

Question Paper

Conducted by the Central Board of Secondary Education (CBSE)



Time Allowed: 3 Hours

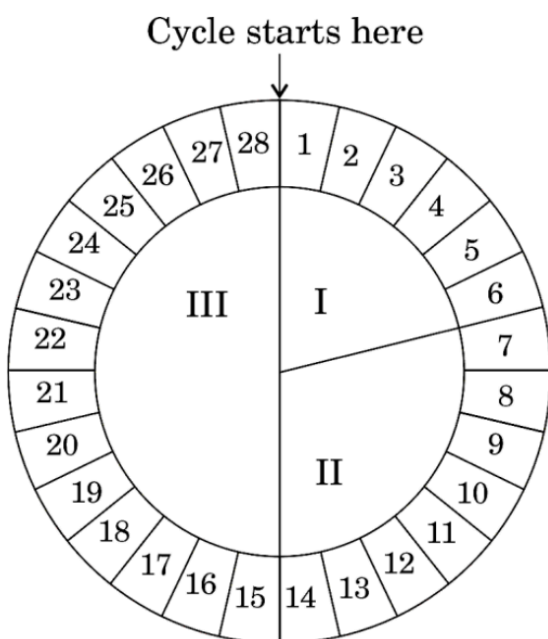
Maximum Marks: 70

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. In a human female, menstrual cycle of 28 days is represented by the diagram given below.



Select the correct statement related with this diagram.

- | | |
|---|--|
| (A) Primary follicle of ovary matures into Graafian follicle in phase II. | (B) The hormone secreted in large amounts in phase III is also responsible for maintaining pregnancy in human females. |
| (C) Corpus luteum secretes progesterone in phase I, however it degenerates completely in phase III. | (D) Both (A) and (B). |

2. The cells of endosperm have 24 chromosomes. What will be the number of chromosomes in the gametes?

- | | |
|--------|--------|
| (A) 8 | (B) 16 |
| (C) 23 | (D) 32 |

3. During different phases of menstrual cycle, hormones are secreted. Choose the option showing the correct sequence of hormones.

- | | |
|---------------------------------|---------------------------------|
| (A) FSH, Progesterone, Estrogen | (B) Estrogen, FSH, Progesterone |
| (C) FSH, Estrogen, Progesterone | (D) Estrogen, Progesterone, FSH |

4. A DNA molecule is 160 base pairs long. It has 30% Guanine. How many Adenine bases are present in this DNA molecule?

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|--------|---------|
| (A) 48 | (B) 64 |
| (C) 96 | (D) 192 |

5. Arrange the following in the correct sequence of their evolution and select the correct option:

- (i) Seaweed
(ii) Invertebrates
(iii) Jawless fish
- | | |
|----------------------|----------------------|
| (A) (i), (ii), (iii) | (B) (i), (iii), (ii) |
| (C) (ii), (iii), (i) | (D) (ii), (i), (iii) |

6. S is the stimulant of central nervous system and interferes with the transport of T, a neurotransmitter. Identify S and T and choose the correct option.

- | | |
|-------------------------------|------------------------------------|
| (A) S - Cocaine, T - Dopamine | (B) S - Heroin, T - Acetylcholine |
| (C) S - Heroin, T - Dopamine | (D) S - Cocaine, T - Acetylcholine |

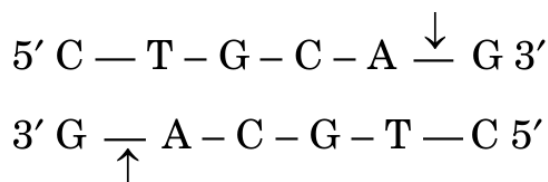
7. Select the odd option in the context of convergent evolution.

- (A) Eyes of Octopus and Mammals
(B) Flippers of Penguins and Dolphins
(C) Flying Squirrel and Flying Phalanger
(D) Thorns of Bougainvillea and Tendrils of Cucurbita

8. *Monascus purpureus* is a yeast used commercially in the production of which one of the following?

- (A) Ethanol
(B) Streptokinase
(C) Citric acid
(D) Statins

9. Given below is the restriction site of a restriction endonuclease Pst I and the cleavage sites on a DNA molecule.



Choose the option that gives the correct resultant fragments.

- (A) $\begin{array}{cc} 5' \text{ C — T — G} & \text{C — A — G } 3' \\ 3' \text{ G — A — C — G — T} & \text{C } 5' \end{array}$
- (B) $\begin{array}{cc} 5' \text{ C — T} & \text{G — C — A — G } 3' \\ 3' \text{ G — A — C — G} & \text{T — C } 5' \end{array}$
- (C) $\begin{array}{cc} 5' \text{ C — T — G — C} & \text{A — G } 3' \\ 3' \text{ G — A — C — G} & \text{T — C } 5' \end{array}$
- (D) $\begin{array}{cc} 5' \text{ C — T — G — C — A} & \text{G } 3' \\ 3' \text{ G} & \text{A — C — G — T — C } 5' \end{array}$

10. Which of the following ecosystem is most productive in terms of net primary productivity?

- (A) Desert
(B) Tropical rainforests
(C) Oceans
(D) Estuaries

11. Bt-toxin genes have been expressed in plants in order to provide resistance against:

- (i) lepidopterans and fungi
(ii) animals and bacteria
(iii) coleopterans and dipterans
(iv) lepidopterans

Options:

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

12. According to IUCN, some of the extinctions include:

- (i) Dodo
(ii) Indian gazelle
(iii) Thylacine
(iv) Steller's Sea Cow

Options:

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

13. Assertion (A): Genetically modified microbes help in crop protection.

Reason (R): *Bacillus thuringiensis* (Bt) bacteria control insects by producing prototoxins.

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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. |
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14. Assertion (A): Trichoderma species are free living fungi that are very common in the root ecosystems.

Reason (R): They are effective bio-control agents of several plant pathogens.

- | | |
|--|---|
| (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. |
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15. Assertion (A): The endometrium undergoes cyclic changes during the menstrual cycle.

Reason (R): Perimetrium contracts strongly during delivery of the baby.

- | | |
|--|---|
| (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. |
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16. Assertion (A): Repetitive sequences make up a very large portion of human genome.

Reason (R): Repetitive sequences do not have direct coding functions in the genome.

- | | |
|--|---|
| (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. |
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Section B

17. Draw a labelled diagram of the embryonic stage that gets implanted in the human uterus. State the functions of two labelled parts.

18(a). Mention the functions of each of the following:

- (i) Tassels of Corn Cob
- (ii) Scutellum

OR

18(b). Farmers prefer apomictic seeds over hybrid seeds. Give any two reasons.

19(a). Suggest how a virus-free healthy plant can be obtained from a diseased sugarcane plant.

OR

19(b). In order to force bacteria to take up the recombinant DNA, they must be made competent. Explain how it can be achieved.

20(a). Differentiate between grazing food chain and detritus food chain.

OR

20(b). Ecological pyramids are widely accepted but they still have some limitations. Write any two limitations.

21. One of the salient features of the genetic code is that it is nearly universal from bacteria to humans. Mention two exceptions to this rule. Why are some codes said to be degenerate?

Section C

22. (a) Draw a sectional view of seminiferous tubule of a human. Label the following cells in the seminiferous tubule:

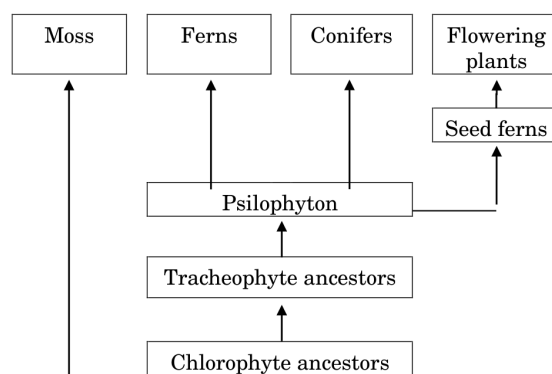
- (i) Cells that divide by mitosis to increase their number
 - (ii) Cells that undergo meiosis I
 - (iii) Cells that undergo meiosis II
 - (iv) Cells that help in the process of spermiogenesis
- (b) Mention the role of Leydig cells.

23. Explain the polygenic inheritance pattern with the help of a suitable example.

24. Mention a product of human welfare obtained with the help of each one of the following:

- (a) *Saccharomyces cerevisiae*
- (b) *Propionibacterium shermanii*
- (c) *Aspergillus niger*
- (d) *Trichoderma polysporum*
- (e) *Acetobacter aceti*
- (f) *Streptococcus*

25. Study the given chart showing evolution of plants. Answer the following questions:



- (a) Identify the plant which acts as an immediate ancestor of both ferns and conifers.
- (b) Name the nearest ancestors of flowering plants.
- (c) Name the most primitive group of plants.
- (d) Psilophyton provides common ancestry to which classes?
- (e) Name the common ancestor of psilophyton and seed ferns.
- (f) Name the common ancestor of mosses and tracheophytes.

26. (a) Write the scientific name of the nematode that infects tobacco plants. Also name the part of the plant that it infects.

(b) How is *Agrobacterium* used to protect tobacco plants from attack by this pest?

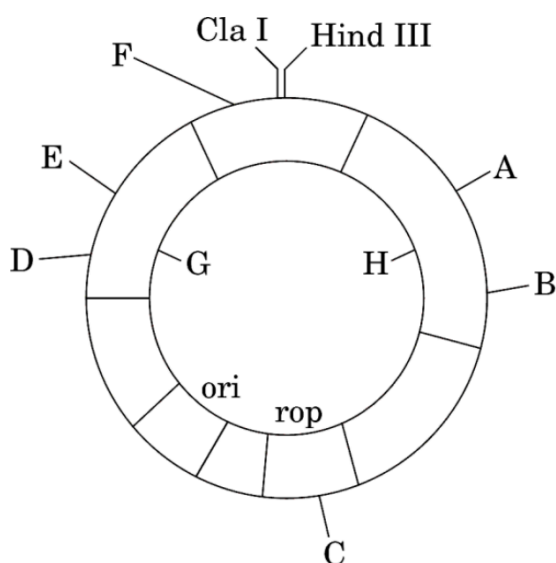
27. Explain the level of biodiversity at genetic, species and ecological levels with the help of one example each.

28. Explain Gause's 'Competitive Exclusion Principle' with the help of a suitable example.

Section D

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

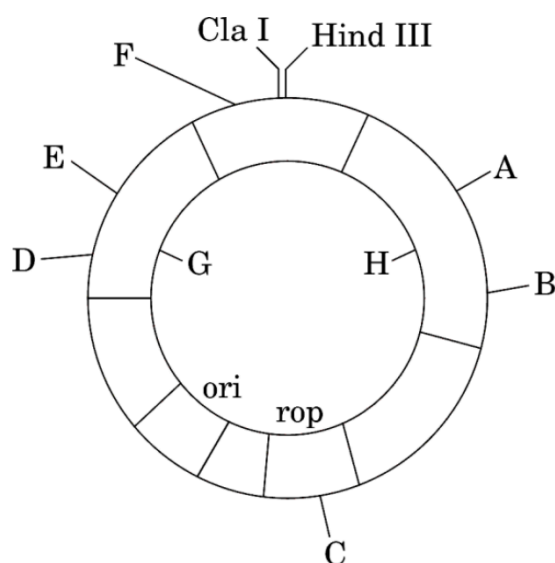
We know that plasmids and bacteriophages are the most commonly used vectors in biotechnology experiments. If we can link an alien piece of DNA to the plasmid DNA, the alien DNA can be multiplied equal to the copy number of the plasmid. Engineered vectors are used these days. Study the diagram of the *E. coli* cloning vector pBR322 and answer the questions that follow:



Why are plasmids and bacteriophages used as cloning vectors?

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

We know that plasmids and bacteriophages are the most commonly used vectors in biotechnology experiments. If we can link an alien piece of DNA to the plasmid DNA, the alien DNA can be multiplied equal to the copy number of the plasmid. Engineered vectors are used these days. Study the diagram of the *E. coli* cloning vector pBR322 and answer the questions that follow:



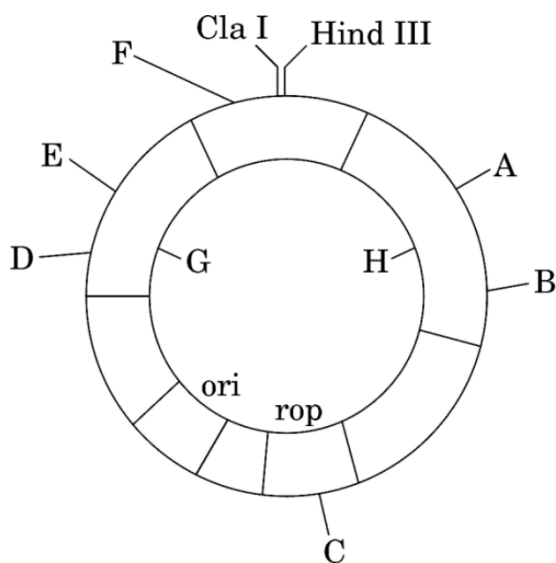
Identify:

- (I) The gene in the cloning vector that controls the copy number of the vector.
- (II) The restriction site - C in the 'rop' gene.

OR

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

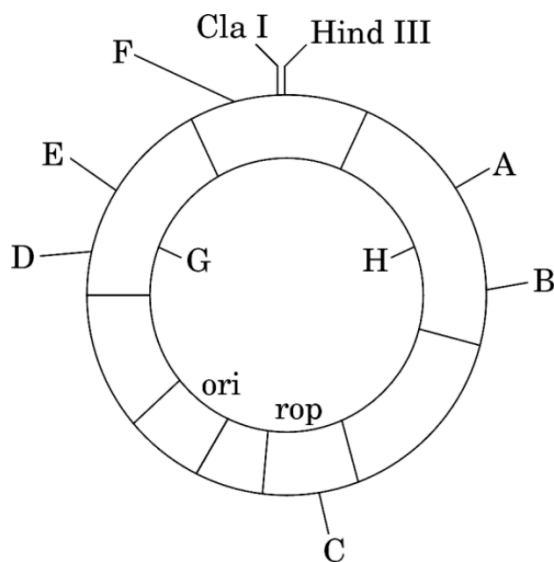
We know that plasmids and bacteriophages are the most commonly used vectors in biotechnology experiments. If we can link an alien piece of DNA to the plasmid DNA, the alien DNA can be multiplied equal to the copy number of the plasmid. Engineered vectors are used these days. Study the diagram of the *E. coli* cloning vector pBR322 and answer the questions that follow:



Identify and name two selectable markers shown in the diagram.

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

We know that plasmids and bacteriophages are the most commonly used vectors in biotechnology experiments. If we can link an alien piece of DNA to the plasmid DNA, the alien DNA can be multiplied equal to the copy number of the plasmid. Engineered vectors are used these days. Study the diagram of the *E. coli* cloning vector pBR322 and answer the questions that follow:



Name the two restriction sites each in the two genes you have identified as selectable markers.

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

The process of copying genetic information from template strand of DNA into RNA is called transcription. It is mediated by RNA polymerase. Transcription takes place in the nucleus of eukaryotic cells. In transcription, only a segment of DNA and only one of the strands is copied into RNA.

Why is the strand of DNA with 3' → 5' polarity transcribed and not the other strand of 5' → 3' polarity?

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

The process of copying genetic information from template strand of DNA into RNA is called transcription. It is mediated by RNA polymerase. Transcription takes place in the nucleus of eukaryotic cells. In transcription, only a segment of DNA and only one of the strands is copied into RNA.

Why is hnRNA required to undergo splicing?

OR

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

The process of copying genetic information from template strand of DNA into RNA is called transcription. It is mediated by RNA polymerase. Transcription takes place in the nucleus of eukaryotic cells. In transcription, only a segment of DNA and only one of the strands is copied into RNA.

Mention the two additional processes which hnRNA needs to undergo after splicing to become functional.

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

The process of copying genetic information from template strand of DNA into RNA is called transcription. It is mediated by RNA polymerase. Transcription takes place in the nucleus of eukaryotic cells. In transcription, only a segment of DNA and only one of the strands is copied into RNA.

Why is only one strand of the DNA transcribed? Give two reasons.

Section E

31(a). Work out separate monohybrid crosses up to F_2 generation between two pea plants and two *Antirrhinum* plants, both having contrasting traits with respect to the colour of the flower. Comment on the patterns of inheritance in the crosses carried out in such two cases.

OR

31(b)(i). Answer the following questions:

How does a chromosomal disorder differ from a Mendelian disorder? Write one example for each.

OR

31(b)(ii). Answer the following questions:

Name the phenomenon that leads to situations like 'XO' abnormality in humans. Also name this genetic disorder. How are individuals with an XO chromosomal abnormality affected? Write its symptoms as well as karyotype.

32(a)(i). Draw the structure of an antibody molecule and label any four of its parts.

32(a)(ii). Differentiate between active and passive immunity. Write any three differences.

OR

32(b)(i). (I) Write the scientific names of the two species of filarial worms causing filariasis. (II) How do they affect the body of infected persons? (III) How does the disease spread?

OR

32(b)(ii). Mention the source and the role of the following in providing defence against infection in the human body:

- (I) Histamine
- (II) Interferons

33(a). Briefly explain the events of fertilisation and implantation in an adult human female.

OR

33(b)(i). Arrange the following hormones in sequence of their secretion in a pregnant woman: hCG; LH; FSH; Relaxin.

OR

33(b)(ii). Mention the source and the functions of the above mentioned hormones.

- End of Question Paper -