

Rajasthan Board Class 12 Biology Question Paper with Solutions(Memory Based)

Time Allowed :2 Hour	Maximum Marks :30	Total Questions :16
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General Instructions

Read the following instructions very carefully and strictly follow them:

- Answers to this Paper must be written on the paper provided separately.
- You will not be allowed to write during the first 15 minutes
- This time is to be spent in reading the question paper.
- The time given at the head of this Paper is the time allowed for writing the answers,
- The paper has four Sections.
- Section A is compulsory - All questions in Section A must be answered.
- You must attempt one question from each of the Sections B, C and D and one other question from any Section of your choice.

1. Define Parthenocarpy and give one example of a fruit that develops this way.

Solution:

Concept: Parthenocarpy is a biological phenomenon related to fruit development without fertilization.

Definition: Parthenocarpy refers to the development of fruit without fertilization of the ovule. As a result, the fruit formed is usually seedless.

Key Features:

- No fertilization occurs
- Ovary develops into fruit directly
- Produces seedless fruits

Example:

- Banana (common natural example)
- Seedless grapes (commercial example)

Importance:

- Improves fruit quality

- Preferred in commercial horticulture
- Can be induced artificially using plant hormones

% Quick Tip

Quick Tip

Parthenocarpy = “Fruit without fertilization”

- Seedless fruit
- Banana is the classic example
- Often induced by auxins or gibberellins

2. What is the function of the Tapetum in the Microsporangium?

Solution:

Concept: The tapetum is the innermost layer of the microsporangium (anther) wall and plays a vital role in pollen development.

Function of Tapetum:

1. **Nourishment of Developing Microspores:** Provides essential nutrients and metabolites required for the growth and maturation of pollen grains.
2. **Formation of Pollen Wall:** Secretes sporopollenin precursors that help in the formation of the exine (outer layer) of pollen.
3. **Production of Enzymes and Proteins:** Synthesizes enzymes and proteins that regulate pollen development.
4. **Secretion of Pollenkitt:** Produces sticky substances (pollenkitt) that help pollen adhere to pollinators.

Importance:

- Essential for viable pollen formation
- Abnormal tapetum leads to male sterility

% Quick Tip

Quick Tip

Tapetum = “Nurse layer of anther”

- Feeds developing pollen
- Helps form pollen wall (sporopollenin)
- Critical for pollen viability

3. What are Okazaki fragments and in which process are they formed?

Solution:

Concept: Okazaki fragments are short DNA segments formed during DNA replication.

Definition: Okazaki fragments are short, newly synthesized DNA fragments produced discontinuously on the lagging strand during DNA replication.

Process in Which They Are Formed: They are formed during:

DNA Replication

Specifically on the **lagging strand**.

Reason for Formation:

- DNA polymerase can synthesize DNA only in the 5' → 3' direction.
- The lagging strand runs in the opposite direction.
- Hence, DNA is synthesized discontinuously in small fragments.

Formation Steps:

1. RNA primer is laid down.
2. DNA polymerase extends the fragment.
3. Multiple short fragments are formed.
4. DNA ligase joins them into a continuous strand.

Key Enzymes Involved:

- DNA polymerase
- Primase
- DNA ligase

% Quick Tip

Quick Tip

Okazaki fragments = Lagging strand fragments

- Found only in DNA replication
- Discontinuous synthesis
- Joined by DNA ligase

Leading strand = continuous, Lagging strand = fragmented.

4. Define Point Mutation with the example of Sickle Cell Anemia.

Solution:

Concept: Mutations are changes in the DNA sequence. A point mutation is the simplest type of mutation involving a single nucleotide change.

Definition: A point mutation is a genetic mutation in which a single nucleotide base is altered, inserted, or deleted in the DNA sequence.

Most commonly, it involves substitution of one base for another.

Example: Sickle Cell Anemia

Sickle cell anemia is a classic example of a point mutation affecting hemoglobin.

Cause:

- Mutation occurs in the gene encoding the β -chain of hemoglobin.
- A single base substitution changes the codon.

Molecular Change:

Normal codon: GAG \rightarrow Glutamic acid

Mutated codon: GTG \rightarrow Valine

This substitution changes one amino acid in the hemoglobin protein.

Effect:

- Hemoglobin becomes abnormal (HbS).
- RBCs become sickle-shaped under low oxygen conditions.
- Leads to anemia, pain, and reduced oxygen transport.

Significance:

- Demonstrates how a single nucleotide change can cause a major disorder.
- Example of a missense mutation.

% Quick Tip

Quick Tip

Point mutation = Single base change

- Sickle cell: GAG \rightarrow GTG
- Glutamic acid \rightarrow Valine
- One base change, big impact

Remember: Small mutation, serious disease.

5. Define Biopiracy with reference to Basmati rice.

Solution:

Concept: Biopiracy refers to the unethical or illegal use of biological resources and traditional knowledge without proper permission or compensation.

Definition: Biopiracy is the unauthorized exploitation of biological materials (plants, animals, microbes) and indigenous knowledge by individuals or corporations for commercial gain without sharing benefits with the original owners or communities.

Example: Basmati Rice Case

Basmati rice is a traditional aromatic rice variety grown mainly in India and Pakistan for centuries.

What Happened?

- A foreign company attempted to patent certain varieties of Basmati rice and related processing methods.
- The patent claimed rights over lines derived from traditional Indian Basmati.
- This raised concerns about ownership of indigenous genetic resources.

Why It Was Considered Biopiracy:

- Traditional knowledge of farmers was used without consent.
- No benefit-sharing with original cultivators.
- Attempt to monopolize a culturally significant crop.

Outcome:

- Legal challenges were raised by India.
- Several patent claims were withdrawn or rejected.
- Highlighted need for protection of biodiversity and traditional knowledge.

Importance:

- Promotes awareness of intellectual property rights in biodiversity.
- Supports laws like Biodiversity Act and Geographical Indications (GI).

% Quick Tip

Quick Tip

Biopiracy = Stealing bio-resources + traditional knowledge

- No permission
- No benefit sharing
- Example: Basmati patent controversy

Protect biodiversity through GI tags and laws.

6. Explain the "Lock and Key" mechanism of enzyme action or the Central Dogma of molecular biology.

Solution:

(A) Lock and Key Mechanism of Enzyme Action:

Concept: The lock and key model explains how enzymes interact specifically with substrates to catalyze biochemical reactions.

Explanation:

- Proposed by Emil Fischer.
- The enzyme has a specific active site.
- The substrate fits exactly into this active site like a key fits into a lock.

Steps:

1. Substrate binds to enzyme's active site.
2. Enzyme-substrate complex is formed.
3. Reaction occurs and products are formed.
4. Products are released; enzyme remains unchanged.

Key Features:

- High specificity
- Enzyme not consumed in reaction
- Explains substrate selectivity

(OR)

(B) Central Dogma of Molecular Biology:

Concept: The central dogma explains the flow of genetic information in living organisms.

Statement:



Steps:**1. Replication:**

- DNA makes an identical copy of itself.
- Ensures genetic continuity.

2. Transcription:

- DNA is transcribed into messenger RNA (mRNA).
- Occurs in nucleus (eukaryotes).

3. Translation:

- mRNA is translated into protein at ribosomes.
- Amino acids are assembled into polypeptide chains.

Importance:

- Explains gene expression
- Basis of molecular genetics
- Foundation of biotechnology

% Quick Tip

Quick Tip

Two memory aids:

- Lock and Key = Enzyme specificity
- Central Dogma = DNA → RNA → Protein

Structure determines function in biology.

7. Describe the In-situ and Ex-situ methods of biodiversity conservation.**Solution:**

Concept: Biodiversity conservation involves protecting species, ecosystems, and genetic diversity. It is mainly achieved through two approaches: In-situ and Ex-situ conservation.

1. In-situ Conservation:

Definition: Conservation of species in their natural habitats or ecosystems.

Features:

- Protects entire ecosystems
- Maintains natural evolutionary processes
- Conserves flora and fauna together

Methods/Examples:

- National parks
- Wildlife sanctuaries
- Biosphere reserves
- Sacred groves

Advantages:

- Maintains ecological balance
- Allows natural adaptation and evolution

2. Ex-situ Conservation:

Definition: Conservation of biodiversity outside its natural habitat under controlled conditions.

Features:

- Artificial conservation methods
- Focuses on individual species

Methods/Examples:

- Zoos
- Botanical gardens
- Seed banks
- Tissue culture and cryopreservation

Advantages:

- Useful for endangered species
- Allows scientific management and breeding

Key Differences:

Basis	In-situ	Ex-situ
<i>Location</i>	<i>Naturalhabitat</i>	<i>Outsidenaturalhabitat</i>
<i>Focus</i>	<i>Wholeecosystem</i>	<i>Individualspecies</i>
<i>Examples</i>	<i>Nationalparks</i>	<i>Zoos, seedbanks</i>
<i>NaturalInteraction</i>	<i>Present</i>	<i>Limited</i>

Conclusion: Both methods are complementary. In-situ preserves ecosystems, while Ex-situ provides backup conservation for rare and endangered species.

% Quick Tip

Quick Tip

Conservation memory trick:

- In-situ = In natural site
- Ex-situ = Exit natural site

Nature parks vs Zoos comparison.
