

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. A human ovum completes its second meiosis :

- | | |
|---|---|
| (A) at the time of fertilisation | (B) when the sperm touches the zona pellucida |
| (C) when the sperm gains entry into the cytoplasm of the ovum | (D) when the acrosome of the sperm releases its enzymes on corona radiata |

2. Choose the option that gives the correct number of pollen grains that will be formed after 325 microspore mother cells undergo microsporogenesis.

- | | |
|----------|---------|
| (A) 325 | (B) 650 |
| (C) 1300 | (D) 975 |

3. Given below are two columns. In Column I the names of four contraceptive devices are given and in Column II the modes of action of the contraceptives are given. Select the option where the contraceptive devices are correctly matched with their respective modes of action.

Column I (Contraceptive devices)

P. Lippes loop
Q. Multiload 375
R. Subcutaneous Norplant
S. Saheli

Column II (Modes of action)

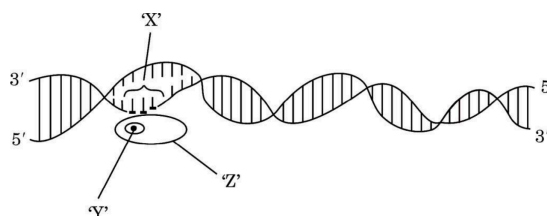
- i. Inhibition of ovulation
- ii. Phagocytosis of sperms in uterus
- iii. Causes thickening of cervical mucous
- iv. Makes cervix hostile to sperms

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

4. The first gene-sequenced crop is :

- | | |
|-----------|-------------|
| (A) Wheat | (B) Tobacco |
| (C) Rice | (D) Cotton |

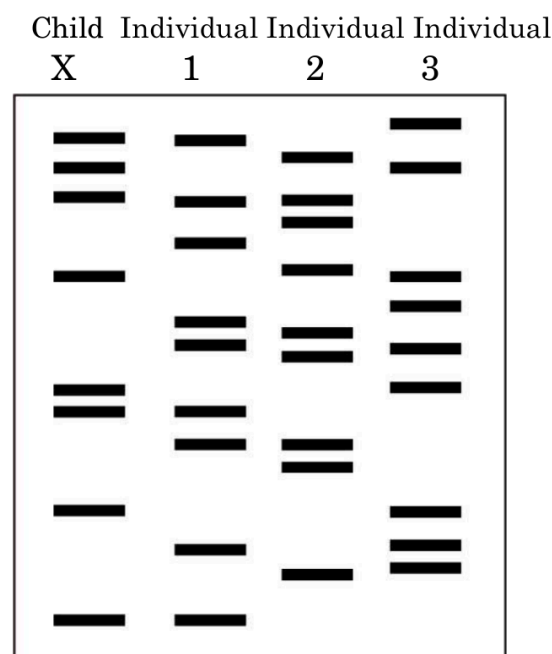
5. Identify the region 'X', the factor 'Y' and the enzyme 'Z' involved in the process of transcription in prokaryote as shown in the schematic representation given below.



Region 'X' | Factor 'Y' | Enzyme 'Z'

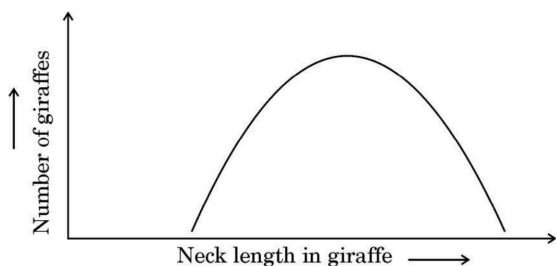
- | | |
|-------------------------------------|---|
| (A) Terminator (σ) RNA polymerase | (B) Promoter Rho (ρ) RNA polymerase |
| (C) Promoter (σ) RNA polymerase | (D) Promoter Sigma (σ) DNA polymerase |

6. Study the DNA profiles obtained as a result of DNA fingerprinting of a child 'X' and three individuals 1, 2 and 3. Which one of the following options shows the possible parents of the child 'X'?



- | | |
|-------------|-----------------------|
| (A) 1 and 2 | (B) 2 and 3 |
| (C) 1 and 3 | (D) Only individual 3 |

7. Select the option that gives the correct description of the process of Natural Selection with respect to the length of the neck of giraffe.



- | | |
|--|---|
| (A) Stabilising selection as giraffes with longer neck lengths are selected further. | (B) Disruptive selection as giraffes with smaller and longer neck lengths are selected. |
| (C) Directional selection as giraffes with longer neck lengths are selected. | (D) Stabilising selection as giraffes with medium neck lengths are selected. |

8. Which of the following samples of DNA in the table given below will give the desired result during polymerase chain reaction ?

Sample | Temperature used for Denaturation | Enzyme used for extension

- | | |
|---|--|
| (a) I High temp. / 90°C Heat stable | |
| (b) II Low temp. / 50°C Heat stable | |
| (c) III Low temp. / 50°C Heat resistant | |
| (d) IV High temp. / 90°C Heat unstable | |
-
- | | |
|---|--|
| (A) I — High temp. / 90°C — Heat stable | (B) II — Low temp. / 50°C — Heat stable |
| (C) III — Low temp. / 50°C — Heat resistant | (D) IV — High temp. / 90°C — Heat unstable |

9. Which one of the following is used during 'RNA i' process, to silence the desired gene ?

- | | |
|-----------|--------------------|
| (A) dsDNA | (B) dsRNA |
| (C) rDNA | (D) DNA polymerase |

10. Which one among the following biofertilizers does not fix atmospheric nitrogen ?

- | | |
|-------------------------|----------------------|
| (A) <i>Oscillatoria</i> | (B) <i>Rhizobium</i> |
| (C) <i>Azospirillum</i> | (D) <i>Glomus</i> |

11. Given below are two columns. In Column I is the list of four enzymes and in Column II is the list of functions of the given enzymes. Which one of the following options shows the enzymes matched with their respective functions correctly ?

Column I (Enzyme)

- P. DNA Ligase
Q. Restriction exonuclease
R. Taq polymerase
S. Restriction endonuclease

Column II (Function)

- i. Removes nucleotides from ends of DNA
ii. Extends primer on a DNA template
iii. Joins the DNA fragments
iv. Cuts DNA at a specific position

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

12. Examples that show commensalism are :

- (i) An orchid growing on mango tree
(ii) Cuckoo bird and crow
(iii) *Cuscuta* growing on Nerium tree
(iv) Barnacles growing on a whale

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

13. Assertion (A): A species of wasp and a fig species cannot complete their life cycle without each other.

Reason (R): While visiting wasps come to lay eggs in the fig inflorescence, the flower of wasp gets pollinated in return.

- | | |
|--|---|
| (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): For sequencing, the total DNA from a cell is isolated and converted into random fragments.

Reason (R): DNA is a very long polymer.

- | | |
|--|---|
| (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. |
-

15. Assertion (A): In order to cut the DNA with a restriction enzyme, it needs to be released from the membrane which encloses it.

Reason (R): A plant cell was treated with chitinase to achieve this.

- | | |
|--|---|
| (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. |
-

16. Assertion (A): Darwin showed how even a slow growing animal like an elephant could reach enormous numbers.

Reason (R): When resources in the habitat are unlimited, each species has the ability to realise its innate potential fully.

- | | |
|--|---|
| (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. From which end of the ovule, and how does the pollen tube gain its entry into the embryo sac of a *Hibiscus* flower ?

State the fate of the male nuclei present in the pollen tube.

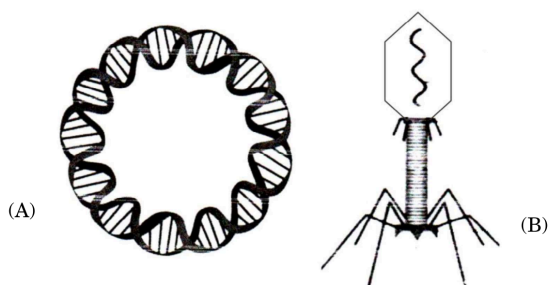
18. (a) Mention the main objective of the Ramsar Convention.

(b) Name any two sites in India that are important in the Ramsar Convention.

19. (a) Why should antibiotics not be taken indiscriminately ? Give any two reasons.

(b) "It is advisable to complete the course of antibiotics as prescribed by the doctor." Justify.

20(a). (i) Identify and name the structures 'A' and 'B' marked in the image given below :

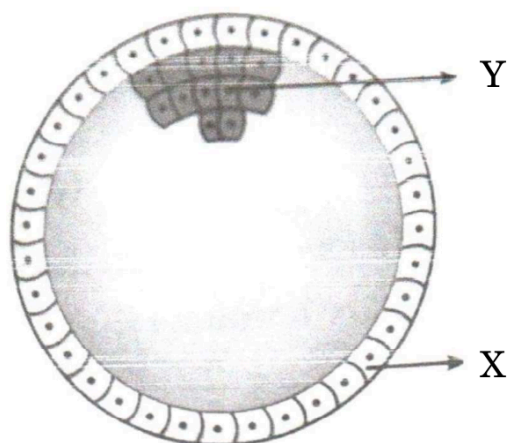


(ii) State their importance in various biotechnology experiments.

OR

20(b). Explain the process by which a bacterial cell can be made 'competent' to take up foreign DNA from its surroundings, using divalent cations and temperature treatment.

21. The diagram given below shows a developmental stage of human embryo. Answer the following questions with reference to it :



(a) Identify and name the human embryonic stage shown.

(b) Mention its exact location in the normal pregnancy of a woman.

(c) Write one function of each of the two parts labelled 'X' and 'Y'.

Section C

22(a)(i). Expand the abbreviations given below, used for different modes of assisted reproductive technologies :

- (1) ZIFT
- (2) ICSI
- (3) IUT
- (4) GIFT

22(a)(ii). Which one of them cannot be considered as a procedure of IVF ? Give reasons in support of your answer.

OR

22(b). Differentiate between the following :

- (i) Perisperm and Pericarp
- (ii) Syncarpous pistil and Apocarpous pistil
- (iii) Plumule and Radicle

23. Treatment of wastewater is done in a sewage treatment plant to make it less polluting. Explain the following with reference to this treatment process :

- (a) Primary sludge
- (b) Activated sludge
- (c) Anaerobic sludge digesters

24. (a) Name the two primate ancestors of the present day humans, who existed approximately about 15 million years ago.

(b) According to geological records, when and where did *Australopithecines* live ?

(c) Give two differences between *Homo habilis* and *Homo erectus*.

25. With the help of a schematic diagram only, show in three steps, the formation of recombinant DNA by the action of restriction endonuclease — *EcoRI* and DNA ligase.

26. (a) Differentiate between malignant and benign tumours.

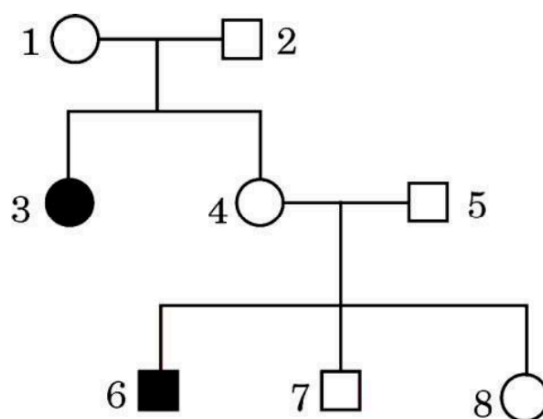
(b) Name and explain the most feared property of a malignant tumour.

27. (a) Write the characteristics of 'stem cells'.

(b) From where can one obtain 'stem cells' in humans ?

(c) State any two applications of 'stem cells' in curing human diseases.

28. Study the pedigree chart of a family given below and answer the questions that follow :



(a) Is the disease in this pedigree chart a recessive or dominant disorder ? Give reason.

(b) Identify the female individual in this family, who for sure is homozygous.

(c) Genotype of which one individual cannot be identified in this pedigree chart ?

(d) Identify a male who is definitely heterozygous.

(e) Is this disease a sex-linked or an autosomal disorder ?

29(a). Gene expresses itself in a cell system as a protein/enzyme. How does an expression of gene occur in a cell system and when does it need to occur, and how the gene expression is regulated in a prokaryote cell system was studied by the combined efforts of Jacques Monod, the biochemist and Francois Jacob, the geneticist. For their work on lactose metabolism in *E. coli* and introducing the concept of "*lac* operon" they were awarded the Nobel Prize in 1965.

Why is *lac* operon said to be a transcriptionally regulated system ?

29(b). Gene expresses itself in a cell system as a protein/enzyme. How does an expression of gene occur in a cell system and when does it need to occur, and how the gene expression is regulated in a prokaryote cell system was studied by the combined efforts of Jacques Monod, the biochemist and Francois Jacob, the geneticist. For their work on lactose metabolism in *E. coli* and introducing the concept of "*lac* operon" they were awarded the Nobel Prize in 1965.

It is said that "the *lac* operon has to be operational at a very low level in the bacterial cell all the time." Justify.

29(c). Gene expresses itself in a cell system as a protein/enzyme. How does an expression of gene occur in a cell system and when does it need to occur, and how the gene expression is regulated in a prokaryote cell system was studied by the combined efforts of Jacques Monod, the biochemist and Francois Jacob, the geneticist. For their work on lactose metabolism in *E. coli* and introducing the concept of "*lac* operon" they were awarded the Nobel Prize in 1965.

Why is the regulator gene in *lac* operon marked as 'i' gene ?

29(d). Gene expresses itself in a cell system as a protein/enzyme. How does an expression of gene occur in a cell system and when does it need to occur, and how the gene expression is regulated in a prokaryote cell system was studied by the combined efforts of Jacques Monod, the biochemist and Francois Jacob, the geneticist. For their work on lactose metabolism in *E. coli* and introducing the concept of "*lac* operon" they were awarded the Nobel Prize in 1965.

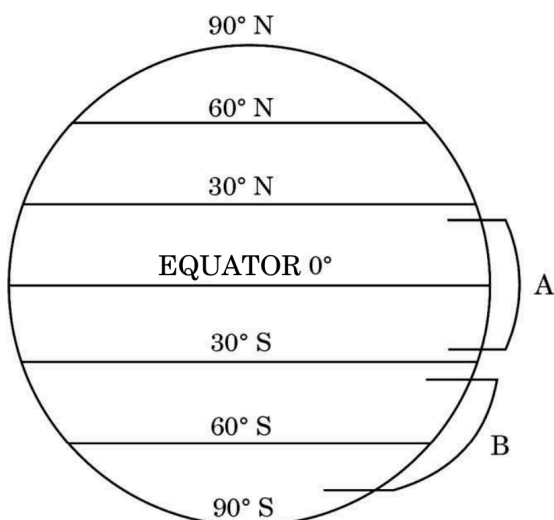
Draw a schematic diagram of *lac* operon in absence of inducer in the culture medium of the bacteria.

OR

29(d). Gene expresses itself in a cell system as a protein/enzyme. How does an expression of gene occur in a cell system and when does it need to occur, and how the gene expression is regulated in a prokaryote cell system was studied by the combined efforts of Jacques Monod, the biochemist and Francois Jacob, the geneticist. For their work on lactose metabolism in *E. coli* and introducing the concept of "*lac* operon" they were awarded the Nobel Prize in 1965.

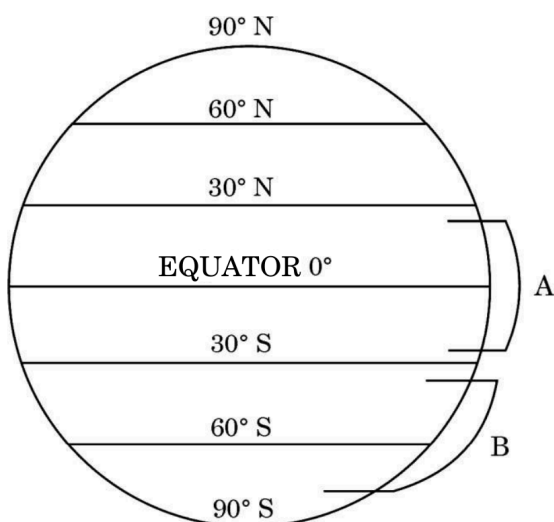
Draw a schematic diagram of *lac* operon in the presence of inducer in the culture medium of the bacteria.

30(a). Study the diagrammatic representation given below of the Earth with regions marked 'A' and 'B' respectively. Answer the questions that follow.



Write the observations made regarding the species diversity when moving from region 'A' to region 'B'. Give two reasons also.

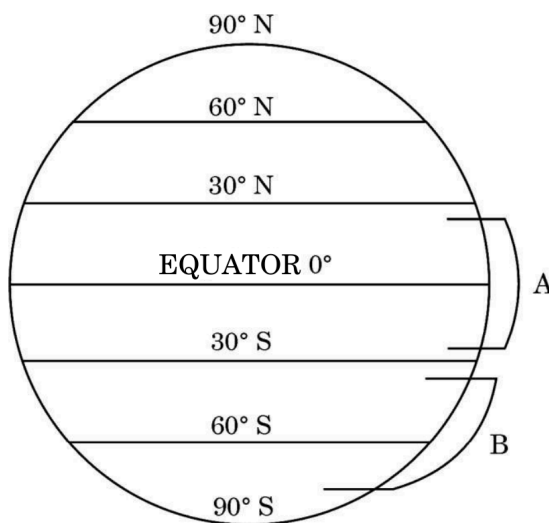
30(b). Study the diagrammatic representation given below of the Earth with regions marked 'A' and 'B' respectively. Answer the questions that follow.



Stating the reason, mention the approximate number of bird species recorded in India.

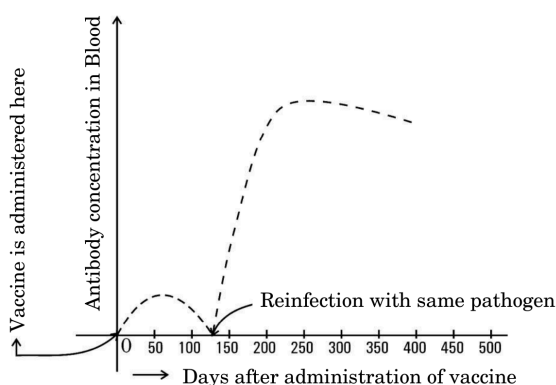
OR

30(b). Study the diagrammatic representation given below of the Earth with regions marked 'A' and 'B' respectively. Answer the questions that follow.



Name the region in the world that records the greatest biodiversity and mention why.

31(a). A time-bound vaccination programme is followed for the children in our country from their birth up to ten years of age. A graph plotted below shows the effect of the vaccination followed by infection by the same pathogen, and the antibody concentration in the blood of the child.



- Explain why the administration of a vaccine causes an increase in the antibody concentration.
- If the child is infected with the same pathogen almost four months later, the antibody concentration in his/her blood increases very fast. Explain why.
- A table given below gives information about different types of immunity and how they are attained. Identify 'P', 'Q', 'R', 'S' and 'T' in the table.

Type of immunity | Production of antibodies | Presence of memory cells | Mode attained

- | | | | |
|-----------------------|-----|-----|---|
| (1) Natural, active | Yes | 'P' | 'Q' |
| (2) Natural, passive | No | 'R' | Across the placenta during pregnancy/breast feeding |
| (3) Acquired, active | 'S' | Yes | Getting a vaccine during breast feeding |
| (4) Acquired, passive | 'T' | No | Getting an injection of antibodies |

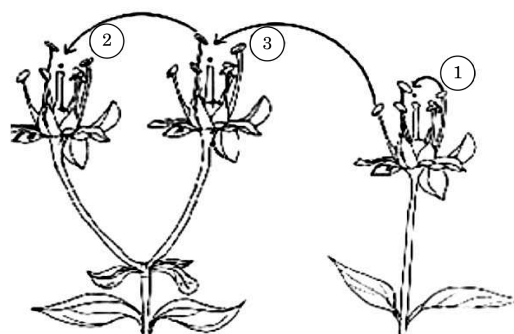
OR

31(b). (i) What is the chemical name of 'smack' ? Why is the consumption of smack considered as an abuse ?

(ii) Name the source plant and one effect of the following drugs on the human body :

- Marijuana
- Cocaine
- Morphine

32(a). Study the diagram given below showing the modes of pollination. Answer the questions that follow :

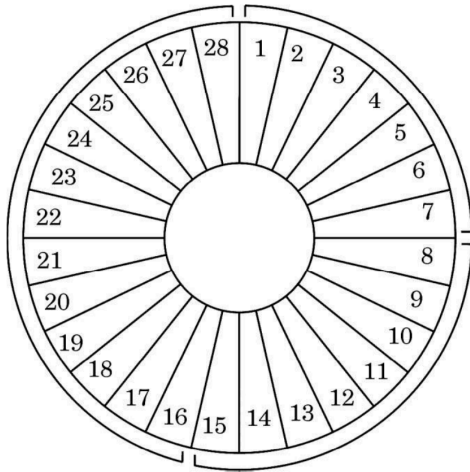


- The given diagram shows three methods of pollen transfer in plants. What are the technical terms used for pollen transfer methods '1', '2' and '3' ?
- How do the following plants achieve pollination successfully ?
 - Water lily
 - Vallisneria
- Flowering plants have developed many devices to avoid inbreeding depression. Explain one hereditary and one physiological device which helps plants to achieve this target.

OR

32(b). Observe the diagram given below showing the menstrual cycle of a normal human female and answer the questions that follow :

Numbers indicate the days of the menstrual cycle



Numbers indicate the days of the menstrual cycle

(i) What are the suitable technical terms used for the following ?

- (1) Days 1-7
- (2) Days 8-12
- (3) Days 16-28
- (4) Days 13-15

(ii) Explain the role of ovarian and pituitary hormones during the following time periods :

- (1) Days 8-12
- (2) Days 13-15
- (3) Days 16-28

33(a). (i) Describe the phenomenon of adaptive radiation as explained by Darwin.

(ii) Is human evolution an example of adaptive radiation ? Give reason in support of your answer.

OR

33(b). You are given a tall pea plant and asked to determine its genotype. Name and explain the cross that you will carry out to find the possible genotype of the given tall pea plant.

- End of Question Paper -