rita objected to her parents' behaviour and explained the need for these advertisements.

- i. What values did the parents show?
- ii. Briefly describe the phases of a menstrual cycle.

Section D

31. i. Given below is the TS of human ovary. Identify the following in the diagram.
Corpus luteum, Secondary oocyte, Antrum, Primary follicle and Primary oocyte

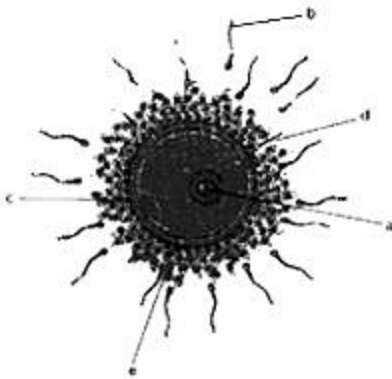


- ii. Explain the changes the primary oocyte undergoes, while in different follicular stages before ovulation.

OR

Study the illustration given below and

- i. Identify 'a'
- ii. Name and state the function of 'c'.
- iii. Identify 'd'
- iv. Explain the role of hormones in the formation and releases of 'a'
- v. Draw a diagram of 'b' separately and label the parts:
 - that helps its entry into 'a'
 - that carry genetic materials
 - that helps in its movement.



32. i. Write the palindromic nucleotide sequence for the following DNA segment.
5' - GAATTC-3'
- ii. Name the restriction endonuclease that recognises this sequence.
 - iii. How are sticky ends produced? Mention their role.

OR

If a desired gene is identified in an organism for some experiments, explain the process of the following:

- i. Cutting this desired gene at specific location.
 - ii. Synthesis of multiple copies of this desired gene.
33. Explain the process of sewage water treatment before it can be discharged into natural water bodies. Why is this treatment essential?

OR

List the events that reduce the Biological Oxygen Demand (BOD) of a primary effluent during sewage treatment.

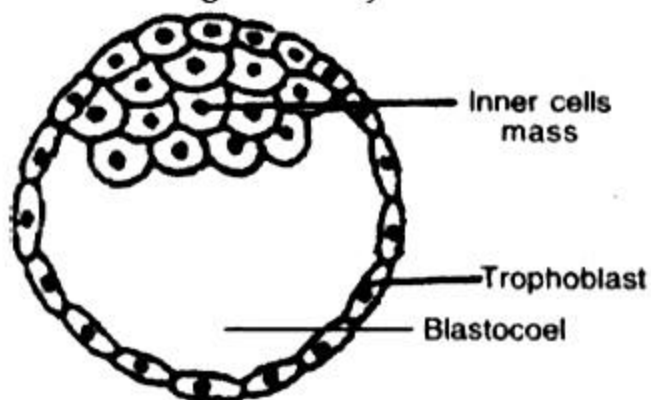
CBSE Class 12 Biology
Sample Paper 02 (2020-21)

Solution

Section A

1. Chorionic villi and inner wall layer of the uterus take part in the formation of the placenta in foetus.

2. **Name of stage:** Blastocyst



3. The proportion of parental gene combinations would be much higher than non-parental types when the two genes in a dihybrid cross are closely situated on the same chromosome and show very little crossing over. The phenomenon of physical association of genes on a chromosome is called **incomplete linkage**.
4. The term used for the changes that occur in population due to alteration in mortality, sex ratio, age groups etc. is Population index.
5. The two activities of animals, which get cues from diurnal and seasonal variations in light intensity are
- Timings of their foraging
 - Migratory activities
 - Reproduction
6. The possible blood groups are likely to be A, B, AB, and O.
7. Two contrasting seed traits studied by Mendel are:-
- Seed shape-** Round and wrinkled
 - Seed color-** Yellow and green
8. Trophozoite or magna stage
9. By Disulphide bonds.

10. Two benefits of LAB are given below

- i. They improve the nutrient quality of curd by increasing the vitamin-B₁₂ content
- ii. LAB also check the growth of disease causing microbes in the stomach.

11. (a) Both assertion and reason are correct.

Explanation: In Snapdragon flower, a cross between true-breeding white and red coloured flower produces a pink coloured flower in F₁ generation. This happens due to incomplete dominance of alleles over the other.

OR

(a) Assertion and reason both are correct

Explanation: In diploid cells, both chromosomes and genes occur in pairs. Two alleles of gene pair are located on homologous sites on homologous chromosomes.

12. (a) Both Assertion and Reason are true and the Reason is the correct explanation of the Assertion

Explanation: Skin and respiratory allergy problems arise in hilly areas due to allergen present in these areas. Allergen induce inflammatory reaction in the body.

13. (a) Both assertion and reason are correct

Explanation: An operon is a cluster of coordinately regulated genes. It includes structural genes (generally encoding enzymes), regulatory genes (encoding, e.g. activators or repressors), and regulatory sites (such as promoters and operators).

The type of control is defined by the response of the operon when no regulatory protein is present.

The inducer–repressor control of the lac operon is an example of **negative control**, in which expression is normally blocked.

In contrast, the CAP–cAMP system is an example of **positive control**, because the expression of the lac operon requires the presence of an activating signal.

14. (c) Assertion is correct statement but reason is wrong statement.

Explanation: Community and ecosystem diversity are of three types- alpha, beta, and gamma. Alpha diversity is the species diversity in a given community or habitat, alpha diversity is dependent upon species richness and evenness or equitability. Beta diversity is biodiversity, which appears in a range of communities due to the replacement of species with the change in community or habitat due to the presence of different micro-habitats, niches and difference in environment conditions. Gamma diversity is diversity

present in ranges of communities as represented by the diversity of habitats or ecosystems over a total landscape or geographical area. Biodiversity is not uniform on the Earth. It varies with the change in latitude or altitude. Biodiversity increase, when we move from high to low latitude (i.e., from the poles to the equator)

15.
 - i. (c) Other organisms
 - ii. (d) all of these
 - iii. (a) revolution around the sun and tilted axis
 - iv. (a) 18 – 25°C and 150 – 400 cm
 - v. (b) Both Assertion and Reason are true but Reason is not the correct explanation of the Assertion
16.
 - i. monocarpellary
 - ii. Stamen
 - iii. integuments
 - iv. Mango
 - v. Only (I)

Section B

17. The advent of the birth control pill makes it unnecessary to use other means of contraception, particularly the condom. Thus STDs are more readily transmitted during sexual activity.
18. Autosomal dominant.
The defective trait is present in both male and female progeny and the unaffected child did not pass the trait.
19. The strategy is based on the process of RNA interference.
It involves blocking of a specific mRNA due to complementary ds RNA molecule that binds to and prevent translation of the mRNA. It is called silencing of mRNA.
20. dsRNA gains entry into the eukaryotic cell either through
 - i. infection by virus having an RNA genome.
 - ii. mobile genetic elements (transposons) that replicate via an RNA intermediate.

OR

Yeasts are the simplest single-celled eukaryotic organisms and like bacteria, they reproduce asexually by budding or fission, genetically well-characterized, easy to grow and manipulate. They can be grown readily in both small culture vessels and large scale

bioreactors.

21. Retroviruses carry reverse transcriptase. This enzyme catalyses the formation of DNA from RNA which integrates with DNA of host cell.
22. (1) Restriction endonucleases
(2) Agarose gel
(3) DNA - ligase
(4) Plasmid
(5) Hindi II
(6) Elution

OR

Selectable markers- They help in identifying and eliminating non-transformants and selectively permitting the growth of transformants. Normally, the genes encoding for antibiotic resistance to antibiotics such as ampicillin, tetracycline, kanamycin or chloramphenicol, etc., are considered as useful selectable markers for *E. coli*.

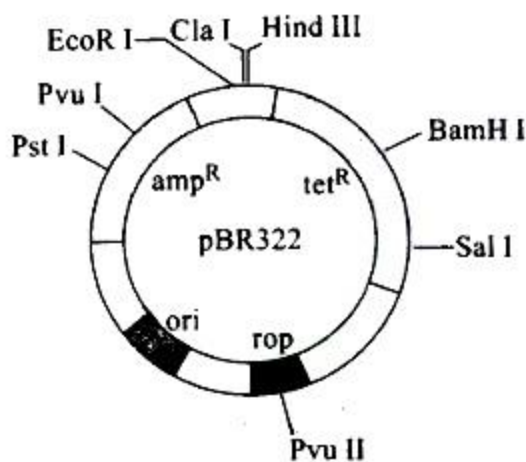


Fig: *E. coli* cloning vector pBR322 showing antibiotic resistance genes (amp^R and tet^R)

23. IUCN maintains a red data book or red list which is a catalogue of taxa facing risk of extinction. It aims to convey the urgency of conserving threatened species to the public and policy makers so as to reduce species extinction.
Uses:
 - (i) Identification and documentation of endangered species of plants and animals.
 - (ii) Creating awareness about importance of preserving the threatened biodiversity.
24. A biome is a complex of communities with specific types of flora and fauna and maintained under distinctive climatic conditions e.g., a desert biome.

Major biomes of India are:

- i. Tropical rainforests
 - ii. Deciduous forests
 - iii. Desert
 - iv. Seacoast
25. Considering that an overwhelmingly large proportion of the species waiting to be discovered are in the tropics. Biologists make a statistical comparison of the temperate-tropical species richness of an exhaustively studied group of insects and extrapolate this ratio to other groups of animals and plants to come up with a gross estimate of the total number of species on earth.

Section C

26. Mutations are new sudden, inheritable, discontinuous variations which appear in the organisms due to a permanent change in their genotype.
- Point mutations are a type of gene mutations which involve the substitution, deletion or insertion of a single nucleotide or nitrogen base of the cistron e.g., Sickle Cell anaemia, an autosomal hereditary disorder is caused by the formation of abnormal haemoglobin called Hb^S . Hb^S differs from normal haemoglobin Hb^A in only one amino acid-6th amino acid of β - chain of glutamic acid is replaced by valine. Thus, disorder is due to the change of one nitrogen base in the cistron.
27. VNTR (Variable Number Tandem Repeat) is a location in the genome where a short nucleoside is organized as a tandem repeat. Analysis of VNTR is used for many purposes; including DNA fingerprinting. But bacteriophage does not have too many DNAs rather only a few strands of DNA are available in bacteriophage. This does not leave scope for repeating sequences in DNA. Hence, VNTR cannot be used in DNA finger-printing of a bacteriophage.
28. There are two immune response.
- i. The primary immune response occurs when an antigen comes in contact with the immune system for the first time. During this time the immune system has to learn to recognize the antigen and how to make an antibody against it and eventually produce memory lymphocytes.
 - ii. The secondary immune response occurs when the second time (3rd, 4th, etc.) the person is exposed to the same antigen. At this point, immunological memory has been established and the immune system can start making antibodies immediately.

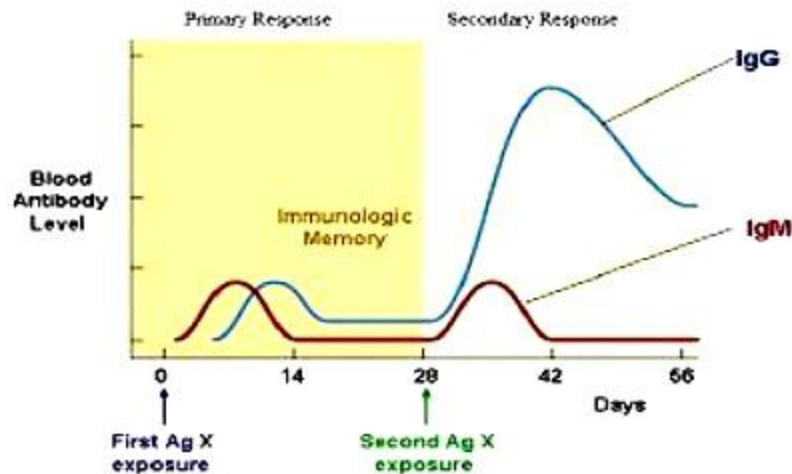


Fig. Immune Response and Secretion of antibodies

29. The process of transcription in eukaryotes can be explained as follows:

Splicing: The primary transcript of RNA undergoes splicing, by which the introns are removed and the exons are joined together.

Capping: Methyl guanosine triphosphate is added to the 5' end of *hn* RNA in capping.

Tailing: Adenylate residues (about 200 – 300) are added at the 3' end Of the *hn* RNA in tailing.

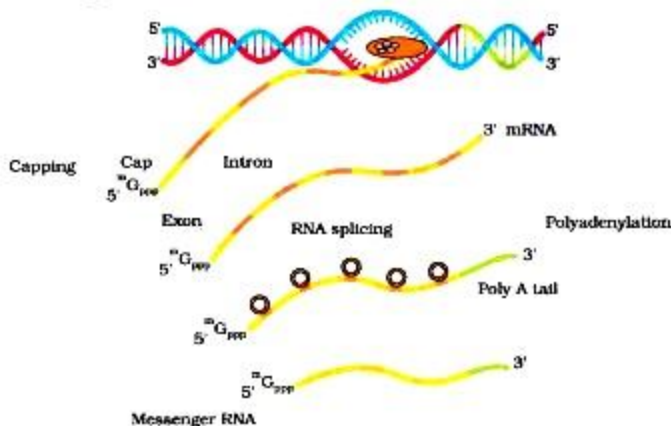


Figure: Eukaryotic transcription

30. Pollen banks are used to store pollens for a very long period of time in viable conditions.

Pollens are preserved in a bank using cryopreservation i.e., they are stored in a viable condition in low-temperature conditions(-196 degree Celsius) using liquid nitrogen.

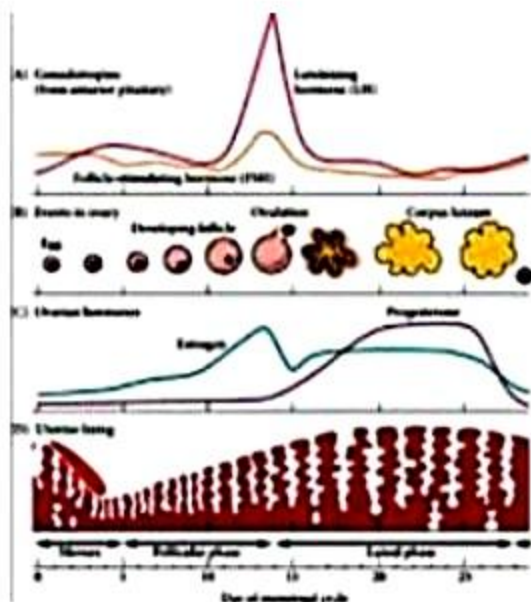
The important applications of pollen banks for our farmers are the following :

- To preserve the agricultural biodiversity in the form of preservation of valuable genetic resources.
- These pollens can be used in various crop hybridization breeding programmes, biochemical and physiochemical studies such as the study of allergens etc.

OR

- i. The parents were traditional but understood the need for such advertisements. They showed maturity and openness later.

ii.



Phases: To write details of the different phases describing the diagram

- a. Menstrual phase
- b. proliferative phase
- c. Secretory phase

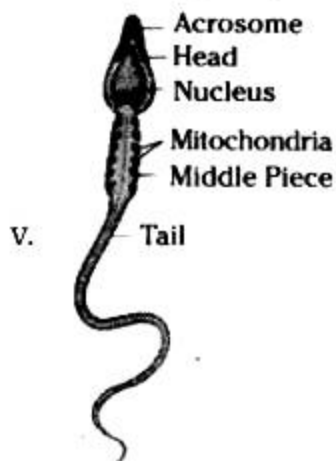
Section D

31. i. The parts identified in the given TS of the ovary are as follows:
 - A-Graafian follicle
 - B-Antrum
 - C-Secondary oocyte
 - D-Corpus Luteum
 - F-Primary follicle and Primary oocyte
- ii. In human females, primary oocytes are formed during the embryonic developmental stages in the foetal ovaries.
 - a. Primary oocytes start dividing and enter prophase -I of meiosis to remain suspended at this stage.
 - b. Each primary oocyte is surrounded by a layer of granulosa cells and becomes the primary follicle.
 - c. The primary follicle when surrounded by more layers of granulosa cells, is called a secondary follicle.

- d. Secondary follicle transforms into a tertiary follicle, with the development of a fluid-filled cavity (antrum) around the primary oocyte.
- e. Granulosa cells become organised into an outer theca externa and an inner theca interna.
- f. Now, primary oocyte completes meiosis-I and forms a larger haploid secondary oocyte and a tiny first polar body.

OR

- i. Human ovum
- ii. Zona pellucida. When one sperm penetrates the ovum, the zona pellucida makes it impervious to other sperm
- iii. Cells of corona radiata layer.
- iv. GnRH of Hypothalamus stimulates the anterior pituitary to secrete FSH and LH.
 - FSH stimulates the formation of ovum by stimulating the growth of ovarian follicles.
 - By the action of LH the oocyte completes the first meiotic division and becomes secondary oocyte and finally release from the follicle.



32. i. Palindromic sequence for
 - 5' - GAATTC - 3'
 - 3' - CTTAAG - 5'
- ii. Restriction endonuclease Eco RI recognises the above palindromic sequence.
- iii. Sticky ends on DNA are formed by the action of enzymes restriction endonucleases. These enzymes cut the strand of DNA a little away from the centre of the palindrome sequence between the same two bases on both the strands. This results in single-stranded stretches on both the complementary strands at their ends. These overhanging stretches are called sticky ends as they form hydrogen bonds with the

complementary basepair sequences.

Role of the sticky ends -These sticky ends produced from hydrogen bonds with their complementary cut counterparts. This stickiness of the ends facilitates the action of the enzyme DNA ligase.

OR

- i. Cutting of the desired gene at a specific location is done by incubating the DNA with specific restriction endonuclease. Restriction enzymes recognise a particular palindromic nucleotide sequence and cut the DNA at that site.
- ii. Synthesis of multiple copies of the desired gene is carried out by Polymerase Chain Reaction (PCR)

Amplification of recombinant DNA gene is done using Polymerase Chain Reaction (PCR). It is carried out in the following steps:

- a. **Denaturation** -The double-stranded DNA is denatured by applying high temperature of 95°C for 15 seconds. Each separated strand acts as a template.
- b. **Annealing** - Two sets of primers are added, which anneal to the 3'end of each separated strand.
- c. **Extension** - DNA polymerase extends the primers by adding nucleotides complementary to the template provided in the reaction. Taq polymerase is used in the reaction, which can tolerate heat. All these steps are repeated many times to get several copies of the desired DNA.

33. Primary treatment of sewage involves the physical removal of large and small particles from sewage through filtration and sedimentation.

The steps involved in this process are:

- i. Floating debris is removed by sequential filtration by passing through wire mesh screens.
- ii. After this, the grit (soil and small pebbles) is removed by sedimentation in settling tanks. The sediment is called primary sludge and the supernatant forms the primary effluent.
- iii. The effluent is then taken for the secondary treatment.

The secondary treatment of sewage is also called biological treatment because, in this treatment, sewage is subjected to biodegradation. It means that it involves the participation of microorganisms. The process of secondary treatment involves the

following steps:

- i. Primary effluent is passed into large aeration tanks with constant mechanical agitation and air supply. This allows vigorous growth of useful aerobic microbes into flocs (masses of bacteria and fungi filaments).
- ii. These microbes consume a major part of organic matter in the effluent while growing. This reduces the BOD of the effluent.
- iii. When BOD of sewage gets reduced, it is passed into the settling tank. The bacterial flocs settle in the tank and the sediment is called activated sludge. A small amount of activated sludge is pumped back into the aeration tank to serve as inoculum.
- iv. The remaining major part of the sludge is pumped into large tanks called anaerobic sludge digesters, where other kinds of bacteria, which grow anaerobically, digest the bacteria and the fungi in the sludge. During this process, bacteria produce a mixture of gases, such as methane, hydrogen sulphide and carbon dioxide, which form biogas. The effluent from secondary treatment is generally released into natural water bodies. It helps to reduce water pollution and water-borne diseases. The gases from biogas are used as a source of energy because it is inflammable.

OR

Roles of 'flocs' and 'activated sludge' in sewage treatment are as follows:

- i. **Flocs:** These are masses of bacteria held together by slime and fungal filaments to form mesh-like structures. These are used during the secondary sewage treatment in the aeration tank to increase the rate of decomposition. The microbes digest a lot of organic matter, converting it into microbial biomass and releasing a lot of minerals. As a result, BOD of the sewage reduces. As the BOD of waste is reduced to 10-15% of raw sewage, it is passed into the settling tank. In these tanks, flocs are allowed to undergo sedimentation.
- ii. **Activated sludge:** The sediment of settling tank is called activated sludge. A part of it is used as inoculum in aeration tanks. The remaining part is passed into a large tank called anaerobic sludge digester. In these tanks, anaerobic microbes are present that digest the organic mass as well as aerobic microbes of activated sludge. The remaining sludge is used as manure or compost.