

## 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. Choose the set of sex determining chromosomes that indicates the correct sex of the respective organism.

- |                                                                                                                                                               |                                                                                                                                                           |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>(A) Homozygous sex chromosomes (ZZ) determine female sex in birds</p> <p>(C) XXY condition in humans, as found in Turner Syndrome, determines male sex</p> | <p>(B) XO type of sex chromosomes determine male sex in grasshoppers</p> <p>(D) Homozygous sex chromosomes (XX) produce male sex in <i>Drosophila</i></p> |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|

2. 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.

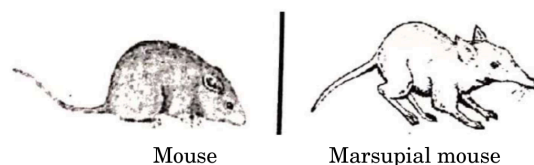
(iv) All bacteria contain  $N^{15}$  DNA.

(v) Bacteria contain either all  $N^{14}$  DNA or all hybrid DNA.

- |                                                                                       |                                                                                       |
|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| <p>(A) (ii) → (iv) → (iii) → (i) → (v)</p> <p>(C) (iii) → (iv) → (i) → (ii) → (v)</p> | <p>(B) (i) → (ii) → (v) → (iv) → (iii)</p> <p>(D) (iv) → (iii) → (ii) → (v) → (i)</p> |
|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|

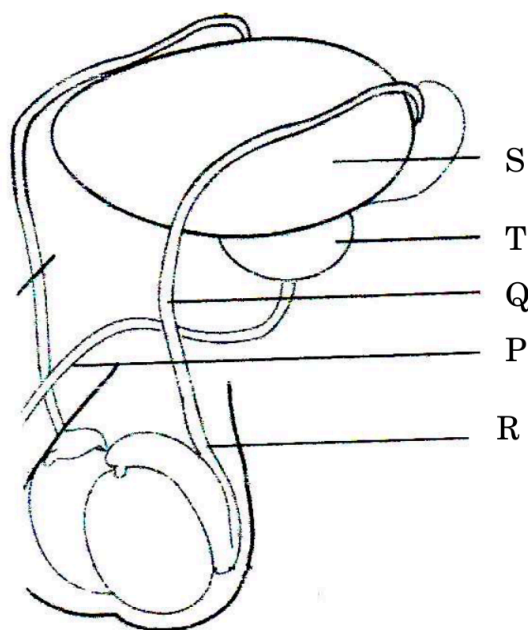
3. Identify the option that gives the correct type of evolution exhibited by the two animals shown, living in the same habitat in Australia.

Mouse | Marsupial mouse



- |                                                                |                                                                |
|----------------------------------------------------------------|----------------------------------------------------------------|
| <p>(A) Convergent Evolution</p> <p>(C) Divergent Evolution</p> | <p>(B) Disruptive Selection</p> <p>(D) Homologous Ancestry</p> |
|----------------------------------------------------------------|----------------------------------------------------------------|

4. 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.



- |                                       |                                       |
|---------------------------------------|---------------------------------------|
| <p>(A) Point S</p> <p>(C) Point Q</p> | <p>(B) Point R</p> <p>(D) Point P</p> |
|---------------------------------------|---------------------------------------|

5. Which of the following options correctly matches the name of the hormone to its site of production in the human body?

| Name of the Hormone | Site of Production   |
|---------------------|----------------------|
| P. Oxytocin         | i. Placenta          |
| Q. Relaxin          | ii. Corpus Luteum    |
| R. hCG              | iii. Pituitary Gland |
| S. Progesterone     | iv. Ovaries          |

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

6. Which of the following seeds have remained alive for the longest period?

- (A) Phoenix dactylifera      (B) Striga asiatica  
(C) Mangifera indica      (D) Yucca gigantea

7. 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

8. 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

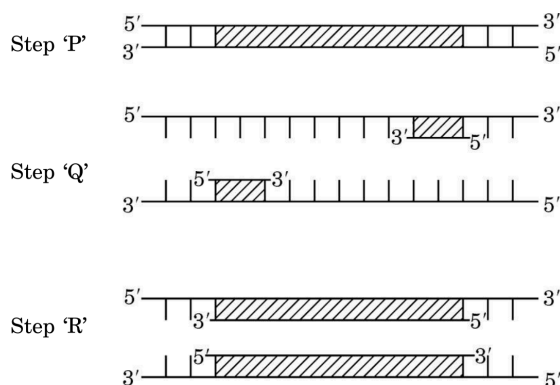
9. Identify the option that does not exhibit a parasitic relationship.

- (A) Head lice in humans      (B) Cuscuta on a mango tree  
(C) Female Anopheles      (D) Ticks on dogs

10. Identify the fungus that ripens the famous 'Roquefort' cheese:

- (A) Saccharomyces cerevisiae      (B) Propionibacterium sharmanii  
(C) Monascus purpureus      (D) Penicillium notatum

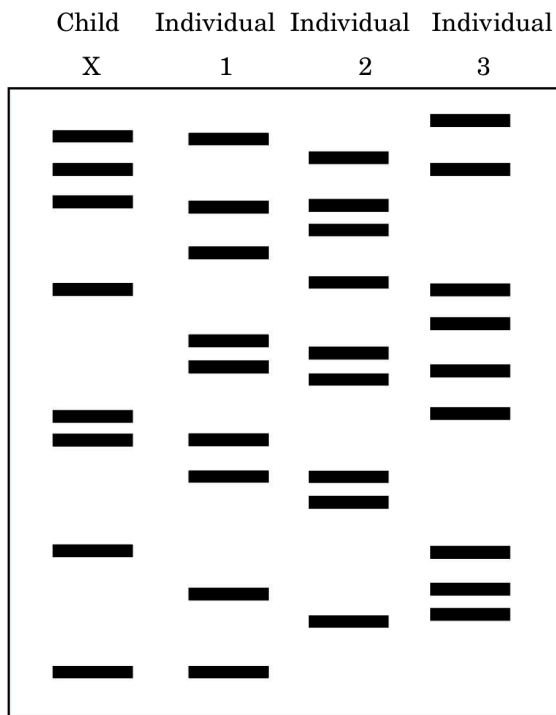
11. The given schematic illustration shows three steps 'P', 'Q' and 'R' of the polymerase chain reaction.



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

Child X | Individual 1 | Individual 2 | Individual 3



- (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.

(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.

## Section B

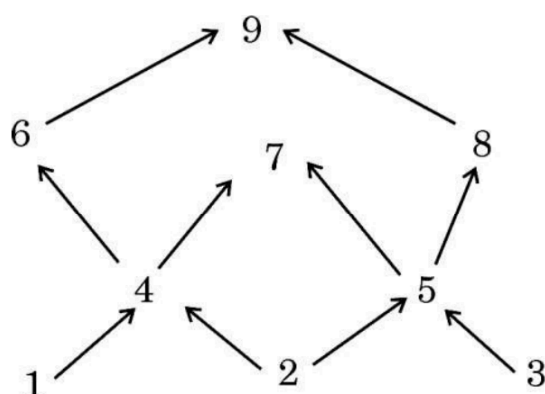
17. (a) Explain the process of the development of a male gametophyte in an angiosperm.

(b) Why is it called a male gametophyte?

18. (a) Write the first step the primary effluent undergoes when it enters the secondary treatment plant and state the purpose.

(b) What is the level of B.O.D indicative of in the secondary treatment plant? Mention its significance.

19. 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.

20. Illustrate with the help of an example how introduction of an alien species turns invasive and causes decline of an indigenous species.

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

OR

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

**22(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

**22(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.

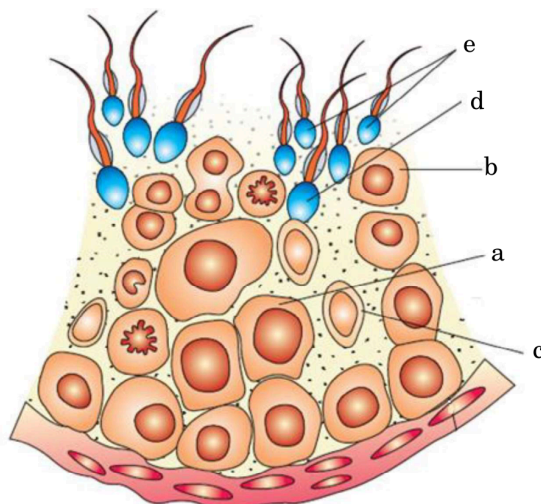
**23.** Expand and explain the following techniques used in the 'Test Tube Baby' programme:

(a) GIFT

(b) ZIFT

(c) IUI

**24.** Given below is a diagrammatic sectional view of a seminiferous tubule. State the developmental process of:



(a) (i) 'b' from 'a'.

(ii) 'e' from 'd'.

(iii) 'd' from 'b'.

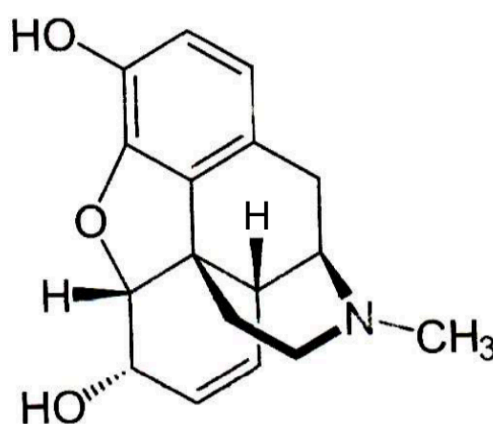
(b) Identify 'a', 'b' and 'c'.

**25.** (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.

**26.**



(a) Name the category of drugs represented by the chemical structure given above.

(b) If the methyl group is substituted by acetyl group we get a bitter crystalline compound. Name the compound.

(c) Name the natural source of these compounds.

(d) State the harmful effects of this class of drugs on the human body.

**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?

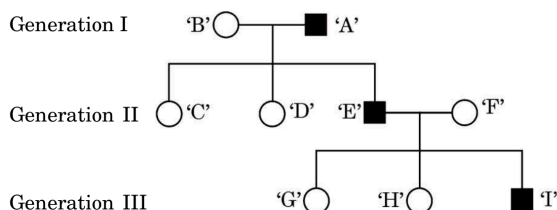
**28.** Explain the following population interactions with the help of one example each:

(a) Brood Parasitism

(b) Co-evolution of mutualists

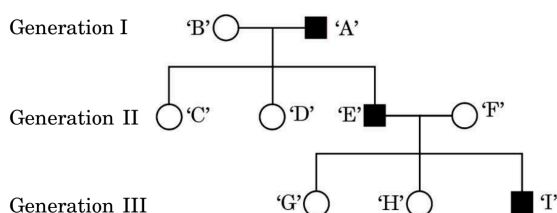
## Section D

**29(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.



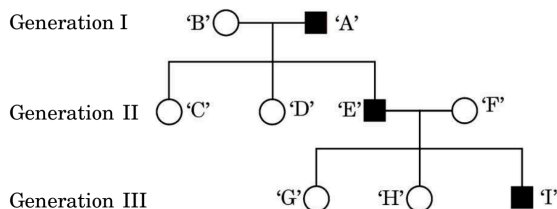
Is the disease sex-linked or autosomal as per the chart? Give reasons in support of your answer.

**29(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.



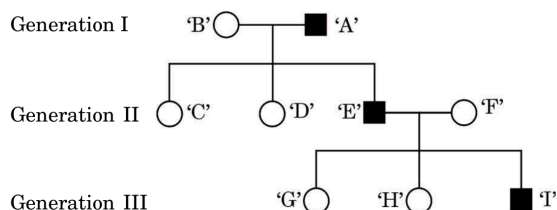
Is it a recessive or a dominant disorder?

**29(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'.

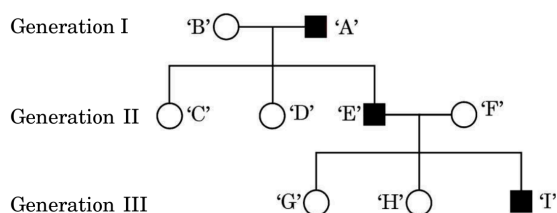
**29(iv)(a).** The following pedigree chart shows the inheritance of a genetic disorder up to three generations of a family. Observe the chart and answer the questions that follow.



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

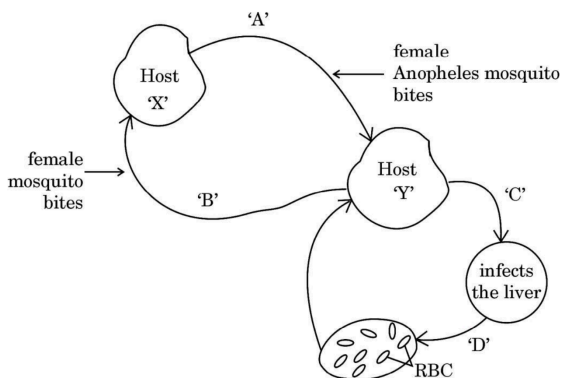
OR

**29(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.



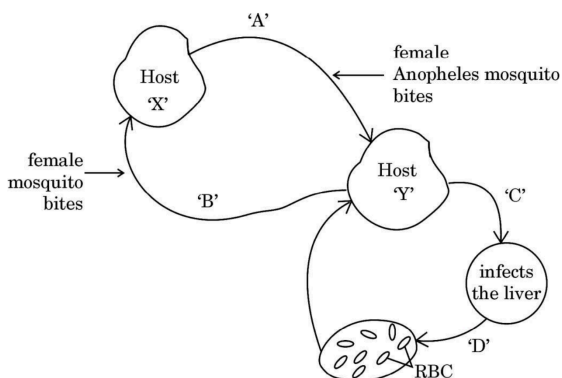
If the mother 'B' is a carrier of the disease, what will be the probability of their daughter being a sufferer of this disease?

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



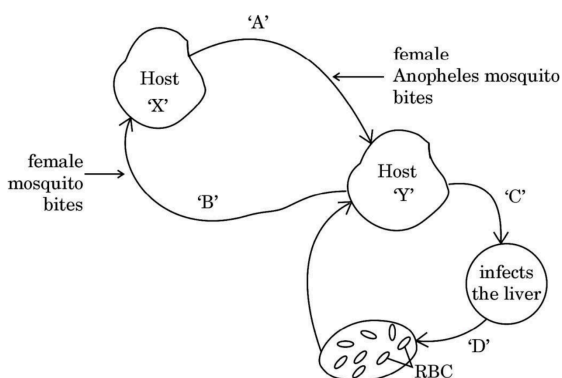
Name the parasitic stage that is being transferred from host 'X' to host 'Y'.

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



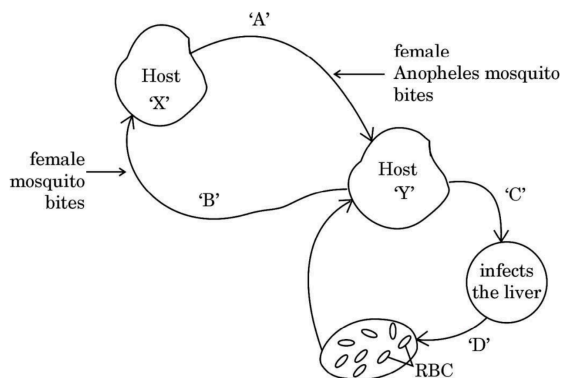
Write the changes the parasite undergoes in the liver.

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



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

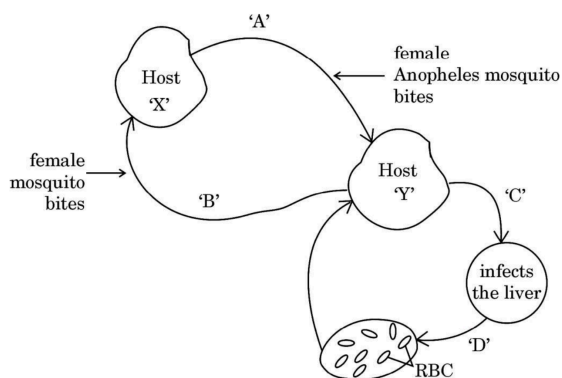
**30(iv)(a).** The diagram shows the life cycle of a pathogenic protozoan.



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

OR

**30(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.

## Section E

**31(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

**31(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.

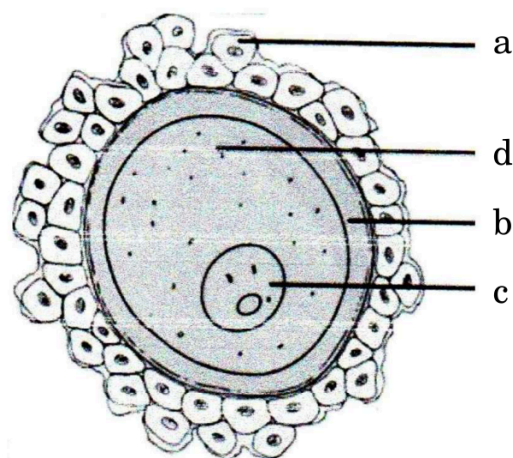
**32(a).** Protein synthesis requires the services of all three types of RNAs, namely t-RNA, m-RNA and r-RNA. Explain the role of each of them during the process of protein synthesis in prokaryotes.

OR

**32(b).** A homozygous tall pea plant with green seeds is crossed with a homozygous dwarf pea plant with yellow seeds.

- (i) Write the possible phenotype and genotype of  $F_1$  generation.
- (ii) State the laws of Mendel that are proved true by the  $F_1$  generation.
- (iii) Mention the  $F_2$  phenotypic ratio along with their possible phenotypes.
- (iv) Write the genotypes of the male and female gametes produced by  $F_1$  progeny.

**33(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

**33(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.

- End of Question Paper -