Rajasthan Board Class 12 Biology Question Paper 2026 with Solutions Memory Based

Time Allowed :3 Hours	**Maximum Marks :**30	**Total Questions :**16

General Instructions

1. Answers to this Paper must be written on the paper provided separately.
2. You will not be allowed to write during the first 15 minutes
3. This time is to be spent in reading the question paper.
4. The time given at the head of this Paper is the time allowed for writing the answers,
5. The paper has four Sections.
6. Section A is compulsory - All questions in Section A must be answered.
7. 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.

Correct Answer: Parthenocarpy is the development of a fruit without fertilization of the ovules, resulting in a seedless fruit. A common example is the Banana.

Solution:
Step 1: Understanding the Concept:
In most angiosperms, fruit development follows the process of fertilization.
However, some plants can produce fruits without the fusion of male and female gametes.
This biological phenomenon is termed "Parthenocarpy".

Step 2: Detailed Explanation:
Parthenocarpy can occur naturally due to genetic factors or can be induced artificially.
Artificial induction involves the application of plant growth regulators like Auxins or Gibberellins to unpollinated flowers.
Since no fertilization occurs, the ovules do not develop into seeds, making these fruits "seedless".
This trait is commercially desirable for fruits that are easier to eat or process.

Step 3: Final Answer:
Parthenocarpy is defined as the production of fruit from an unfertilized ovary.
Examples include Banana, Seedless Grapes, and Pineapple.

Quick Tip

Do not confuse "Parthenocarpy" with "Apomixis". Parthenocarpy produces seedless fruits, while Apomixis produces seeds without fertilization (asexual seed formation).

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

Correct Answer: The primary function of the tapetum is to provide nutrition to the developing pollen grains (microspores) and contribute to the formation of the pollen wall.

Solution:
Step 1: Understanding the Concept:
The microsporangium is the structure within the anther where pollen is produced.
It is surrounded by four wall layers: Epidermis, Endothecium, Middle layers, and the Tapetum.
The Tapetum is the innermost layer and consists of cells with dense cytoplasm and often more than one nucleus.

Step 2: Detailed Explanation:
1. **Nutritional Support:** The tapetum absorbs nutrients from the outer layers and passes them to the sporogenous tissue and developing microspores.
2. **Sporopollenin Secretion:** It secretes Ubisch bodies containing sporopollenin, which forms the highly resistant exine layer of the pollen grain.
3. **Enzymatic Action:** It secretes the enzyme 'callase' to break down the callose wall holding the microspore tetrad together.
4. **Pollenkit:** In entomophilous (insect-pollinated) plants, it produces a sticky, lipid-rich layer called pollenkit on the pollen surface.

Step 3: Final Answer:
The Tapetum is a specialized nutritive layer that supports the development, wall formation, and maturation of microspores into functional pollen grains.

Quick Tip

Tapetal cells are often polyploid (having more than two sets of chromosomes) because they undergo DNA replication and nuclear division without subsequent cell division (endomitosis).

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

Correct Answer: Okazaki fragments are short, newly synthesized DNA segments formed on

the lagging strand during DNA replication.

Solution:
Step 1: Understanding the Concept:
DNA polymerase can only synthesize DNA in the $5' \to 3'$ direction.
Because the two strands of the DNA double helix are antiparallel, they present a challenge during the unwinding of the replication fork.

Step 2: Detailed Explanation:
On the template strand with $3' \to 5'$ polarity (leading strand), synthesis is continuous towards the replication fork.
On the template strand with $5' \to 3'$ polarity (lagging strand), synthesis must occur in small segments moving away from the fork.
These segments are called Okazaki fragments.
Each fragment requires its own RNA primer to initiate synthesis.
Later, these fragments are joined together by the enzyme DNA ligase to form a complete, continuous strand.

Step 3: Final Answer:
Okazaki fragments are discontinuous pieces of DNA synthesized on the lagging strand.
The process in which they are formed is **DNA Replication**.

Quick Tip

Think of DNA replication like a highway: the Leading strand is the fast lane (continuous), while the Lagging strand is like a road with many stop-and-go points (Okazaki fragments).

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

Correct Answer: A point mutation is a change in a single base pair of DNA. In Sickle Cell Anemia, a substitution occurs in the gene coding for the beta-globin chain of hemoglobin.

Solution:
Step 1: Understanding the Concept:
Mutation refers to a sudden heritable change in the DNA sequence.
When the change is limited to only one nucleotide or one base pair, it is called a point mutation.

Step 2: Detailed Explanation:
In Sickle Cell Anemia, a single base substitution happens in the DNA sequence for the β-globin chain.
The codon GAG (which codes for Glutamic acid) changes to GUG (which codes for Valine) at

the 6^{th} position.
DNA level change: CTC (normal) $\rightarrow$ CAC (mutated).
mRNA level change: GAG (normal) $\rightarrow$ GUG (mutated).
This substitution causes the hemoglobin to polymerize under low oxygen conditions, distorting the Red Blood Cell into a sickle shape.

Step 3: Final Answer:
Point Mutation is a single nucleotide polymorphism.
Example: Sickle Cell Anemia involves the replacement of Glutamic Acid by Valine at the 6^{th} position of the β-globin chain due to a single base change.

Quick Tip

Points to remember: GAG codes for GLU (Glutamic acid), and GUG codes for VAL (Valine). This small change causes a life-threatening systemic disease.

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5. Define Biopiracy with reference to Basmati rice.

Correct Answer: Biopiracy is the exploitation of biological resources and traditional knowledge of a country by organizations or multinational companies without proper authorization or compensation.

Solution:
Step 1: Understanding the Concept:
Biological resources like plants, animals, and microbes are often part of a nation's indigenous heritage.
Biopiracy occurs when foreign entities patent these resources or related traditional knowledge without acknowledging the source country.

Step 2: Detailed Explanation:
Basmati rice is a distinct variety known for its unique aroma and flavor, traditionally grown in India and Pakistan for centuries.
In 1997, a US-based company (RiceTec) was granted a patent on Basmati rice by the US Patent and Trademark Office.
This patent claimed "new" varieties of Basmati, which were actually derived from Indian farmer's varieties crossed with semi-dwarf varieties.
This allowed the company to sell "Basmati" globally, potentially restricting Indian exports and claiming ownership over a product that wasn't theirs to begin with.

Step 3: Final Answer:
Biopiracy is the unauthorized commercialization of bio-resources.
In the Basmati case, it involved an American company patenting a traditional Indian rice va-

riety to gain exclusive marketing rights.

Quick Tip

India successfully challenged several biopiracy cases, including those involving Neem, Turmeric, and Basmati, highlighting the importance of protecting traditional knowledge.

6(a). Explain the "Lock and Key" mechanism of enzyme action.

Correct Answer: The "Lock and Key" model proposes that an enzyme acts as a lock and the substrate acts as a specific key that fits perfectly into the enzyme's active site.

Solution:
Step 1: Understanding the Concept:
Enzymes are highly specific biological catalysts.
Emil Fischer proposed the Lock and Key hypothesis in 1894 to explain this specificity.

Step 2: Detailed Explanation:
1. **Specificity:** Each enzyme has a specifically shaped region called the "active site".
2. **Binding:** The substrate has a complementary shape to the active site. Only the correct substrate (the "key") can fit into the active site (the "lock").
3. **Formation of ES Complex:** When the substrate binds, it forms an Enzyme-Substrate (ES) complex.

$$\text{Enzyme (E)} + \text{Substrate (S)} \rightarrow \text{ES Complex}$$

4. **Product Formation:** The chemical reaction occurs, converting the substrate into products.
5. **Release:** The products are released, and the enzyme remains unchanged, ready for the next reaction.

Step 3: Final Answer:
The Lock and Key mechanism explains enzyme specificity by assuming that the active site is a rigid structure that only accepts a substrate with a perfectly matching geometry.

Quick Tip

Remember that while the Lock and Key model explains specificity, the "Induced Fit" model is more accurate for most enzymes as it accounts for the flexibility of the active site.

6(b). Explain the Central Dogma of molecular biology.

Correct Answer: The Central Dogma is the fundamental principle describing the unidirectional flow of genetic information from DNA to RNA to Protein.

Solution:
Step 1: Understanding the Concept:
Proposed by Francis Crick in 1957, the Central Dogma explains how the "code of life" stored in DNA is translated into functional proteins.

Step 2: Detailed Explanation:
The flow of information involves three main processes:
1. **Replication:** DNA makes a copy of itself.

$$\text{DNA} \rightarrow \text{DNA}$$

2. **Transcription:** The information in DNA is copied into messenger RNA (mRNA).

$$\text{DNA} \rightarrow \text{mRNA}$$

3. **Translation:** The mRNA sequence is decoded by ribosomes to build a protein (polypeptide chain).

$$\text{mRNA} \rightarrow \text{Protein}$$

In some viruses, "Reverse Transcription" occurs where information flows from RNA back to DNA.

Step 3: Final Answer:
The Central Dogma states: $\text{DNA} \xrightarrow{\text{Transcription}} \text{mRNA} \xrightarrow{\text{Translation}} \text{Protein}$.

Quick Tip

If asked about exceptions to the Central Dogma, mention Retroviruses (like HIV) which use the enzyme Reverse Transcriptase to synthesize DNA from an RNA template.

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

Correct Answer: In-situ conservation is the protection of species within their natural habitat, whereas Ex-situ conservation is the protection of species outside their natural habitat.

Solution:
Step 1: Understanding the Concept:
Biodiversity conservation strategies are categorized based on whether the organisms are protected in their environment or moved to a specialized facility.

Step 2: Detailed Explanation:
In-situ (On-site) Conservation:
- This involves protecting the entire ecosystem so that all species within it are preserved.
- It is cost-effective and allows for natural evolution.
- **Examples:** National Parks, Wildlife Sanctuaries, Biosphere Reserves, and Sacred Groves.

Ex-situ (Off-site) Conservation:
- This involves moving threatened species to a safe, controlled environment under human supervision.
- It is essential for species whose numbers have declined to critically low levels.
- **Examples:** Zoological Parks (Zoos), Botanical Gardens, Seed Banks, and Cryopreservation (freezing embryos/gametes).

Step 3: Final Answer:
In-situ conservation focuses on protecting the "home" of the species, while Ex-situ focuses on providing a "hospital" or "bank" for the species to prevent extinction.

Quick Tip

"In-situ" literally means "in place," and "Ex-situ" means "out of place." Use this to remember the difference easily!

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8. Explain the DNA Double Helix structure as proposed by Watson and Crick.

Correct Answer: The DNA double helix is a structure composed of two polynucleotide strands coiling around a common axis, held together by hydrogen bonds between nitrogenous bases.

Solution:
Step 1: Understanding the Concept:
In 1953, James Watson and Francis Crick described the B-DNA model.
Their model was based on X-ray crystallography data from Rosalind Franklin and Maurice Wilkins.

Step 2: Detailed Explanation:
1. **Two Strands:** DNA consists of two long chains of nucleotides.
2. **Sugar-Phosphate Backbone:** The "sides" of the ladder are made of alternating deoxyribose sugar and phosphate groups.
3. **Antiparallel Orientation:** One strand runs in the $5' \to 3'$ direction, while the other runs $3' \to 5'$.
4. **Base Pairing:** Nitrogenous bases are linked via Hydrogen bonds. Adenine (A) pairs with Thymine (T) by two bonds ($A = T$); Guanine (G) pairs with Cytosine (C) by three bonds ($G \equiv C$).
5. **Helix Dimensions:** The helix is right-handed. The pitch (one full turn) is 3.4 nm, containing roughly 10 base pairs. The distance between base pairs is 0.34 nm.
6. **Width:** The diameter of the helix is constant at 2 nm because a purine always pairs with a pyrimidine.

Step 3: Final Answer:
The Watson-Crick model established that DNA is an antiparallel double helix stabilized by complementary base pairing and stacking forces.

Quick Tip

Always mention the hydrogen bond count (2 for A-T, 3 for G-C) as it explains why G-C rich DNA is more stable and has a higher melting point.
