

Question Paper

Conducted by the Central Board of Secondary Education (CBSE)



Time Allowed: 3 Hours

Maximum Marks: 70

General Instructions

- (i) This question paper contains **33 questions**. All questions are compulsory.
- (ii) Section A: Questions 1 to 16 carry 1 mark each.
- (iii) Section B: Questions 17 to 21 carry 2 marks each.
- (iv) Section C: Questions 22 to 28 carry 3 marks each.
- (v) Section D: Questions 29 to 30 carry 4 marks each.
- (vi) Section E: Questions 31 to 33 carry 5 marks each.
- (vii) Attempt one alternative where an internal choice is provided. Follow the instructions within each question.
- (viii) Draw neat, properly labelled diagrams wherever necessary.

Section A

1. Given below is a list of steps Meselson and Stahl carried out in their experiment to prove that DNA replication is semi-conservative. Select the option that gives the correct sequence of steps followed by them.

- (i) Bacteria transferred to a N^{14} medium and sampled every 20 minutes.
- (ii) All bacteria contain hybrid DNA (N^{14} DNA and N^{15} DNA).
- (iii) Bacteria grown in N^{15} medium for many generations.
- (iv) All bacteria contain N^{15} DNA.
- (v) Bacteria contain either all N^{14} DNA or all hybrid DNA.

- (A) (ii) $\rightarrow$ (iv) $\rightarrow$ (iii) (B) (i) $\rightarrow$ (ii) $\rightarrow$ (v) $\rightarrow$ (i) $\rightarrow$ (v)
 (C) (iii) $\rightarrow$ (iv) $\rightarrow$ (i) $\rightarrow$ (ii) $\rightarrow$ (v) (D) (iv) $\rightarrow$ (iii) $\rightarrow$ (ii) $\rightarrow$ (v) $\rightarrow$ (i)

2. Which of the following statements are true about the males in a colony of honey bees?

- (i) They have 16 chromosomes per cell.
- (ii) They produce sperms by meiosis.
- (iii) They have a grandfather but no father.
- (iv) All males in the colony are haploid except one.

- (A) (i) and (iii) only (B) (ii) and (iii) only
 (C) (iii) and (iv) only (D) (ii) and (iv) only

3. Identify the option that gives the correct type of evolution exhibited by the two animals shown, living in the same habitat in Australia.



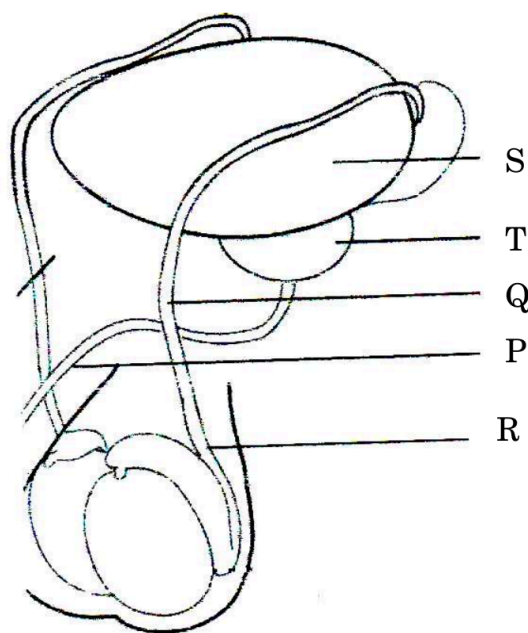
- (A) Convergent Evolution (B) Disruptive Selection
 (C) Divergent Evolution (D) Homologous Ancestry

4. Match the correct Structures given in Column I with the Fruit in Column II in the chart given below:

Column I (Structure)	Column II (Fruit)
P. Perisperm	i. Maize
Q. Thalamus	ii. Black pepper
R. Pericarp	iii. Strawberry
S. Endosperm	iv. Mango

- (A) P-i, Q-ii, R-iii, S-ii (B) P-ii, Q-iii, R-iv, S-i
 (C) P-iii, Q-i, R-i, S-iii (D) P-iv, Q-i, R-ii, S-iv

5. A human male decides to adopt a surgical method for contraception. Identify the point in the diagram where a cut would be made and tied.



- (A) Point S (B) Point R
 (C) Point Q (D) Point P

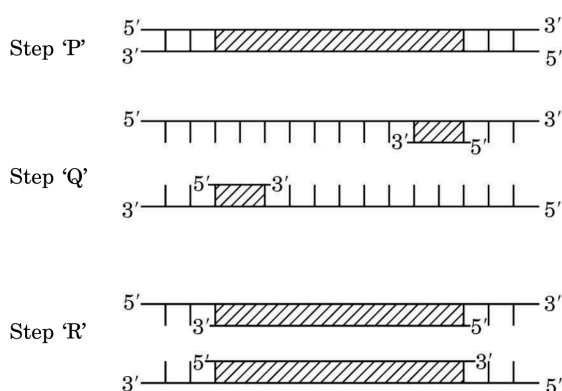
6. Which of the following hormones are active during the ovulatory phase of menstrual cycle in a normal human female?

- (A) FSH and LH (B) LH and Estrogen
(C) FSH and Estrogen (D) Estrogen and Progesterone

7. Which one of the following fixes the atmospheric nitrogen but is not an autotroph?

- (A) Oscillatoria (B) Rhizobium
(C) Anabaena (D) Nostoc

8. The given schematic illustration shows three steps 'P', 'Q' and 'R' of the polymerase chain reaction.



Which of the following statements are correct with reference to the illustration given above?

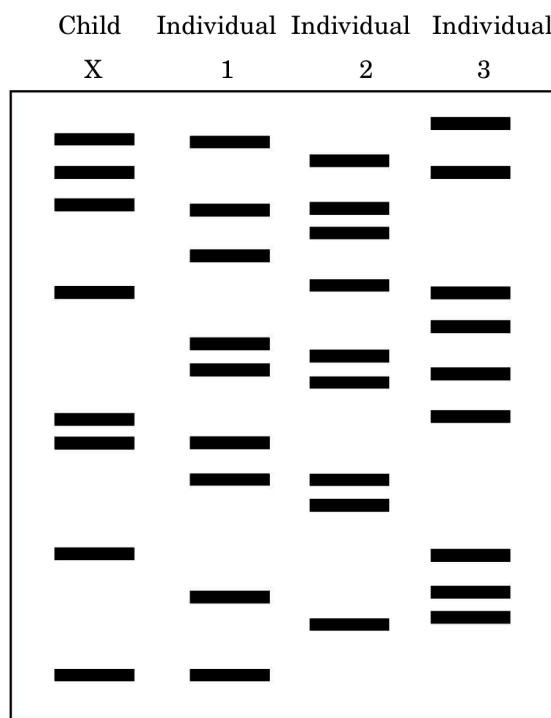
- (i) Step 'P' is showing denaturation at low temperature.
(ii) Step 'Q' is a denaturation of DNA strand at high temperature, followed by annealing.
(iii) Step 'R' is an extension of DNA in presence of thermostable DNA polymerase.

(iv) Step 'Q' is extension with two sets of primers.

- (A) (i) and (iii) only (B) (ii) and (iii) only
(C) (ii) only (D) (i) only

9. DNA profiles of the child and three individuals 1, 2 and 3 who claim to be the parents of the child are given below. Select the option that shows the correct actual parent/parents of the child.

Child X | Individual 1 | Individual 2 | Individual 3



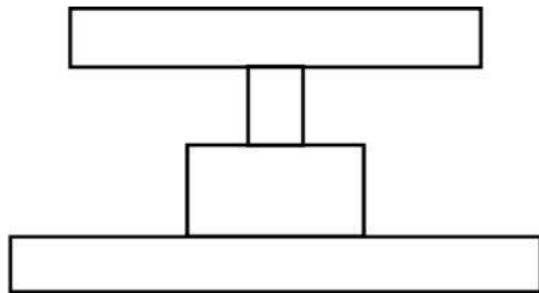
- (A) Individual 1 and 3 (B) Individual 1 and 2
(C) Individual 2 and 3 (D) Individual 1 is the only parent of the child amongst 1, 2 and 3

10. Select the options which is/are incorrect statement(s) with respect to T-lymphocytes in the human body.

- (i) They are a type of white blood cells.
(ii) They are produced in bone marrow.
(iii) They remain active at all times in the body.
(iv) They mature in the bone marrow.

- (A) (i) and (iv) only (B) (iii) only
(C) (iv) only (D) (iii) and (iv) only

11. Given below is a diagram of an ecological pyramid of numbers. Choose the correct food chain from the list of food chains given, that represents the given pyramid.



- | | |
|------------------------------------|--|
| (A) Grass → Goat →
Fox → Tiger | (B) Mice → Cat →
Hyena → Cheetah |
| (C) Grass → Rabbit →
Fox → Flea | (D) Grass → Insects →
Sparrow → Snake |

12. Human settlement often leads to habitat loss which leads to fragmentation, forming smaller patches of habitats. Select the statements that describe how a small patch differs from a large patch of the same habitat.

- (i) Invasive species will never be seen here.
- (ii) Population of large animals decreases.
- (iii) Biodiversity decreases.
- (iv) Competition from surrounding habitats increases.

- | | |
|----------------------------------|---------------------------------|
| (A) (ii), (iii) and (iv)
only | (B) (ii) and (iv) only |
| (C) (i) and (iii) only | (D) (i), (ii) and (iii)
only |

13. Assertion (A): In a monohybrid cross between tall plants and dwarf plants, the F_2 generation showed tall and dwarf plants in the ratio of 3:1.

Reason (R): There is no blending of traits/characters in the F_2 generation.

- | | |
|---|--|
| (A) Both Assertion (A)
and Reason (R) are
true and Reason (R)
is the correct
explanation of the
Assertion (A). | (B) Both Assertion (A)
and Reason (R) are
true, but Reason (R)
is not the correct
explanation of the
Assertion (A). |
| (C) Assertion (A) is
true, but Reason (R)
is false. | (D) Assertion (A) is
false, but Reason
(R) is true. |

14. Assertion (A): Homo sapiens have evolved from chimpanzee-like ancestors.

Reason (R): There is no difference between the two in the amino acid sequence of the protein Cytochrome-C.

- | | |
|---|--|
| (A) Both Assertion (A)
and Reason (R) are
true and Reason (R)
is the correct
explanation of the
Assertion (A). | (B) Both Assertion (A)
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| (C) Assertion (A) is
true, but Reason (R)
is false. | (D) Assertion (A) is
false, but Reason
(R) is true. |

15. Assertion (A): Breast-feeding is advised by the doctor as it is essential for the new borns.

Reason (R): Colostrum secreted by the mother during initial days of lactation has abundant antibodies containing I_gE and I_gG .

- | | |
|---|--|
| (A) Both Assertion (A)
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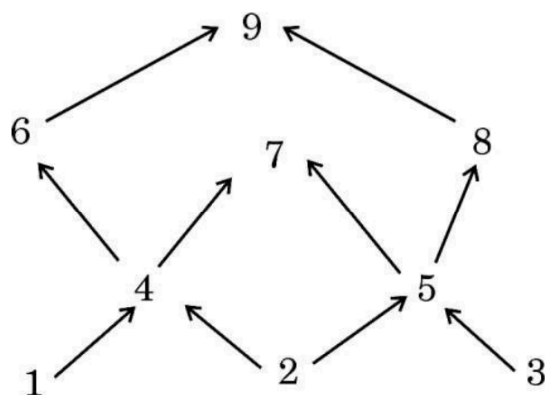
16. Assertion (A): The Monarch butterfly is highly distasteful to the predators.

Reason (R): The butterfly has a very rough skin which is not palatable.

- | | |
|---|--|
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and Reason (R) are
true and Reason (R)
is the correct
explanation of the
Assertion (A). | (B) Both Assertion (A)
and Reason (R) are
true, but Reason (R)
is not the correct
explanation of the
Assertion (A). |
| (C) Assertion (A) is
true, but Reason (R)
is false. | (D) Assertion (A) is
false, but Reason
(R) is true. |

Section B

17. Given below is a food web that involves nine organisms.



- (a) Identify two producers and two carnivores shown in the food web.
- (b) Is it possible to make an ecological pyramid depicting this food web? Give reason in support of your answer.

18(a). 'Insertional inactivation' is a method to detect recombinant DNA. Explain the method.

OR

18(b). Explain how recombinant DNA technology is used to detect a disease even before any clinical symptom appears.

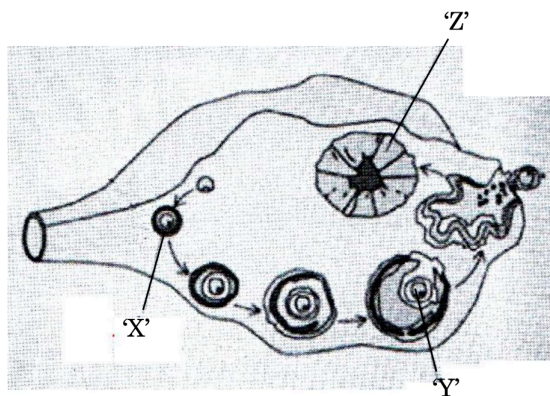
19. List and explain any two factors that lead to a decrease in the population density of an area.

20. (a) Explain the process of the development of a male gametophyte in an angiosperm.
(b) Why is it called a male gametophyte?

21. Explain the role of microorganisms in the following:

- (a) Reducing the sugar content in grape juice
(b) Production of a fuel

22. The diagram given below shows the events occurring in an ovary during Oogenesis in a human female.



- Identify 'X'. Mention the time when the process occurs in a human female.
- Identify 'Y'. When and how is it formed?
- Name the hormone produced by 'Z'.

23. (a) Darwin's theory of Natural Selection is widely accepted but some limitations have been identified by modern biologists. Mention the limitations identified.

(b) Name and state the most accepted theory of evolution in modern times.

(c) Mention any two ways the limitations identified in Darwin's theory of evolution are explained in modern biology.

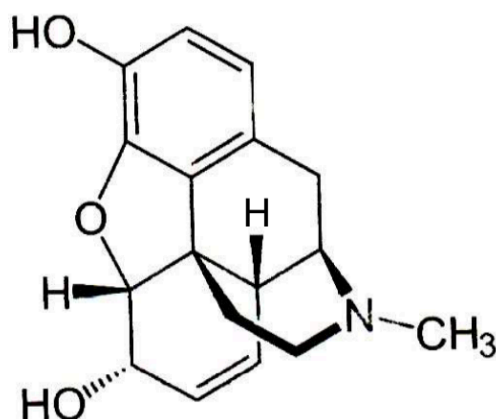
24(a). (i) How many types of RNA polymerases are there in a eukaryote cell? Mention which one of them transcribes hnRNA.

(ii) Write the changes that hnRNA undergoes before it leaves the nucleus as mRNA.

OR

24(b). The length of DNA in any cell is far greater than the dimension of its nucleus. Explain how this enormous DNA is packaged in a eukaryotic cell.

25.



- Name the category of drugs represented by the chemical structure given above.
- If the methyl group is substituted by acetyl group we get a bitter crystalline compound. Name the compound.
- Name the natural source of these compounds.
- State the harmful effects of this class of drugs on the human body.

26. Expand and explain the following techniques used in the 'Test Tube Baby' programme:

- GIFT
- ZIFT
- IUI

27. (a) Write the scientific name of the nematode that infests the tobacco plants and the part that it infests.

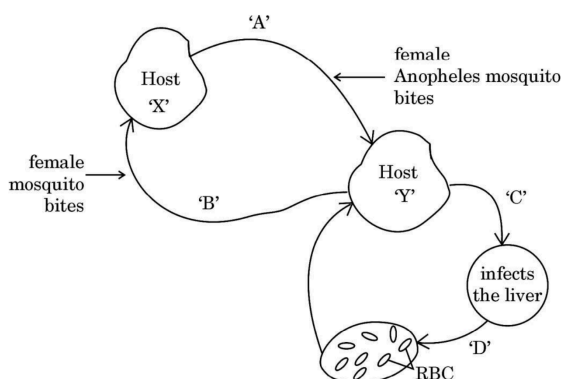
(b) How is Agrobacterium used to protect tobacco plant from this attack?

28. Explain the following population interactions with the help of one example each:

- Brood Parasitism
- Co-evolution of mutualists

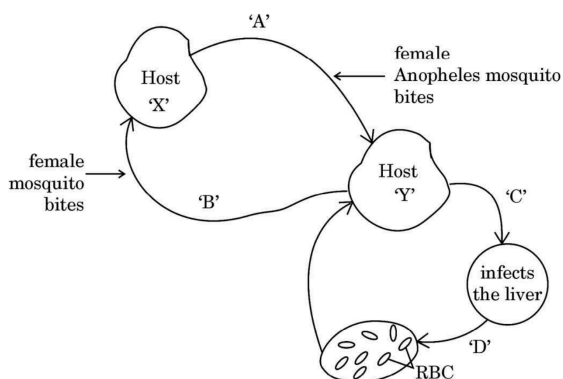
Section D

29(i). The diagram shows the life cycle of a pathogenic protozoan.



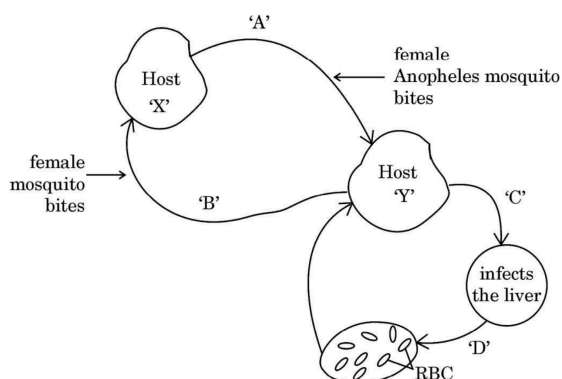
Name the parasitic stage that is being transferred from host 'X' to host 'Y'.

29(ii). The diagram shows the life cycle of a pathogenic protozoan.



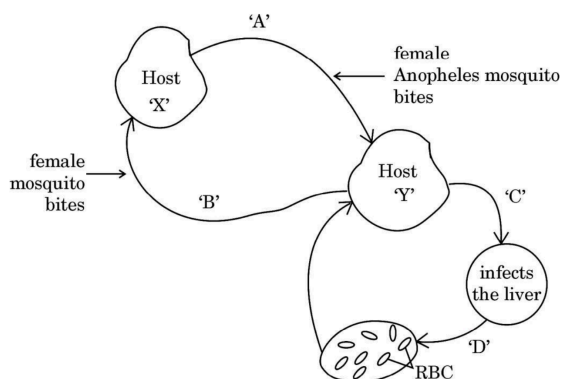
Write the changes the parasite undergoes in the liver.

29(iii). The diagram shows the life cycle of a pathogenic protozoan.



Write the changes the parasite undergoes when it enters the RBC.

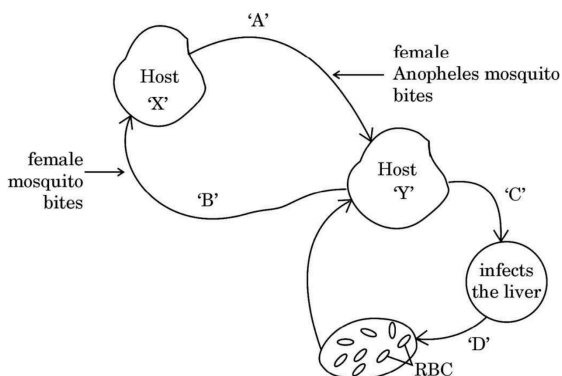
29(iv)(a). The diagram shows the life cycle of a pathogenic protozoan.



Trace the changes the parasite undergoes when the host 'X' takes its blood meal from infected host 'Y'.

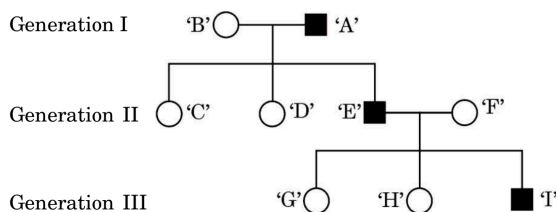
OR

29(iv)(b). The diagram shows the life cycle of a pathogenic protozoan.



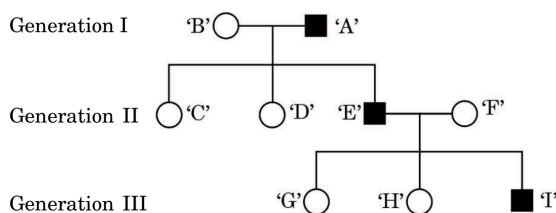
At which stage during the life cycle of the pathogen does the host 'Y' experience the symptoms of the disease? Name the disease and the toxic substance responsible for these symptoms.

30(i). The following pedigree chart shows the inheritance of a genetic disorder up to three generations of a family. Observe the chart and answer the questions that follow.



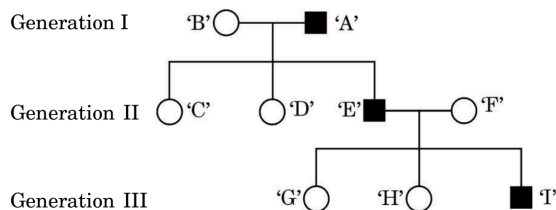
Is the disease sex-linked or autosomal as per the chart? Give reasons in support of your answer.

30(ii). The following pedigree chart shows the inheritance of a genetic disorder up to three generations of a family. Observe the chart and answer the questions that follow.



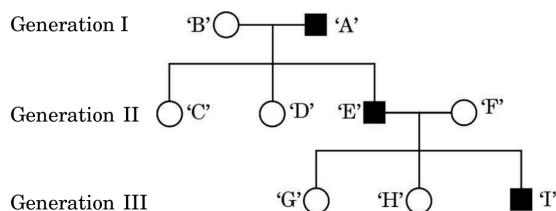
Is it a recessive or a dominant disorder?

30(iii). The following pedigree chart shows the inheritance of a genetic disorder up to three generations of a family. Observe the chart and answer the questions that follow.



Write the genotypes of the individuals 'C', 'D' and 'H'.

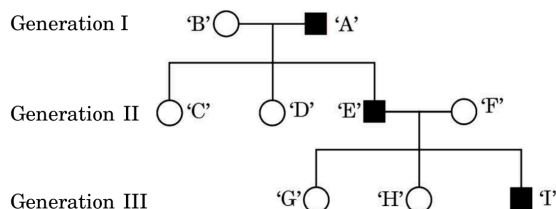
30(iv)(a). The following pedigree chart shows the inheritance of a genetic disorder up to three generations of a family. Observe the chart and answer the questions that follow.



If the female 'D' marries a normal man, what will be the probability of their daughter being a sufferer of this disease?

OR

30(iv)(b). The following pedigree chart shows the inheritance of a genetic disorder up to three generations of a family. Observe the chart and answer the questions that follow.



If the mother 'B' is a carrier of the disease, what will be the probability of their daughter being a sufferer of this disease?

Section E

31(a). (i) Draw a labelled diagram of a replication fork in a prokaryote indicating the process of DNA replication.

(ii) Differentiate between the two newly synthesised DNA strands within the fork.

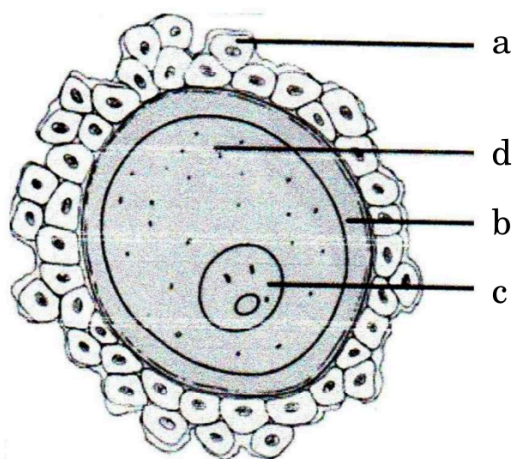
(iii) Name the enzymes involved in the process of DNA replication.

(iv) Name the eukaryote where the semi-conservative mode of replication was experimentally proved.

OR

31(b). You are given a tall pea plant with green seeds. The genotype of this plant is unknown. You are allowed to do only 'selfing' of these plants to find out the genotype of the given plant. Work out all possible crosses and show how you would determine the genotype of the given plant.

32(a). Given below is a diagrammatic representation of a human ovum.



(i) Identify the parts 'a', 'b' and 'c'.

(ii) This ovum is released from the ovary with incomplete meiotic division. When, where and how is the meiotic division completed?

(iii) How does an ovum ensure the entry of a single sperm during fertilisation?

OR

32(b). (i) Double fertilisation is an event unique to all flowering plants. Explain the process.

(ii) Give a reason for the following:

(1) A seed of an orange has many embryos.

(2) Cashew is a false fruit but Guava is a true fruit.

33(a). Answer the following questions with respect to recombinant DNA technology:

(i) Why is plasmid considered to be an important tool in rDNA technology? From where can plasmids be isolated? (Any two sources)

(ii) Explain the role of 'ori' and selectable marker in a cloning vector.

(iii) 'r-DNA technology cannot proceed without restriction endonuclease.' Justify.

OR

33(b). Answer the following questions based on Bt-crops:

(i) Why do farmers prefer to grow Bt cotton crop than genetically unmodified cotton crops?

(ii) Name any two insects that are killed by Bt toxin.

(iii) Explain the mechanism by which Bt toxin kills the insects but not the bacterium which possesses the toxin.

- End of Question Paper -