

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. Mohit performed an analysis of two different soil samples from two areas A and B. He recorded these results:

Soil Sample A: Lignin 40%, Sugar 10%, Chitin 45%, Nitrogen 5%

Soil Sample B: Lignin 5%, Sugar 35%, Chitin 15%, Nitrogen 45%

Which of these is true about their rate of decomposition in both the soil?

- | | |
|--|--|
| (A) Soil A has a slower rate of decomposition than Soil B. | (B) Soil A has a faster rate of decomposition than Soil B. |
| (C) Both have the same rate of decomposition. | (D) No decomposition occurs in A and B. |

2. Diameter of the pollen grain generally is:

- | | |
|-------------------------|--------------------------|
| (A) 5 to 10 micrometer | (B) 10 to 15 micrometer |
| (C) 25 to 50 micrometer | (D) 50 to 100 micrometer |

3. Menstrual cycle in human females consists of various events.

Select the option that indicates the correct sequence of these events of menstrual cycle.

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|--|--|
| (A) Menstrual phase, Follicular phase, Luteal phase, Ovulatory phase | (B) Luteal phase, Follicular phase, Ovulatory phase, Menstrual phase |
| (C) Menstrual phase, Follicular phase, Ovulatory phase, Luteal phase | (D) Follicular phase, Luteal phase, Menstrual phase, Ovulatory phase |

4. A Dihybrid cross is done between two parent pea plants (pure line) who differ in two pairs of contrasting traits: Seed colour and seed shape.

In the F_2 generation the number of phenotypes and genotypes will be:

- | | |
|------------------------------------|------------------------------------|
| (A) phenotypes = 4; genotypes = 16 | (B) phenotypes = 9; genotypes = 14 |
| (C) phenotypes = 4; genotypes = 8 | (D) phenotypes = 4; genotypes = 9 |

5. RNA interference (RNAi) helps in making tobacco-plant resistant to a nematode (*Meloidogyne incognita*). Choose the correct option that shows how RNAi is achieved:

- | | |
|--|---|
| (A) Preventing the process of translation of mRNA of the nematode. | (B) Preventing the process of replication of DNA of the nematode. |
| (C) Preventing the process of transcription of DNA of the plant. | (D) Preventing the process of replication of DNA of the plant. |

6. The sequence of nitrogenous bases in a segment of a coding strand of DNA is 5'-AATGCTAGGCAC-3'. Choose the option that shows the correct sequence of nitrogenous bases in the mRNA transcribed by the DNA.

- | | |
|------------------------|------------------------|
| (A) 5'-UUACGAACCGAG-3' | (B) 5'-AAUGCUAGGCAC-3' |
| (C) 5'-UUACGUACCGUG-3' | (D) 5'-AACGUAGGCAGC-3' |

7. A man whose father was colour-blind marries a woman who had a colour-blind mother and normal father. What percentage of male children of this couple will be colour-blind?

- | | |
|---------|---------|
| (A) 25% | (B) 0% |
| (C) 50% | (D) 75% |

8. Evolution of modern man involves the following man-like primates. Choose the correct series of human evolution.

- | | |
|---|--|
| (A) Dryopithecus → Homo erectus → Australopithecines → Homo sapiens | (B) Australopithecines → Homo erectus → Neanderthal → Homo sapiens |
| (C) Australopithecines → Ramapithecus → Dryopithecus → Homo sapiens | (D) Homo erectus → Australopithecines → Homo sapiens → Neanderthal |

9. GEAC stands for:

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|--|--|
| (A) Genome Engineering Action Committee | (B) Ground Environment Action Committee |
| (C) Genetic and Environment Approval Committee | (D) Genetic Engineering Approval Committee |

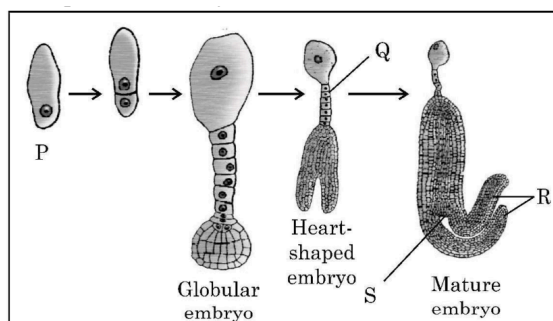
10. Transplantation of tissues/organs to some patients often fails due to rejection of such tissues/organs by the body of the patient. Which type of immune response is responsible for such rejections?

- | | |
|-----------------------------------|-----------------------------------|
| (A) Autoimmune response | (B) Humoral immune response |
| (C) Physiological immune response | (D) Cell mediated immune response |

11. Amplification of gene of interest by using DNA polymerase may go upto:

- | | |
|-----------------------|----------------------|
| (A) 0.1 million times | (B) 1 million times |
| (C) 1 billion times | (D) 1 trillion times |

12. The diagram given below shows labelling of four parts of a dicot embryo during its development as P, Q, R and S.



Choose the option that indicates correct labelling of 'P', 'Q', 'R' and 'S' of embryo in different stages of its development:

- | | |
|--|---|
| (A) P-Egg, Q-Suspensor, R-Radicle, S-Cotyledon | (B) P-Zygote, Q-Suspensor, R-Cotyledon, S-Plumule |
| (C) P-Egg, Q-Radicle, R-Suspensor, S-Cotyledon | (D) P-Zygote, Q-Suspensor, R-Cotyledon, S-Radicle |

13. Assertion (A): Perisperm is a diploid tissue.

Reason (R): Perisperm is the remains of nucellus which surrounds the embryo in certain seeds.

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|--|---|
| (A) Both (A) and (R) are true and (R) is the correct explanation of (A). | (B) Both (A) and (R) are true, but (R) is not the correct explanation of (A). |
| (C) (A) is true, but (R) is false. | (D) (A) is false, but (R) is true. |

14. Assertion (A): While working on Staphylococci, Alexander Fleming observed that *Penicillium notatum* inhibits the growth of bacteria.

Reason (R): The inhibiting chemical was commercially extracted and its full potential was established by Alexander Fleming.

- | | |
|--|---|
| (A) Both (A) and (R) are true and (R) is the correct explanation of (A). | (B) Both (A) and (R) are true, but (R) is not the correct explanation of (A). |
| (C) (A) is true, but (R) is false. | (D) (A) is false, but (R) is true. |

15. Assertion (A): One of the property of genetic code is degeneracy.

Reason (R): Some amino acids can be coded by more than one codon.

- | | |
|--|---|
| (A) Both (A) and (R) are true and (R) is the correct explanation of (A). | (B) Both (A) and (R) are true, but (R) is not the correct explanation of (A). |
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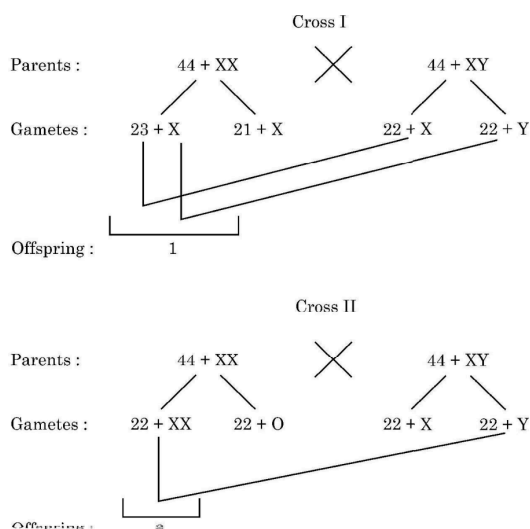
16. Assertion (A): A bioreactor provides the optimal conditions for achieving the desired product by providing optimum growth conditions.

Reason (R): The most commonly used bioreactors are of stirring type.

- | | |
|--|---|
| (A) Both (A) and (R) are true and (R) is the correct explanation of (A). | (B) Both (A) and (R) are true, but (R) is not the correct explanation of (A). |
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Section B

17. Study the two different crosses given below:



Cross I

Parents: $44 + XX \times 44 + XY$

Gametes: $23 + X, 21 + X, 22 + X, 22 + Y$

Offspring: 1

Cross II

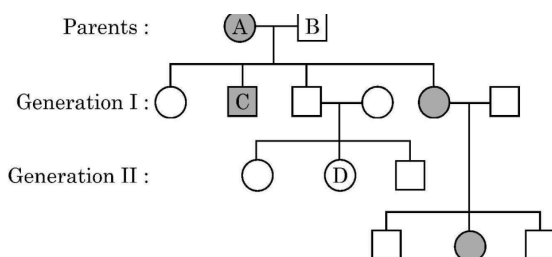
Parents: $44 + XX \times 44 + XY$

Gametes: $22 + XX, 22 + O, 22 + X, 22 + Y$

Offspring: 2

Identify the abnormalities 1 and 2 in the offsprings of given crosses and distinguish between them.

18. Study the pedigree analysis of Myotonic dystrophy given below:



Answer the following questions:

(a) Write genotype of A, B, C and D.

(b) Identify whether the trait is

(i) Sex linked or autosomal

(ii) Dominant or recessive

19(A). A patient with ADA deficiency requires periodic infusion of genetically engineered lymphocytes. Explain why such periodic infusion is required and also suggest a permanent cure for such ADA deficiency.

OR

19(B). Describe in brief any two techniques that can be utilised to transfer recombinant DNA into the host cell directly without using any vector.

20(A). How are morphine and heroin related? Mention their effect on the human body.

OR

20(B). (i) Name an alcoholic drink which is produced by the help of microbes:

(1) With distillation

(2) Without distillation

(ii) Explain how cyanobacteria can be used as bio-fertilizer.

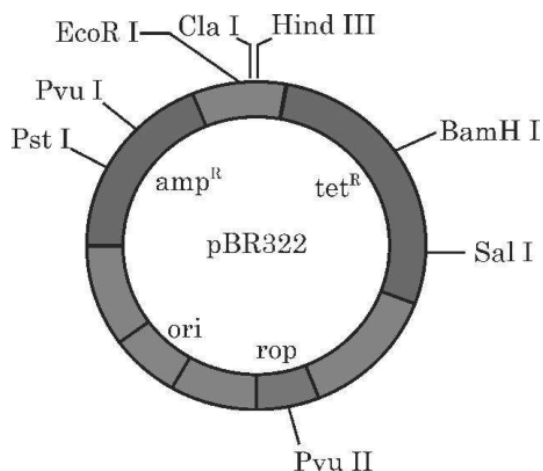
21(A). Analyse the following ecosystems and discuss, which will be more productive in terms of primary productivity:

A young forest, a natural old forest, a shallow polluted lake.

OR

21(B). Differentiate between Net primary productivity and Gross primary productivity in an ecosystem.

22. (a) Study the cloning vector shown below.



Explain the importance of 'ori' and 'rop' in the E. coli cloning vector shown in the above given diagram.

- (b) Differentiate between exonucleases and endonucleases.

23. The great German naturalist and geographer Alexander Von Humboldt observed that within a region species richness increased with increasing explored area, but only upto a limit.

- (a) For the above situation, construct a graph and write an equation.
(b) Also write various values of Z (regression coefficient).

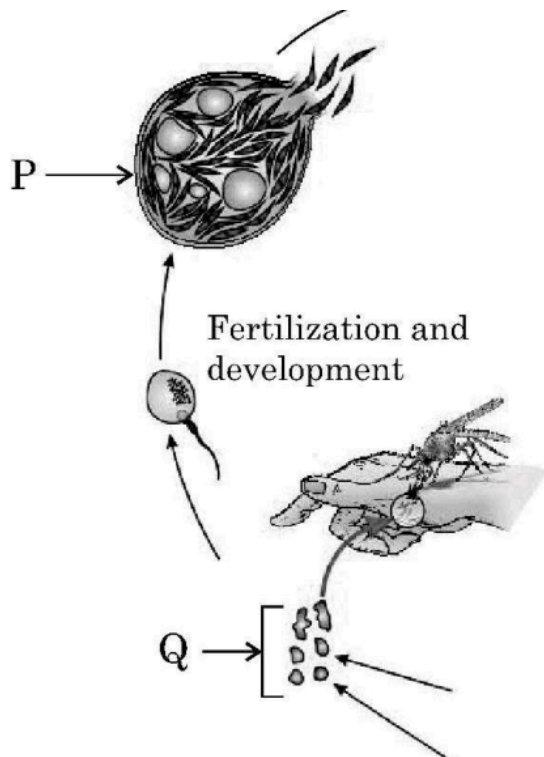
24. Shyam and Radha are expecting their first child with Radha being in her second month of pregnancy with no complications. Shyam's family has a history of cystic fibrosis while Radha's family has a history of Down's syndrome, leading to a concern that the baby may have one of these conditions.

- (a) Suggest and explain a way of testing if their baby is at risk for any genetic disorders.
(b) In case of presence of one or both of the abnormalities and posing a risk to the mother's health, mention one possible option for them to consider. Is that option safe for Radha at the current gestational age? Justify.
(c) Under what conditions is the process mentioned in (b) illegal?

25. (a) Write the palindromic nucleotide sequence for following sequence of DNA segment: 5'-GAATTC-3'

- (b) Name the restriction endonuclease that recognizes this sequence.
(c) How are sticky ends produced? Mention their role.

26. Study a part of life cycle of Plasmodium given below:

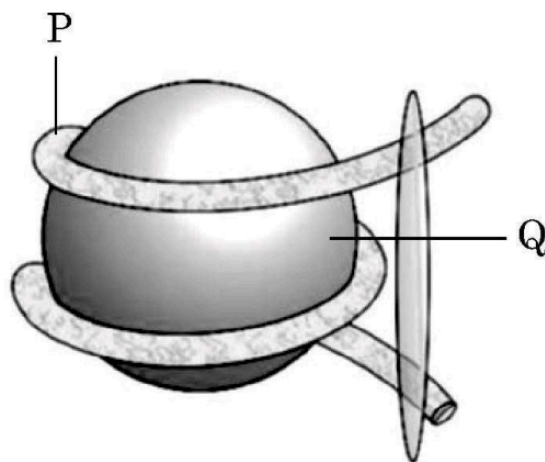


Answer the following questions:

- Name the infective stage of Plasmodium that is stored in the female Anopheles mosquito.
- Where does fertilization and development of parasite take place?
- Identify labels P and Q in the given diagram.
- Asexual and sexual phase of the life cycle of the Plasmodium takes place in two different hosts. Write their names.

27. Compare and contrast convergent and divergent evolution.

28. Study the diagram given below and answer the questions that follows:



- Identify the structure shown in the above figure.
- Identify the labels P and Q.
- Write the nature of histone proteins.
- Distinguish between Euchromatin and Heterochromatin.

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

In nature, we rarely find isolated, single individuals of any species; majority of them live in groups in a well-defined geographical area, share or compete for similar resources, potentially interbreed and thus constitute a population. The population has certain attributes whereas, an individual organism does not. A population at a given time is composed of individuals of different ages. The size of the population tells us a lot about its status in the habitat. Whatever ecological processes we wish to investigate in a population, be it the outcome of competition with another species, the impact of the predator or the effect of pesticide application, we always evaluate in terms of any change in the population size. The size, in nature, could be low or go into millions. Population size, technically called population density (N) need not necessarily be measured in numbers only. The size of a population for any species is not a static parameter. It keeps on changing with time depending on various factors including food availability, predation pressure and adverse weather.

(a) The Monarch butterfly is highly distasteful to its predator because of a special chemical present in its body. How does the butterfly acquire this chemical?

(b) If population density at a time $t + 1$ is 800, Emigration = 100, Immigration = 200, Natality = 200 and Mortality = 150, calculate the population density at time t and comment upon the type of age pyramid that will be formed in this case.

(c) What is the difference in a method of measuring population density in an area if there are 200 carrot grass plants to only single huge banyan tree?

OR

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

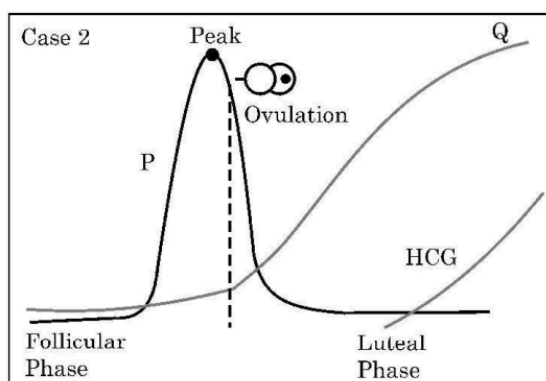
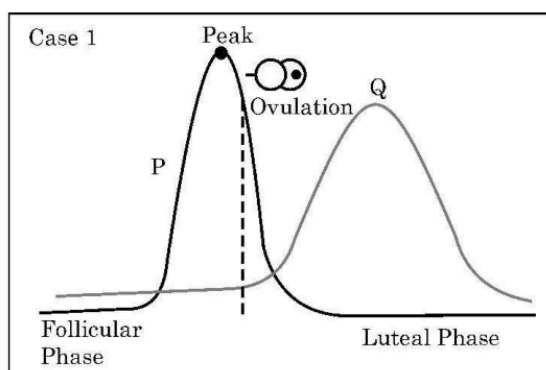
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(b) If population density at a time $t + 1$ is 800, Emigration = 100, Immigration = 200, Natality = 200 and Mortality = 150, calculate the population density at time t and comment upon the type of age pyramid that will be formed in this case.

(d) Name two methods to measure the population density of tigers.

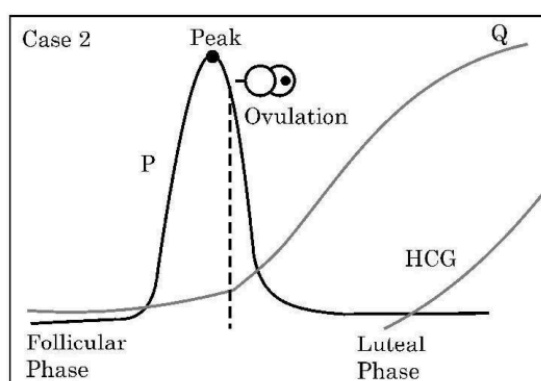
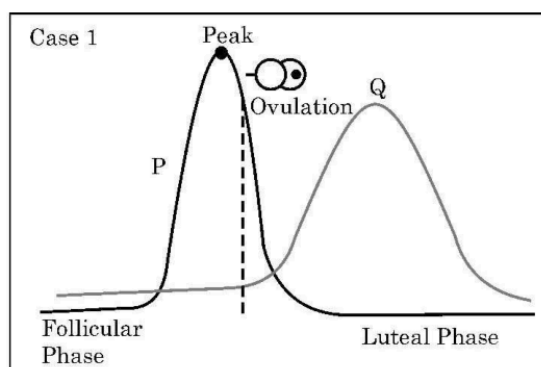
30. Study the graphs given below for Case 1 and Case 2 showing different levels of certain hormones and answer the questions that follows:



- Which hormone is responsible for the peak observed in Case 1 and Case 2? Write one function of that hormone.
- Write changes that take place in the ovary and uterus during follicular phase.
- Name the hormone Q of Case 2. Write one function of hormone Q.

OR

30. Study the graphs given below for Case 1 and Case 2 showing different levels of certain hormones and answer the questions that follows:

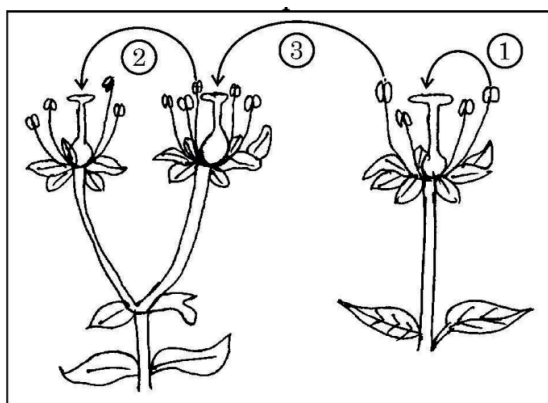


- Which hormone is responsible for the peak observed in Case 1 and Case 2? Write one function of that hormone.
- Write changes that take place in the ovary and uterus during follicular phase.
- Which structure in the ovary will remain functional in Case 2? How is it formed?

Section E

31(A). (a) Distinguish between the two cells enclosed in a mature male gametophyte of an angiosperm.

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



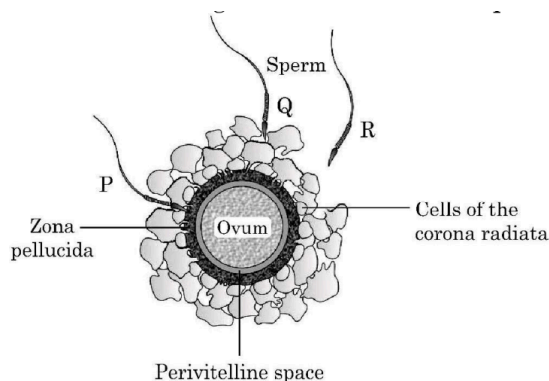
(i) The given diagram shows three methods of pollen transfer in plants. Examine them carefully and write the technical terms used for pollen transfer methods '1', '2' and '3'.

(ii) How do the following plants achieve pollination successfully? (a) Water lily (b) Vallisneria

(iii) Write advantages of pollen transfer in method '3'.

OR

31(B). Given below is the diagram of human ovum surrounded by a few sperms. Observe the diagram and answer the questions that follows:



(i) Compare the fate of sperms 'P', 'Q' and 'R' shown in the diagram.

(ii) Write the role of Zona pellucida in this process.

(iii) Analyse the changes occurring in the ovum after the entry of sperm.

(iv) How acrosome and middle piece are able to play an important role in human fertilization?

32(A). Answer the following questions:

- (i) State what do you understand by “MALT”? Where it is located inside our body?
- (ii) Explain cytokine barriers.
- (iii) Name the diagnostic test for AIDS. On what principle does it work?
- (iv) Bone marrow and thymus play an important role in human immune system. Explain how are they able to achieve this.

OR

32(B). (i) Fill 'H', 'I', 'J', 'K', 'L' and 'M' in following table with suitable words:

	Chemical / Bioactive Molecule	Micro-organism	Category	Use
(a)	Butyric acid	H	I	Important applications in food, chemical & pharma industry
(b)	J	<u>Monascus purpureus</u>	K	Inhibit cholesterol biosynthesis pathway
(c)	Cyclosporin A	L	Fungus	M

(ii) Why are baculoviruses used as biological control agents?

- 33(A).** (i) Haemophilia and red green colourblindness is usually observed in men. Why?
- (ii) Perform a cross(es) where haemophilic daughter(s) and haemophilic son(s) are produced in same ratio.

OR

33(B). (i) Where do transcription and translation occur in bacteria and eukaryotes respectively?

(ii) Draw a labelled schematic sketch of replication fork of DNA.

(iii) A DNA segment has a total of 1000 nucleotides, out of which 240 of them are Adenine containing nucleotides. How many pyrimidine bases this segment possesses?

- End of Question Paper -