# MHT CET 2023 May 15 Shift 2 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. Which nitrogen base is not present in RNA?**

**Correct Answer:** Thymine

**Solution:**

**Step 1: Understanding the Question:**
The question asks to identify the nitrogenous base that is found in DNA but not in RNA.

**Step 2: Detailed Explanation:**
Nucleic acids, DNA (Deoxyribonucleic acid) and RNA (Ribonucleic acid), are made of nucleotides.
Each nucleotide consists of a sugar, a phosphate group, and a nitrogenous base.
There are two types of nitrogenous bases: Purines (Adenine and Guanine) and Pyrimidines (Cytosine, Thymine, and Uracil).
DNA contains Adenine (A), Guanine (G), Cytosine (C), and Thymine (T).
RNA contains Adenine (A), Guanine (G), Cytosine (C), and Uracil (U).
In RNA, Uracil (U) replaces Thymine (T). Uracil is structurally similar to thymine but lacks a methyl group.
Therefore, Thymine is the nitrogenous base that is not present in RNA.

**Step 3: Final Answer:**
Based on the composition of nucleic acids, Thymine (T) is present in DNA but absent in RNA, where it is replaced by Uracil (U). Thus, option (D) is the correct answer.

Quick Tip

To easily remember the difference, associate 'U' with RNA. A simple mnemonic is: "RNA has U". In DNA, Adenine (A) pairs with Thymine (T), while in RNA, Adenine (A) pairs with Uracil (U).

**2. In angiosperms anther are mostly?**

**Correct Answer:** Dithecous and bilobed

**Solution:**

**Step 1: Understanding the Question:**
The question asks for the most common structural characteristic of anthers in angiosperms (flowering plants).

**Step 2: Detailed Explanation:**
The anther is the male reproductive part of a flower, which is part of the stamen (Stamen = Anther + Filament).
Its primary function is to produce and store pollen grains.
A typical angiosperm anther has two lobes, hence it is described as **bilobed**.
Each lobe contains two thecae (chambers), so the anther is described as **dithecous**.
Each theca contains a microsporangium, meaning a dithecous anther is tetrasporangiate (contains four microsporangia).
Inside these microsporangia, meiosis occurs to produce microspores, which develop into pollen grains.
Therefore, the most common structure for an anther in angiosperms is dithecous and bilobed.

**Step 3: Final Answer:**
The typical anther in angiosperms is characterized by having two lobes and two thecae per lobe. This structure is correctly described as dithecous and bilobed. Thus, option (B) is correct.

Quick Tip

Visualize the cross-section of a typical anther, which often looks like a butterfly shape with four circular sacs (microsporangia). This image helps reinforce the concepts of 'bilobed' (two main halves) and 'dithecous' (two chambers per lobe).

**3. If a gene controls two or more traits, it is an example of?**

**Correct Answer:** Pleiotropy

**Solution:**

**Step 1: Understanding the Question:**
The question describes a genetic scenario where a single gene influences multiple, seemingly unrelated phenotypic traits and asks for the correct term for this phenomenon.

**Step 2: Detailed Explanation:**
**Pleiotropy** is the condition where one gene influences two or more distinct phenotypic traits. A mutation in a pleiotropic gene can have effects on various aspects of an organism's phenotype. For example, the genetic disorder Phenylketonuria (PKU) is caused by a mutation in a single gene that codes for the enzyme phenylalanine hydroxylase. This single gene defect leads to multiple symptoms, including mental retardation, reduced hair and skin pigmentation.
This is different from **Polygenic inheritance**, where multiple genes collectively influence a single trait (e.g., skin color, height).
**Co-dominance** is when both alleles in a heterozygote are fully expressed.
**Multiple allelism** is when a gene has more than two alleles in a population.

**Step 3: Final Answer:**
The phenomenon where a single gene controls multiple traits is known as pleiotropy. Therefore, option (B) is the correct answer.

Quick Tip

To avoid confusion, remember:
**Pleio**tropy → One gene → **Plu**ral effects.
**Poly**genic → **Poly** (many) genes → One trait.

---

**4. After fertilization which hormone helps ovary to become fruit?**

**Correct Answer:** Auxin

**Solution:**

**Step 1: Understanding the Question:**
The question asks to identify the primary plant hormone responsible for stimulating the development of the ovary into a fruit after fertilization has occurred.

**Step 2: Detailed Explanation:**
After successful fertilization, the developing seeds and embryo produce plant hormones.
**Auxin** is the key hormone that initiates fruit development. It is produced in the developing embryo and seeds.
This auxin is transported to the ovary wall, stimulating cell division and enlargement, a process known as fruit set. This causes the ovary to grow and mature into a fruit.
While other hormones like gibberellins and cytokinins also play roles in fruit growth and maturation, auxin is the primary trigger for the ovary to begin its transformation into a fruit post-fertilization.
Ethylene is primarily associated with fruit ripening, and abscisic acid is generally an inhibitory hormone.

**Step 3: Final Answer:**
Auxin is the principal hormone that promotes the development of the ovary into a fruit following fertilization. Therefore, option (D) is correct.

Quick Tip

Associate **Auxin** with **growth initiation**. It is responsible for apical dominance, root initiation, and importantly, initiating fruit development. Think of it as the "get growing" signal for the ovary.

---

**5. The term genome was introduced by?**

**Correct Answer:** Hans Winkler

**Solution:**

**Step 1: Understanding the Question:**
This is a knowledge-based question asking for the name of the scientist who coined the term "genome".

**Step 2: Detailed Explanation:**
The term "genome" was coined in 1920 by **Dr. Hans Winkler**, a German botanist at the University of Hamburg.
He created the term as a portmanteau of the words **gen**e and chromos**ome**.
Winkler proposed the term to describe the complete set of chromosomes and their contained genes in a haploid cell of an organism.
Today, the definition has been refined to mean the complete set of genetic material (DNA or RNA in viruses) of an organism.

**Step 3: Final Answer:**
The term "genome" was introduced by Hans Winkler in 1920. Hence, option (C) is the correct answer.

Quick Tip

For questions related to scientific discoveries and terminology, creating flashcards with the term, scientist's name, and year can be an effective memorization technique for exams.

---

**6. Which part of the brain does not have its own source of ventricle?**

**Correct Answer:** Cerebral cortex

**Solution:**

**Step 1: Understanding the Question:**
The question asks to identify the part of the brain that does not contain a ventricle, which is a fluid-filled space.

**Step 2: Detailed Explanation:**
The ventricles are a communicating network of cavities within the brain that are filled with cerebrospinal fluid (CSF). There are four main ventricles:
- The two **lateral ventricles** are located within the cerebral hemispheres.
- The **third ventricle** is located in the diencephalon, between the thalami.
- The **fourth ventricle** is located between the brainstem (pons and medulla) and the cerebellum.
The **cerebral cortex** is the outermost folded layer of the cerebrum. It is composed of gray matter and is responsible for higher cognitive functions.
While the cerebral hemispheres contain the lateral ventricles deep inside them, the cortex itself is a solid layer of neural tissue and does not contain any ventricles. It is, however, bathed in CSF that circulates from the ventricles.

**Step 3: Final Answer:**
The cerebral cortex is the outer layer of the brain and does not contain any ventricles within its structure. The ventricles are located in deeper regions of the brain. Thus, option (C) is correct.

Quick Tip

Visualize the brain's structure: the cortex is the wrinkled 'surface' or 'crust', while the ventricles are the inner 'chambers' or 'cavities'. The cortex is on the outside, the ventricles are on the inside.

---

**7. Which kidney stone is formed from amino acids?**

**Correct Answer:** Cystine stone

**Solution:**

**Step 1: Understanding the Question:**
The question asks to identify the type of kidney stone that is composed of amino acids. (Note: The original question phrasing "secretes amino acids" is inaccurate; stones are formed from substances, they do not secrete them).

**Step 2: Detailed Explanation:**
Kidney stones are hard deposits made of minerals and salts that form inside the kidneys.

- **Calcium oxalate stones** are the most common type, formed from calcium and oxalate.
- **Uric acid stones** form when urine is too acidic.
- **Struvite stones** are often related to urinary tract infections.
- **Cystine stones** are rare and form in people with a hereditary disorder called "cystinuria". This genetic condition causes the amino acid cystine to leak from the kidneys into the urine. When there is too much cystine in the urine, it can crystallize and form stones. Cystine is an amino acid.

**Step 3: Final Answer:**
Cystine stones are formed from the amino acid cystine due to a genetic disorder. Therefore, option (D) is the correct answer.

Quick Tip

The name of the stone gives a direct clue to its composition. Remember the connection: **Cystine** stone is made from the amino acid **Cystine**. This makes it easy to identify in an exam.

---

**8. Which is used as a source of ATP during Kreb cycle?**

**Correct Answer:** NADH

**Solution:**

**Step 1: Understanding the Question:**
The question asks what molecule produced during the Krebs cycle serves as a major source for ATP generation. The phrasing is slightly indirect; the Krebs cycle produces high-energy electron carriers which are then used to make ATP.

**Step 2: Detailed Explanation:**
The Krebs cycle (or citric acid cycle) is a central part of aerobic respiration. It does not produce a large amount of ATP directly.
Instead, its primary role is to oxidize acetyl-CoA and generate high-energy electron carriers.
For each turn of the cycle, the main products are:
- 3 molecules of **NADH** (Nicotinamide adenine dinucleotide)
- 1 molecule of **$FADH_2$** (Flavin adenine dinucleotide)
- 1 molecule of **ATP** (or GTP, which is equivalent).

The NADH and $FADH_2$ molecules are crucial because they carry high-energy electrons to the Electron Transport Chain (ETC). In the ETC, the energy from these electrons is used to synthesize a large amount of ATP through a process called oxidative phosphorylation. Each NADH molecule yields approximately 2.5-3 ATPs, and each $FADH_2$ yields about 1.5-2 ATPs.
Therefore, NADH is the major "source" of potential energy from the Krebs cycle that is converted into ATP.

**Step 3: Final Answer:**
NADH, produced in the Krebs cycle, is the primary electron carrier that donates electrons to the ETC to generate the majority of ATP. Hence, it is considered a major source for ATP synthesis. Option (B) is the correct answer.

Quick Tip

Think of the Krebs cycle as a factory that produces 'energy checks' (NADH and $FADH_2$). These checks are then cashed in at the 'bank' (the Electron Transport Chain) to get the final 'currency' (ATP).

---

**9. How many ATP molecules are formed during substrate level phosphorylation from one molecule of glucose in aerobic respiration?**

**Correct Answer:** 6

**Solution:**

**Step 1: Understanding the Question:**
The question asks for the total number of ATP molecules produced directly via substrate-level phosphorylation during the complete aerobic breakdown of one molecule of glucose.

**Step 2: Key Formula or Approach:**
Substrate-level phosphorylation is the direct synthesis of ATP from ADP by transferring a phosphate group from a substrate molecule. We need to sum the ATP produced this way in Glycolysis and the Krebs Cycle.
Total ATP = (ATP from Glycolysis) + (ATP from Krebs Cycle).

**Step 3: Detailed Explanation:**
The breakdown of one glucose molecule involves two main stages where substrate-level phosphorylation occurs:
**1. Glycolysis:**
- In the energy payoff phase, 4 ATP molecules are produced via substrate-level phosphorylation.
- (Note: 2 ATP are consumed in the preparatory phase, so the *net gain* is 2 ATP, but the question asks for the total number *formed*).
- So, 4 ATP are formed in glycolysis.
**2. Krebs Cycle (Citric Acid Cycle):**
- Glycolysis breaks one glucose into two pyruvate molecules. Each pyruvate is converted to acetyl-CoA, which enters the Krebs cycle. Therefore, there are two turns of the Krebs cycle per glucose molecule.
- In each turn of the Krebs cycle, one molecule of GTP (guanosine triphosphate) is formed, which is energetically equivalent to one ATP.
- For two turns of the cycle, 2 GTP (equivalent to 2 ATP) are formed.

**Total Calculation:**
Total ATP formed = (ATP formed in Glycolysis) + (ATP formed in Krebs Cycle)

$$\text{Total ATP} = 4 + 2 = 6$$

**Step 4: Final Answer:**
A total of 6 ATP molecules are formed via substrate-level phosphorylation from one molecule of glucose (4 from glycolysis and 2 from the Krebs cycle). Therefore, option (C) is correct.

Quick Tip

Be careful with the wording. "Net gain" of ATP from glycolysis is 2, but the total "formed" is 4. The question asks for the total formed from the entire process (glycolysis + Krebs cycle), which is 4 + 2 = 6. Distinguish this from oxidative phosphorylation, which produces the majority of ATP (∼28-34).

---

**10. Due to protein deficiency, which disorder is seen in infants?**

**Correct Answer:** Marasmus

**Solution:**

**Step 1: Understanding the Question:**
The question asks to identify the disorder in infants caused by a deficiency of protein. Both Marasmus and Kwashiorkor are forms of Protein-Energy Malnutrition (PEM).

**Step 2: Detailed Explanation:**
**Marasmus** is a severe form of malnutrition caused by a significant deficiency of **all macronutrients: protein, carbohydrates, and fats**. It leads to severe energy deficiency, resulting in extensive wasting of muscle and body fat, leaving the infant looking emaciated or "skin and bones". It includes a severe protein deficiency.
**Kwashiorkor** is a condition that results from inadequate **protein intake with sufficient (or near-sufficient) calorie intake**. A classic symptom is edema (swelling), particularly in the abdomen, feet, and hands.
The question is general ("protein deficiency"). While Kwashiorkor is the classic "protein-only" deficiency disorder, Marasmus is a deficiency of both protein and calories and is also a correct answer in the context of protein deficiency disorders. Given the provided answer key points to Marasmus, it is considered correct. Both are severe conditions seen in infants due to protein malnutrition.
- Scurvy is caused by Vitamin C deficiency.
- Rickets is caused by Vitamin D deficiency.

**Step 3: Final Answer:**
Marasmus is a severe disorder seen in infants caused by a deficiency of protein and calories.

It fits the description of a disorder due to protein deficiency. Thus, option (D) is the correct answer.

Quick Tip

A way to differentiate the two main protein-energy disorders:
- **M**arasmus: Think **M**ajor **M**alnutrition (deficiency of everything). Results in severe wasting.
- **K**washiorkor: Primarily a protein deficiency with adequate calories. Often characterized by edema (swollen belly).

---