

General Instructions:

1. All questions are compulsory.
2. The question paper is divided into five sections, containing 33 questions.
3. Section–A has 16 questions of 1 mark each; Section–B has 5 questions of 2 marks each; Section– C has 7 questions of 3 marks each; Section– D has 2 case-based questions of 4 marks each; and Section–E has 3 questions of 5 marks each.
4. Internal choices are provided in some questions. Attempt only one alternative in such cases.
5. Wherever necessary, neat and properly labelled diagrams must be included.

Section – A (1 Mark Each)

(Each question includes the Unit or Chapter Name)

1. Unit: Reproduction

Signals for parturition in human females originate from:

- a) Fully developed foetus only
- b) Both placenta and fully developed foetus
- c) Placenta only
- d) Oxytocin released from maternal pituitary

2. Unit: Genetics and Evolution

To produce 1600 seeds, the number of meiotic divisions required will be:

- a) 2400
- b) 2000
- c) 1600
- d) 1800

3. Unit: Genetics and Evolution

A sample of normal double-stranded DNA was found to have thymine content of 27%. What will be the expected proportion of guanine in this strand?

- a) 23%
- b) 32%
- c) 36%
- d) 73%

4. Unit: Biotechnology and its Applications

If *E. coli* has 4.6×10^6 base pairs and completes replication in 18 minutes, then the average rate of polymerization is approximately:

- a) 2000 bp/s
- b) 4000 bp/s
- c) 3000 bp/s
- d) 1000 bp/s

5. Unit: Genetics and Evolution

Suresh and Rajesh have defective haemoglobin due to genetic disorders. In Suresh, the problem is qualitative as he is having incorrectly functioning globin molecules, while in Rajesh the problem is quantitative, having very few globin molecules. Identify the disorder they are suffering from.

- a) Sickle Cell Anaemia
- b) Thalassemia
- c) Haemophilia
- d) Hemoglobinopathy

6. Unit: Genetics and Evolution

In *E. coli*, the lac operon gets switched on when lactose is:

- a) Present in the medium and it binds to the repressor
- b) Not present in the medium and the repressor binds to the operator
- c) Not present in the medium and RNA polymerase binds to the operator
- d) Active lactose present in the medium binds to RNA polymerase

7. Unit: Reproduction

Which of the following features shows the mechanism of sex determination in honey-bees?

- a) An offspring formed from the union of a sperm and egg develops as a female
- b) Males have half the number of chromosomes than that of female
- c) The males are haploid having 32 chromosomes
- d) All workers and males are diploid having 16 chromosomes

8. Unit: Biotechnology and its Applications

The following diagram shows a fragment of DNA which is going to be transcribed, the upper strand with polarity 3' to 5' is the template strand:

3' ATTGCC 5'

What will be the sequence of mRNA after transcription?

- a) 5' AUUGCC 3'
- b) 5' UAACGG 3'
- c) 5' GGCAAU 3'
- d) 5' ATTCGG 3'

9. Unit: Ecology and Environment

Idli – dosa dough rises due to the production of which of the following gas?

- a) CO
- b) CO₂
- c) NO
- d) NO₂

10. Unit: Genetics and Evolution

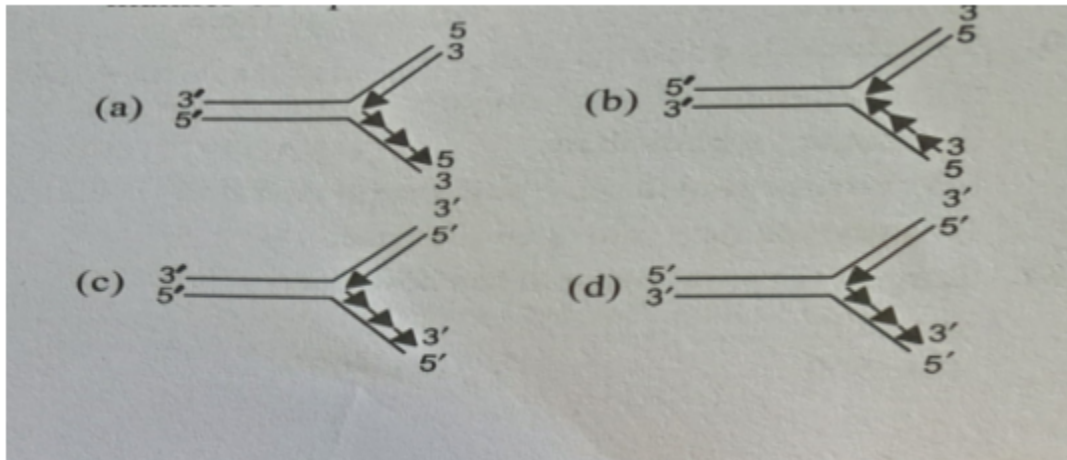
Adaptive radiation leads to:

- a) Increased competition among species
- b) Decreased speciation rates

- c) Limited morphological diversity among species
- d) Rapid divergence of traits among populations inhabiting a given geographical area

11. Unit: Biotechnology and its Applications

Which of the following correctly represents the manner of replication of DNA



Answer: (d)

12. Unit: Biology and Human Welfare

During the secondary treatment of sewage, which of the following changes in the effluent occur due to flocs?

- a) Reduction in BOD
- b) Increase in BOD
- c) Decrease in DO
- d) No change in DO or BOD

13. Unit: Reproduction

Assertion (A): Cells of tapetum have more than one nucleus.

Reason (R): They undergo meiosis without cytokinesis.

Select the correct option:

- a) Both A and R are true and R is the correct explanation of A.
- b) Both A and R are true and 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. Unit: Genetics and Evolution

Assertion (A): Deoxyribonucleoside triphosphates serve dual purposes.

Reason (R): They act as proof readers and provide energy.

Select the correct option:

- a) Both A and R are true and R is the correct explanation of A.
- b) Both A and R are true and 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. Unit: Biotechnology and its Applications

Assertion (A): A floating cover placed over the slurry in a biogas plant keeps on rising.

Reason (R): This cover keeps on rising due to the gas produced in the tank by the microbial activity.

Select the correct option:

- a) Both A and R are true and R is the correct explanation of A.
- b) Both A and R are true and R is not the correct explanation of A.
- c) A is true but R is false.
- d) A is false but R is true.

16. Unit: Genetics and Evolution

Assertion (A): DNA fragments can be isolated by Gel electrophoresis on the basis of their size.

Reason (R): The larger the fragment size, the faster it moves.

Select the correct option:

- a) Both A and R are true and R is the correct explanation of A.
- b) Both A and R are true and R is not the correct explanation of A.
- c) A is true but R is false.
- d) A is false but R is true.

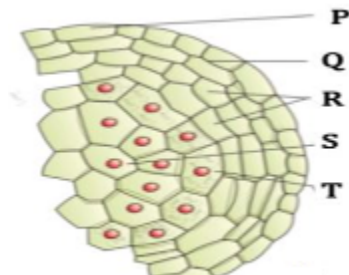
Section – B (3 Marks Each)

(Each question includes the Unit or Chapter Name)

17. Unit: Reproduction

Given below is an enlarged view of one microsporangium of a mature anther.

- (i) Identify and name R, S & T wall layers.
- (ii) Mention the characteristics and function of the cell forming wall layer “T”



Answer: (i) R = Middle layer

S = Microspore mother's cell

T = Tapetum

- (ii) “T” wall layer helps in providing nutrition to microspore and synthesis of sporopollenin in exine

18. Unit: Genetics and Evolution

Describe the process of genetic recombination during meiosis. How does it contribute to genetic diversity in sexually reproducing organisms?

19. Unit: Biotechnology and its Applications

Explain the process of recombinant DNA technology. Describe the steps involved in the construction of a recombinant DNA molecule.

20. Unit: Ecology and Environment

Explain the nitrogen cycle with the help of a flowchart. Discuss the role of bacteria in the nitrogen cycle and its importance for plant growth.

21. Unit: Biology and Human Welfare

Describe the mechanism of action of insulin in humans. How does it regulate blood sugar levels? Discuss the physiological changes seen in diabetes mellitus.

Section – C (3 Marks Each)

(Each question includes the Unit or Chapter Name)

22. Unit: Reproduction

Describe the structure of the human male reproductive system. Explain the function of each component involved in sperm production and transportation.

23. Unit: Genetics and Evolution

What are the principles of Mendel's laws of inheritance? Discuss how the concept of dominance and recessiveness is explained through Mendel's experiments.

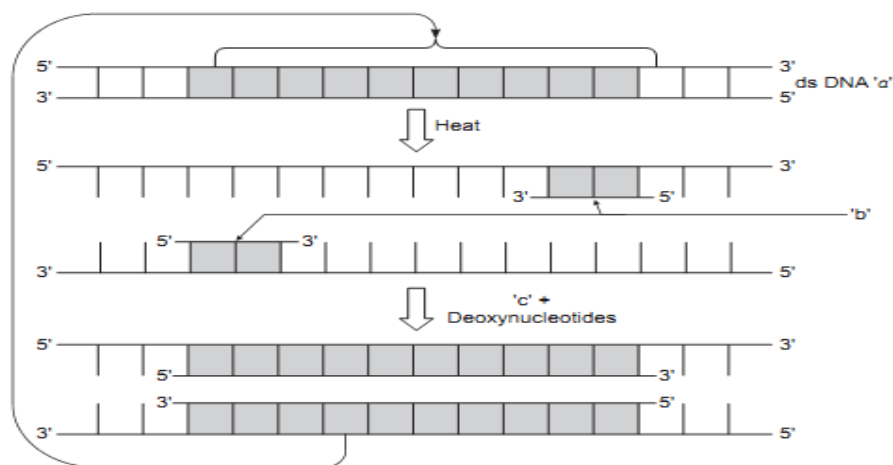
24. Unit: Biology and Human Welfare

Explain the role of vaccines in preventing diseases. How do vaccines stimulate immunity in the human body? Provide examples of commonly used vaccines.

25. Unit: Biotechnology and its Applications

A schematic representation of Polymerase chain reaction (PCR) is given below. Answer

the questions that follows:



- Name the process 'a' and identify 'b'.
- Identify 'c' and mention its importance in PCR.
- For what purpose PCR technique is used?

26. Unit: Ecology and Environment

Discuss the concept of ecological succession. Differentiate between primary and secondary succession, and explain how each contributes to ecosystem development.

27. Unit: Reproduction

What is the role of the placenta in human pregnancy? Explain the exchange of materials between the mother and the fetus.

28. Unit: Genetics and Evolution

Explain the concept of natural selection as proposed by Charles Darwin. How does natural selection contribute to the evolution of species?

Section – D (Case Study Based)

(Each question includes the Unit or Chapter Name)

29. Unit: Genetics and Evolution

Case Study: A population of birds in a remote island is observed for several generations. Initially, most birds have either short or long beaks. Over time, a significant number of birds start exhibiting medium-sized beaks. Scientists observe that the new trait is more advantageous for feeding on a newly discovered type of food in the area, leading to better survival and reproduction.

Questions: a. What evolutionary process is responsible for the change in beak size within the population?

b. Explain how natural selection works in this case and how it influences the bird population's evolution.

30. Unit: Biotechnology and its Applications

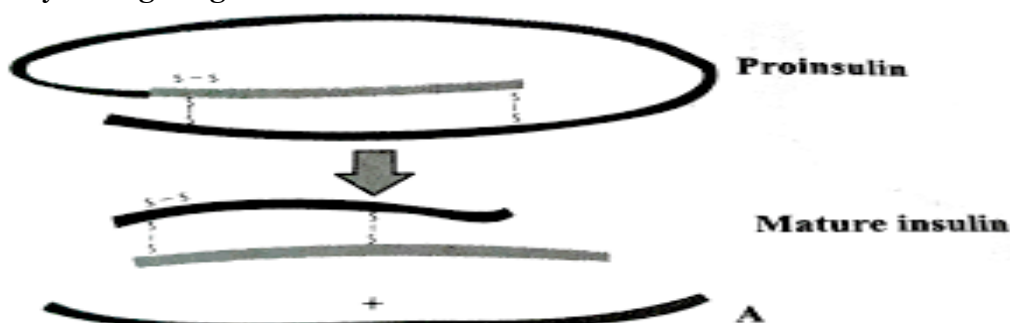
Case Study: Scientists are attempting to develop a genetically modified (GM) crop that is resistant to drought. They introduce a gene from a drought-resistant plant species into the crop. After multiple generations of the GM crop, researchers observe improved drought tolerance and higher yield compared to the non-GM variety.

Questions: a. What technique is being used to introduce the drought-resistant gene into the crop?

b. Discuss the potential benefits and risks of genetically modifying crops for better agricultural productivity.

OR

Study the figure given below of a biomolecule



- What does the above diagram depict?
- Identify the strand "A" mentioned in the above figure.
- Write the main steps involved for the formation of mature insulin with the help of Genetic Engineering.

Section – E (Long Answer Type)

31. Unit: Reproduction

Question: Explain the process of spermatogenesis in humans. Include details of the stages involved, the role of Sertoli cells, and the hormonal regulation of spermatogenesis. How do factors such as temperature and age influence sperm production in men?

OR

- a) IVF is becoming more popular in current scenario that is helping childless couples to bear a child. Describe the different steps that are carried out in this technique.
- b) Would you consider Gamete Intrafallopian Transfer (GIFT) as an IVF ? Give reason to support your answer.
-

32. Unit: Biotechnology and its Applications

Question: Describe the principle, steps, and applications of the Polymerase Chain Reaction (PCR). How does PCR amplify a specific segment of DNA, and what are its major uses in research, diagnostics, and forensic science? Discuss any ethical concerns associated with the use of PCR in genetic studies.

OR

Answer the following questions based on Meselson and Stahl's experiment:

- (i) Write the name of the chemical substance used as source of nitrogen in the experiment by them.
 - (ii) Why did the scientists synthesize the light and the heavy DNA molecules in the organism used in the experiment?
 - (iii) How did the scientists make it possible to distinguish the heavy DNA molecule from the light DNA molecule? Explain.
 - (iv) Write the conclusion the scientists arrived at, after completing the experiment.
-

33. Unit: Ecology and Environment

Question: What is meant by the term "biogeochemical cycles"? Explain the nitrogen cycle in detail, including the processes of nitrogen fixation, nitrification, denitrification, and ammonification. How do human activities such as industrialization and agriculture affect the nitrogen cycle?

OR

- (i) Name the two types of desirable approaches to conserve biodiversity? Explain with examples bringing out the difference between the two types.
- (ii) State the features of a stable biological community?