

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 female undergoing IVF treatment has blocked fallopian tube. The technique by which the embryo with more than 8 blastomeres will be transferred into the female for further development is:

- (A) ZIFT (B) GIFT
(C) IUT (D) AI

2. Which one of the following statements is correct?

- (A) Homozygous sex chromosomes (ZZ) determine female sex in birds. (B) XO type of sex chromosomes determine male sex in grasshoppers.
(C) XXY condition in humans is found in Turner's syndrome. (D) Homozygous sex chromosomes (XX) produce males in *Drosophila*.

3. 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

4. The first movements of the foetus and appearance of hair on its head are usually observed during which month of pregnancy?

- (A) Fourth month (B) Fifth month
(C) Sixth month (D) Third month

5. Thorns of *Bougainvillea* and tendrils of *Cucurbita* are examples of:

- (A) Analogous organs (B) Convergent evolution
(C) Homologous organs (D) Vestigial organs

6. Internal bleeding, muscular pain, blockage of the intestinal passage and anaemia are some of the symptoms caused due to infection by:

- (A) *Ascaris* (B) *Wuchereria*
(C) *Plasmodium* (D) *Trichophyton*

7. 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)

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

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

9. *Bacillus thuringiensis* is used to control which one of the following pathogens/pests?

- (A) Bacterial pathogen (B) Fungal pathogen
(C) Nematodes (D) Insect pests

10. In pBR322, tetracycline, resistance gene (tet^R) has recognition site for which of the following restriction endonuclease?

- (A) *Hind III* (B) *BamHI*
(C) *EcoRI* (D) *PstI*

11. In RNAi, genes are silenced using which of the following biomolecules?

- | | |
|-----------|-----------|
| (A) ssDNA | (B) dsDNA |
| (C) dsRNA | (D) ssRNA |

12. The biomass available in plants for consumption by herbivores and decomposers, is called:

- | | |
|--------------------------------|------------------------------|
| (A) Gross primary productivity | (B) Net primary productivity |
| (C) Standing crop | (D) Secondary productivity |

13. Assertion (A): Nucleopolyhedrovirus are useful as they are good biocontrol agents.

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

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|--|---|
| (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): The interaction between a whale and the small barnacles on its back is considered as commensalism.

Reason (R): In the above association, neither of the species is benefitted.

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|--|---|
| (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): The pyramid of biomass in a pond aquatic ecosystem is always inverted.

Reason (R): The biomass of consumers like fishes far exceeds that of the producers like phytoplanktons.

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|--|---|
| (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): Cleistogamous flowers have assured seed set.

Reason (R): Cleistogamous flowers are invariably autogamous and do not depend on any pollinating agents.

- | | |
|--|---|
| (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. Mention the sites of action of the hormones 'GnRH' and 'FSH' during spermatogenesis. Write one function of each of these hormones.

18. 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?

19. How do 'implants' act as an effective method of contraception in human females? Mention one advantage of implants over contraceptive pills.

20. Why and how can bacteria be made 'competent'?

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

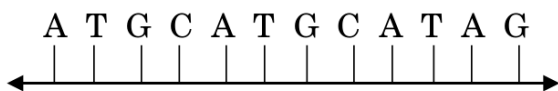
OR

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. (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.

23. (a) Draw a diagram of human ovum prior to fertilization. Label any four parts.

(b) Explain how polyspermy is avoided during fertilization.

24. (a) Draw a figure of *E. coli* vector pBR322 and label the following:

- (i) Origin of replication
- (ii) Ampicillin resistance site
- (iii) Tetracyclin resistance site
- (iv) 'rop'

(b) Mention the significance of origin of replication.

25. Define adaptive radiation. How did Darwin explain adaptive radiation?

26. (a) How do some viruses cause cancer in humans?

(b) How do benign tumours turn malignant? How do malignant tumours harm the human body?

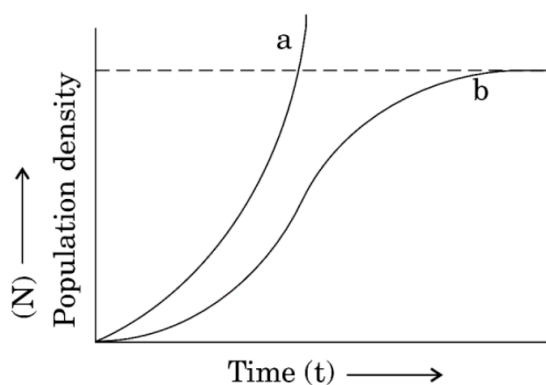
27. There are many animals, which have become extinct in the wild, but continue to be maintained in zoological parks. Answer the questions that follow:

(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.

28(a). Study the graph given below and answer the questions that follow:



(i) Write the status of food and space in the curves a and b.

(ii) In the absence of predators, which one of the two curves would appropriately depict the prey population?

(iii) 'Time' has been shown on x-axis and there is a parallel dotted line above it. Give the significance of this dotted line.

OR

28(b). Answer the following questions:

(i) Define 'predation'.

(ii) Why is predation required in a community of different organisms? Give any two points.

(iii) Why are predators 'prudent' in nature?

29(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.

29(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*?

OR

29(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?

29(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?

30(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.

30(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.

30(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.

30(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.

Section E

31(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

- 31(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.

32(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.

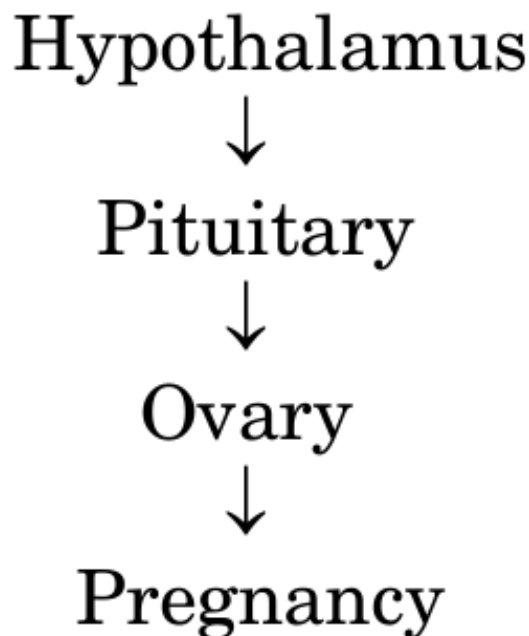
OR

32(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?

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



OR

33(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.

- End of Question Paper -