

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. Which of the following groups of cells in the male gonad represent haploid cells?

- | | |
|-----------------------------|-------------------------------|
| (A) Spermatogonial cells | (B) Germinal epithelial cells |
| (C) Secondary spermatocytes | (D) Primary spermatocytes |

2. Filiform apparatus in the embryo sac of an angiosperm is present at the micropylar tip of:

- | | |
|------------------|----------------|
| (A) Central cell | (B) Egg cell |
| (C) Synergids | (D) Antipodals |

3. A man is found to have a sperm count of less than 20 million/mL and his wife is diagnosed with blockage in the oviduct. This couple would be advised to go for which of the following techniques?

- (i) ZIFT
(ii) AI
(iii) IUT
(iv) ICSI
(v) GIFT
- | | |
|--------------------|--------------------|
| (A) (i) and (iii) | (B) (ii) and (iii) |
| (C) (iii) and (iv) | (D) (iv) and (v) |

4. Which of the following amino acid substitutions is responsible for causing sickle cell anemia?

- | | |
|---|--|
| (A) Valine is substituted by glutamic acid in the α -globin chain at the sixth position. | (B) Valine is substituted by glutamic acid in the β -globin chain at the seventh position. |
| (C) Glutamic acid is substituted by valine in the α -globin chain at the sixth position. | (D) Glutamic acid is substituted by valine in the β -globin chain at the sixth position. |

5. Name the extinct ancestor of humans who ate only fruits and hunted with stone weapons.

- | | |
|------------------|----------------------|
| (A) Ramapithecus | (B) Australopithecus |
| (C) Dryopithecus | (D) Homo erectus |

6. Choose the correct statements:

- (i) Polycistronic mRNA is generally found in eukaryotes.
(ii) The RNA polymerase II transcribes precursor of mRNA, the hnRNA.
(iii) The process of translation of mRNA begins when the mRNA encounters the large subunit of ribosomes.
(iv) Stop codons do not have any tRNAs.
- | | |
|-------------------|------------------------|
| (A) (i) and (ii) | (B) (ii) and (iii) |
| (C) (ii) and (iv) | (D) (i), (ii) and (iv) |

7. Some cyanobacteria in aquatic and terrestrial environment that enrich the soil by fixing nitrogen are:

- | | |
|-------------------------------|----------------------------------|
| (A) Rhizobium and Azotobacter | (B) Azospirillum and Glomus |
| (C) Anabaena and Nostoc | (D) Azospirillum and Azotobacter |

8. Nicotine affects blood pressure and heart rate due to release of certain adrenal hormones. Following are some of the adrenal hormones:

- (i) Adrenaline
(ii) Cortisol
(iii) Noradrenaline
(iv) Aldosterone

Select the correct option:

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

9. Elution means:

- | | |
|---|---|
| (A) making the DNA bands visible under UV radiations. | (B) separation of DNA fragments on agarose gel. |
| (C) isolating alien DNA from the choice organism. | (D) cutting and extraction of DNA bands from the agarose gel. |

10. The recombinant protein obtained from transgenic animals that could be used to treat emphysema is:

- | | |
|-----------------------------|---------------------------|
| (A) Humulin | (B) α -lactalbumin |
| (C) α -1-antitrypsin | (D) Iodothyronine |

11. The construction of the first recombinant DNA was done by using the native plasmid of:

- | | |
|----------------------|----------------------------|
| (A) E. coli | (B) Salmonella typhimurium |
| (C) B. thuringiensis | (D) Agrobacterium |

12. Connell's elegant field experiments on the rocky seacoast of Scotland, found that larger barnacles Balanus dominated the intertidal area and removed the smaller barnacles Chathamalus. This happened due to:

- | | |
|----------------|-----------------|
| (A) Parasitism | (B) Predation |
| (C) Mutualism | (D) Competition |

13. Assertion (A): After implantation, finger-like projections appear on the trophoblast called chorionic villi.

Reason (R): Chorionic villi are surrounded by the uterine tissue and the maternal blood.

- | | |
|--|---|
| (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): Nucleopolyhedrovirus are useful, as they are good biological control agents.

Reason (R): They are species-specific narrow spectrum bioinsecticides.

- | | |
|--|---|
| (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): Decomposition process is slower, if detritus is rich in lignin and cutin.

Reason (R): Decomposition is largely an oxygen-requiring process.

- | | |
|--|---|
| (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): The human blood group 'AB' exemplifies co-dominance.

Reason (R): The gene for human blood group trait exists in three allelic forms I^A , I^B and i .

- | | |
|--|---|
| (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

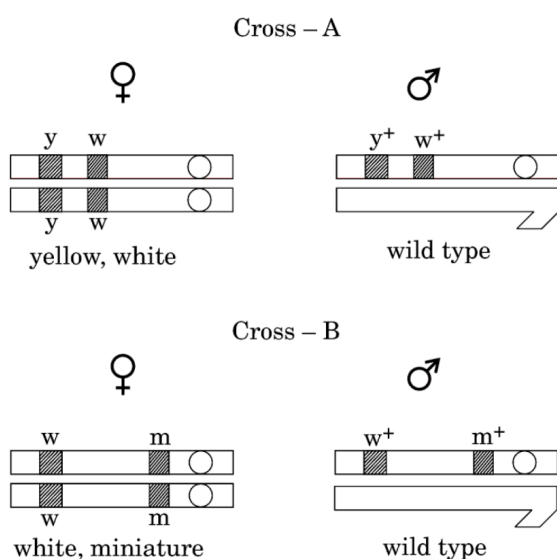
17. (a) Write one way by which apomictic seeds can be developed.

(b) Why do farmers prefer apomictic seeds over hybrid seeds?

18. Identify a, b, c and d in the following table with reference to birth control.

Method	Example
a	Diaphragm
Female sterilisation	b
c	Saheli
d	Cu-T

19. Study the figures given below and answer the questions.



Identify in which of the crosses the strength of linkage between the genes is higher. Give reason in support of your answer.

20. A laboratory assistant collected three water samples, namely river water, untreated sewage water and secondary effluent discharged from a sewage treatment plant. But the laboratory attendant did not note which was which. The samples were labelled A, B and C and subjected to a BOD test. The BOD values of the three samples A, B and C were recorded as 30 mg/L, 8 mg/L and 400 mg/L respectively.

(a) Which sample of the water is most polluted?

(b) Can you assign the correct label to each, assuming the river water is relatively clean?

21(a). Biodiversity must be conserved as it plays an important role in many ecosystem services that nature provides. Explain any two ecosystem services.

OR

21(b). (i) State, what does 'standing crop' of a trophic level represent.

(ii) List any two ways of measuring the standing crop of a trophic level.

Section C

22. Differentiate between wind-pollinated and insect-pollinated flowers. Give an example of each type.

23. Explain the three different ways in which natural selection operates. Explain with the help of graphs.

24. (a) Construct a complete transcription unit with promoter and terminator on the basis of the hypothetical coding strand given below:



(b) Write the RNA strand transcribed from the above transcription unit along with its polarity.

25. (a) What is primary productivity? Why does it vary in different types of ecosystems?

(b) Why is the assimilation of energy at the herbivore level called secondary productivity?

26. There are many animals, which have become extinct in the wild, but continue to be maintained in zoological parks. Answer the questions that follow:

(a) What type of bio-diversity conservation is observed in this case?

(b) Explain any other two ways which help in this type of conservation.

(c) Besides zoological parks, mention one place that serves this purpose.

27. (a) How is insulin different from proinsulin?

(b) Explain all the stages of how human insulin is produced through rDNA technology.

28(a). Name the cells of the human body attacked by HIV first, when it gains entry into a human body. How does this virus replicate further to cause immunodeficiency in the body?

OR

28(b). Show with the help of a flow chart only, the life-cycle of malarial parasite in human.

OR

29(a). Read the following passage and answer the questions that follow:

Immunity in our body is of two types (i) Innate immunity, and (ii) Acquired immunity. Innate immunity is a non-specific defence mechanism, whereas Acquired immunity is pathogen specific. Acquired immunity is characterised by memory. Antibodies are specific to antigens and there are four types of antibodies produced in our body — IgA, IgE, IgG and IgM. It shows primary response where it encounters the pathogen for the first time and secondary response during the subsequent encounters with the same antigen/pathogen. These immune responses are carried out with the help of two special types of lymphocytes present in the blood.

Name the two types of specialised cells which carry out the primary and secondary responses.

29(b)(i). Read the following passage and answer the questions that follow:

Immunity in our body is of two types (i) Innate immunity, and (ii) Acquired immunity. Innate immunity is a non-specific defence mechanism, whereas Acquired immunity is pathogen specific. Acquired immunity is characterised by memory. Antibodies are specific to antigens and there are four types of antibodies produced in our body — IgA, IgE, IgG and IgM. It shows primary response where it encounters the pathogen for the first time and secondary response during the subsequent encounters with the same antigen/pathogen. These immune responses are carried out with the help of two special types of lymphocytes present in the blood.

Name any two barriers present in our body that provide innate immunity.

29(b)(ii). Read the following passage and answer the questions that follow:

Immunity in our body is of two types (i) Innate immunity, and (ii) Acquired immunity. Innate immunity is a non-specific defence mechanism, whereas Acquired immunity is pathogen specific. Acquired immunity is characterised by memory. Antibodies are specific to antigens and there are four types of antibodies produced in our body — IgA, IgE, IgG and IgM. It shows primary response where it encounters the pathogen for the first time and secondary response during the subsequent encounters with the same antigen/pathogen. These immune responses are carried out with the help of two special types of lymphocytes present in the blood.

The organ transplants (grafts) are often rejected if not taken from suitable compatible persons. Mention the characteristic of our immune system that is responsible for the rejection.

29(c). Read the following passage and answer the questions that follow:

Immunity in our body is of two types (i) Innate immunity, and (ii) Acquired immunity. Innate immunity is a non-specific defence mechanism, whereas Acquired immunity is pathogen specific. Acquired immunity is characterised by memory. Antibodies are specific to antigens and there are four types of antibodies produced in our body — IgA, IgE, IgG and IgM. It shows primary response where it encounters the pathogen for the first time and secondary response during the subsequent encounters with the same antigen/pathogen. These immune responses are carried out with the help of two special types of lymphocytes present in the blood.

How is active immunity different from passive immunity? Write any two differences.

30(a). Read the following passage and answer the questions that follow:

Gene expresses itself in a cell system as a protein/enzyme. How an expression of gene occurs in a cell system, when it needs to occur and how the gene expression is regulated in prokaryotic cell system was studied by the combined efforts of Francois Jacob, a geneticist and Jacques Monod, a biochemist. 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 'lac operon' has to be operational at a very low level in the bacterial cell all the time. Justify.

30(b)(i). Read the following passage and answer the questions that follow:

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

How are the structural genes activated in the lac operon in *E. coli*?

30(b)(ii). Read the following passage and answer the questions that follow:

Gene expresses itself in a cell system as a protein/enzyme. How an expression of gene occurs in a cell system, when it needs to occur and how the gene expression is regulated in prokaryotic cell system was studied by the combined efforts of Francois Jacob, a geneticist and Jacques Monod, a biochemist. 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 regulation of operon called negative regulation?

30(c). Read the following passage and answer the questions that follow:

Gene expresses itself in a cell system as a protein/enzyme. How an expression of gene occurs in a cell system, when it needs to occur and how the gene expression is regulated in prokaryotic cell system was studied by the combined efforts of Francois Jacob, a geneticist and Jacques Monod, a biochemist. 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?

Section E

31(a). (i) EcoR I has played a very important role in rDNA technology.

(I) Explain the convention for naming EcoR I.

(II) Write the recognition site of this endonuclease restriction enzyme.

(ii) Name the overhanging stretches of DNA produced by these restriction enzymes. Describe their role in the formation of rDNA.

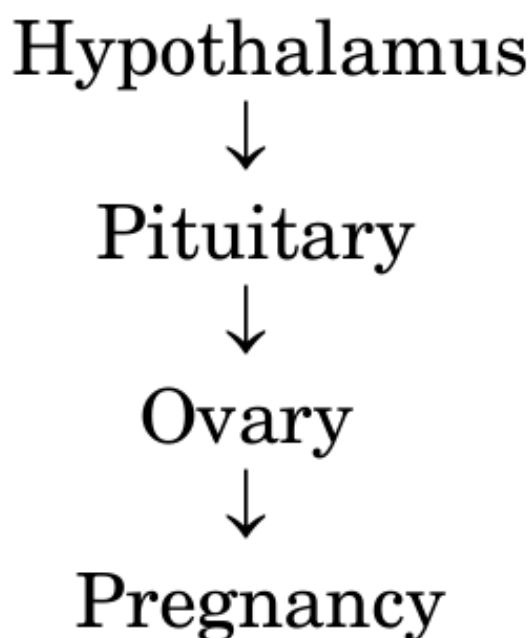
OR

31(b). (i) Insertional inactivation is a method to detect the recombinant DNA. Explain this method.

(ii) Name the commonly used vector for transferring genes in plants from bacteria.

(iii) How is this able to transform a normal plant cell into a tumour?

32(a). Study the flow chart given below. Name the hormones involved at each stage and explain their functions.



OR

32(b). (i) Draw a diagram of L.S. of maize grain and label its any six parts.

(ii) Differentiate between perisperm and endosperm giving one example of each.

33(a). Write the types and locations of the genes causing thalassemia in humans. State the cause and symptoms of the disease. How is sickle-cell anemia different from this disease?

OR

33(b). (i) Enlist any four prime goals of the Human Genome Project (HGP).

(ii) List the two methodologies which were involved in the human genome project. Mention how they were used.

(iii) Expand 'YAC' and mention what it was used for.

- End of Question Paper -