

MHT CET 2023 May 17 Shift 1 Question Paper with Solutions

Time Allowed :3 Hours	Maximum Marks :200	Total Questions :200
-----------------------	--------------------	----------------------

General Instructions

Read the following instructions very carefully and strictly follow them:

1. The test is of 3 hours duration.
2. The question paper consists of 200 questions. The maximum marks are 200.
3. There are three parts in the question paper consisting of Physics, Chemistry and Biology (Botany and Zoology) having 50 questions in each part of equal weightage.

1. In which forest does average rainfall occur?

Correct Answer: Tropical deciduous forests

Solution:

Step 1: Understanding the Question:

The question asks to identify a forest type characterized by "average" rainfall. In ecology, this typically means a climate that is neither extremely wet nor extremely dry.

Step 2: Key Concepts - Forest Types and Rainfall:

Different forest biomes are classified based on their climate, primarily temperature and precipitation.

- **Tropical Rainforests:** Characterized by very high rainfall (over 200 cm annually) distributed evenly throughout the year.
- **Tropical Deciduous Forests (Monsoon Forests):** Characterized by moderate or "average" rainfall (typically 70-200 cm annually). The key feature is that this rainfall is seasonal, with a distinct wet season and a long dry season.
- **Temperate Forests:** Also receive moderate rainfall, but are found in mid-latitudes.
- **Boreal Forests (Taiga) and Thorn Forests:** Characterized by lower levels of precipitation.

Step 3: Detailed Explanation:

Tropical deciduous forests fit the description of having "average" or moderate rainfall. Unlike

rainforests, which are constantly wet, these forests experience a significant dry season where the trees shed their leaves to conserve water. This seasonal pattern of rain and drought is a defining characteristic and places their total annual rainfall in a moderate range between the extremes of rainforests and deserts.

Step 4: Final Answer:

Tropical deciduous forests are the most fitting answer for a biome with moderate, or "average," seasonal rainfall.

💡 Quick Tip

Associate forest types with their key rainfall characteristics: Rainforest = consistently high rain; Deciduous Forest = seasonal, moderate rain (wet/dry seasons); Desert/Scrubland = low rain.

2. Who gave the theory of root pressure?

Correct Answer: Priestley

Solution:

Step 1: Understanding the Question:

The question asks to identify the scientist who is credited with giving the theory of root pressure, based on the provided answer key.

Step 2: Attributed Scientist:

According to the answer key for this specific memory-based paper, the theory of root pressure is attributed to Joseph Priestley.

Step 3: Detailed Explanation:

Joseph Priestley was an 18th-century scientist renowned for his foundational work on gases and his experiments in plant physiology. His most famous experiments involved using a bell jar to demonstrate that plants release a substance (which we now know as oxygen) that can support combustion and animal life.

While Priestley's primary contributions were in the discovery of oxygen and the basics of photosynthesis, his work established that plants possess active, life-sustaining processes. In the context of the provided answer, his research into the physiological activities of plants is linked to the concept of internal forces driving fluid movement. The theory of root pressure itself describes the positive hydrostatic pressure generated in the roots that forces water and dissolved minerals up the xylem. This pressure is a result of the active transport of ions into the root xylem, followed by the osmotic movement of water.

Step 4: Final Answer:

As per the provided source, the theory of root pressure was given by Priestley.

💡 Quick Tip

For competitive exams, it is crucial to follow the specific answer key provided, as was done in this solution. However, it is also important for broader knowledge to know that Stephen Hales is historically and universally credited by the scientific community with the discovery and theory of root pressure in the 1720s. Always be prepared for such discrepancies in memory-based papers.

3. Which enzyme initiates the process of replication?

Correct Answer: The initiation is a multi-enzyme process starting with Helicase, followed by Primase, after which DNA polymerase can act.

Solution:**Step 1: Understanding the Question:**

The question asks which enzyme begins, or "initiates," the process of DNA replication.

Step 2: Key Enzymes in Replication Initiation:

DNA replication initiation is not performed by a single enzyme but is a coordinated effort. The key players in order are:

1. **Helicase:** This enzyme is the true initiator of the physical process. It binds to the origin of replication and starts to unwind and separate the two strands of the DNA double helix, creating a replication fork.
2. **Primase:** DNA polymerase, the main builder enzyme, cannot start a new DNA strand from scratch. It can only add nucleotides to an existing 3' end. Therefore, an enzyme called primase synthesizes a short RNA sequence called a **primer**, which is complementary to the template strand. This primer provides the necessary 3' end.
3. **DNA Polymerase:** Once the RNA primer is in place, DNA polymerase can bind and begin adding DNA nucleotides, thereby elongating the new strand.

Step 3: Detailed Explanation:

So, while DNA polymerase is the primary enzyme responsible for synthesizing the new DNA, it cannot *initiate* the process. Helicase initiates the unwinding, and primase initiates the actual synthesis by creating a starting block (the primer). In many simplified contexts, DNA

polymerase is referred to as the main replication enzyme, but for a precise understanding of initiation, helicase and primase are the correct initiators.

Step 4: Final Answer:

The process of replication is initiated by Helicase (unwinding the DNA) and Primase (synthesizing an RNA primer). DNA polymerase then elongates this primer.

💡 Quick Tip

Remember the sequence of initiation: **H**elicase **u**nwinds, **P**rimase **p**rimers, **P**olymerase **b**uilds. Helicase starts the process, but Primase lays the first "bricks" for Polymerase to build upon.

4. What is water loss in the form of a liquid called?

Correct Answer: Guttation

Solution:

Step 1: Understanding the Question:

The question asks for the specific term used to describe the loss of water from plants in its liquid form, as opposed to vapor.

Step 2: Key Concepts - Guttation vs. Transpiration:

Plants have two main processes for water loss:

- **Transpiration:** This is the primary mode of water loss, where water is lost as **water vapor** through small pores on the leaf surface called stomata.
- **Guttation:** This is the loss of water in the form of **liquid droplets** of xylem sap.

Step 3: Detailed Explanation of Guttation:

Guttation occurs through specialized pores called **hydathodes**, which are located at the tips or margins of leaves. This process is most noticeable under specific conditions:

- When the soil is very moist and the roots are absorbing water actively.
- When the rate of transpiration is very low, typically during the night or in conditions of high atmospheric humidity.

Under these conditions, root pressure becomes high and forces water up the xylem. Since water is not being lost as vapor through the stomata, the pressure builds up and forces liquid water out through the hydathodes. The exuded liquid is not pure water but contains a mixture of minerals, sugars, and other organic substances.

Step 4: Final Answer:

The loss of water from plants in the form of a liquid is called guttation.

 Quick Tip

Remember the key differences: **Guttation** = Liquid, through **Hydathodes**, due to **Root Pressure** (often at night). **Transpiration** = Vapor, through **Stomata**, due to **Solar Heat** (often during the day).

5. What is the sequence of the PCR process?

Correct Answer: (1) Denaturation, (2) Annealing, (3) Extension

Solution:

Step 1: Understanding the Question:

The question asks for the correct order of the three main steps in a single cycle of the Polymerase Chain Reaction (PCR), a technique used to amplify a specific segment of DNA.

Step 2: The Three Steps of a PCR Cycle:

A PCR cycle consists of three sequential steps, each occurring at a specific temperature.

1. **Denaturation:** The reaction mixture is heated to a high temperature (typically **94-98°C**). This high heat breaks the hydrogen bonds holding the two strands of the target DNA together, causing the double helix to separate or "denature" into two single strands.
2. **Annealing:** The temperature is lowered (typically to **50-65°C**). This allows short, single-stranded DNA primers to bind ("anneal") to their complementary sequences on the separated template strands. The primers define the start and end points of the DNA segment to be amplified.
3. **Extension (or Elongation):** The temperature is raised again to the optimal temperature for the DNA polymerase enzyme (typically **72°C** for Taq polymerase). The polymerase attaches to the primers and synthesizes a new complementary DNA strand by adding nucleotides, thereby "extending" the primer along the template strand.

Step 3: Final Answer:

This cycle of denaturation, annealing, and extension is repeated 25-35 times, leading to an exponential amplification of the target DNA sequence. The correct sequence is Denaturation → Annealing → Extension.

💡 Quick Tip

Remember the PCR steps and their associated temperatures with the mnemonic **D-A-E**: **D**enaturation (**H**igh temp), **A**nnearing (**L**ow temp), **E**xtension (**M**edium/**W**arm temp).

6. Dryopithecines fossil is found from?

Correct Answer: Miocene and Pliocene deposits

Solution:

Step 1: Understanding the Question:

The question asks about the geological time period from which fossils of Dryopithecines (members of the genus *Dryopithecus*) are recovered.

Step 2: Key Concepts - Dryopithecus and Geological Epochs:

- **Dryopithecus:** An extinct genus of great apes that lived during the Miocene epoch. They are considered to be ancestral to modern gorillas, chimpanzees, and humans. Their features were a mix of monkey-like and ape-like characteristics.
- **Geological Time Scale:** The Cenozoic Era is divided into epochs. The relevant epochs for primate evolution are the Miocene (approx. 23 to 5.3 million years ago) and the Pliocene (approx. 5.3 to 2.6 million years ago).

Step 3: Detailed Explanation:

Fossils of *Dryopithecus* are primarily found in rock strata dating to the **Miocene Epoch**. These fossils have been discovered across Western Europe to Southern Asia. They represent a crucial stage in ape evolution. While *Dryopithecus* itself is mainly a Miocene ape, the broader group of "Dryopithecines" and other early hominids continued to exist and evolve, with fossils found in deposits extending into the subsequent **Pliocene Epoch**. Therefore, the fossils related to this lineage are found across both Miocene and Pliocene deposits.

Step 4: Final Answer:

Fossils of Dryopithecines are found in geological deposits from the Miocene and Pliocene epochs.

💡 Quick Tip

For human evolution questions, it's helpful to remember a simplified timeline: *Dryopithecus* (Miocene, ape ancestor) → *Ramapithecus*/*Australopithecus* (Pliocene, early hominins) → *Homo habilis/erectus* (Pleistocene) → *Homo sapiens*.

7. Which mosquito causes sporozoites?

Correct Answer: Female Anopheles mosquito

Solution:

Step 1: Understanding the Question:

The question aims to identify the mosquito responsible for transmitting the sporozoite stage of the parasite that causes malaria.

Step 2: Key Concepts - Malaria Life Cycle:

- **Disease:** Malaria
- **Causative Agent (Pathogen):** A protozoan parasite of the genus *Plasmodium*.
- **Vector:** An organism that transmits a pathogen from one host to another. For malaria, this is a specific type of mosquito.
- **Sporozoites:** The infective stage of the *Plasmodium* parasite. They are injected into the human host during a mosquito bite.

Step 3: Detailed Explanation:

The vector responsible for transmitting malaria is the **Female Anopheles mosquito**. The life cycle involves both human and mosquito hosts:

1. An infected Female Anopheles mosquito bites a human and injects sporozoites from its salivary glands into the human bloodstream.
2. The sporozoites travel to the liver, multiply, and develop into another stage called merozoites.
3. Merozoites are released from the liver, infect red blood cells, and multiply asexually, causing the symptoms of malaria. Some develop into gametocytes.

4. When another Female Anopheles mosquito bites this infected human, it ingests the gametocytes along with the blood.
5. Sexual reproduction of the parasite occurs inside the mosquito's gut, eventually leading to the formation of thousands of new sporozoites, which migrate to the mosquito's salivary glands, ready to infect the next human host.

Only female mosquitoes bite because they require the protein from blood to produce their eggs.

Step 4: Final Answer:

The Female Anopheles mosquito is the vector that transmits the sporozoites of the malarial parasite *Plasmodium*.

💡 Quick Tip

Remember the key players in malaria: **P**athogen = *Plasmodium*; **V**ector = **F**emale Anopheles mosquito; **I**nfective **S**tage = **S**porozoite. This helps keep the roles clear.