MHT CET 2024 28 April Shift 2 Question Paper with Solutions

Time Allowed :3 hours	**Maximum Marks :**200	**Total Questions :**12

General Instructions

Read the following instructions very carefully and strictly follow them:

1. This question booklet contains 150 Multiple Choice Questions (MCQs).
2. Section-A: Physics & Chemistry - 50 Questions each and Section-B: Mathematics - 50 Questions.
3. Choice and sequence for attempting questions will be as per the convenience of the candidate.
4. Read each question carefully.
5. Determine the one correct answer out of the four available options given for each question.
6. Physics and Chemistry have 1 mark for each question, and Maths have 2 marks for every question. There shall be no negative marking.
7. No mark shall be granted for marking two or more answers of the same question, scratching, or overwriting.
8. Duration of the paper is 3 Hours.

Biology

1. Match the following:

Column - I	**Column - II**
1. Stem cutting	a. Blackberry
2. Leaf cutting	b. Rose
3. Root cutting	c. Sansevieria

(A) 1-b, 2-a, 3-c

(B) 1-a, 2-b, 3-c

(C) 1-c, 2-b, 3-a

(D) 1-c, 2-a, 3-b

Correct Answer: 1-b, 2-a, 3-c

Solution:

Step 1: Understanding the types of cuttings used for plant propagation:

- Stem cutting: A method used to propagate plants like blackberry (Column II - a).

- Leaf cutting: A method commonly used for plants like rose (Column II - b).

- Root cutting: A technique used for plants like sansevieria (Column II - c).

Step 2: The correct matches are:

1. Stem cutting $\rightarrow$ Blackberry

2. Leaf cutting $\rightarrow$ Rose

3. Root cutting $\rightarrow$ Sansevieria

Conclusion: The correct answer is $1 - b, 2 - a, 3 - c$.

Quick Tip

Cuttings are an important method of plant propagation. Understanding the appropriate cutting method for different plant types helps ensure successful growth and rooting.

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2. Grapes fruit elongation which hormone is used?

(A) Auxins

(B) Cytokinins

(C) Gibberellins

(D) Ethylene

Correct Answer: (C) Gibberellins

Solution:

Step 1: Gibberellins are plant hormones that play a critical role in promoting growth, including fruit elongation. They are commonly used to increase the size of fruits like grapes.

Step 2: - (A) Auxins promote cell elongation but are primarily involved in root growth and development.

- (B) Cytokinins are involved in cell division and promote shoot formation.

- (D) Ethylene is associated with fruit ripening rather than elongation.

Conclusion: Gibberellins are the hormone responsible for fruit elongation in grapes.

Quick Tip

Gibberellins are essential in promoting cell elongation and are commonly used in agriculture to increase the size and quality of fruits.

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3. _____ is a middle layer of adrenal cortex.

(A) Zona reticularis

(B) Zona glomerulosa

(C) Zona fasciculata

(D) Medulla

Correct Answer: (C) Zona fasciculata

Solution:

Step 1: The adrenal cortex is divided into three layers: - Zona glomerulosa (outermost) produces mineralocorticoids. - Zona fasciculata (middle layer) produces glucocorticoids, such as cortisol. - Zona reticularis (innermost) produces sex hormones.

Step 2: - (A) Zona reticularis produces sex hormones, not glucocorticoids.

- (B) Zona glomerulosa produces mineralocorticoids.

- (D) The medulla is the inner part of the adrenal gland, responsible for producing

catecholamines.

Conclusion: The middle layer of the adrenal cortex is the zona fasciculata.

Quick Tip

The adrenal cortex plays a vital role in producing hormones that regulate metabolism, immune response, and stress adaptation.

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4. What vitamin is produced using Erenothecium ashbyi?

(A) Vitamin A

(B) Vitamin B-12

(C) Vitamin D

(D) Vitamin E

Correct Answer: (B) Vitamin B-12

Solution:

Step 1: Erenothecium ashbyi is a bacterium that can produce vitamin B-12, which is essential for the formation of red blood cells and the maintenance of the nervous system.

Step 2: - (A) Vitamin A is produced from carotenoids in plants, not by Erenothecium ashbyi.

- (C) Vitamin D is synthesized by the body when exposed to sunlight.

- (D) Vitamin E is primarily an antioxidant, not produced by Erenothecium ashbyi.

Conclusion: Erenothecium ashbyi produces vitamin B-12.

Quick Tip

Vitamin B-12 is crucial for red blood cell formation and nerve function. Certain bacteria like Erenothecium ashbyi are involved in its production.

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5. The improved oil content and oil quality of oil crops like soybean oil palm rapeseed and sunflower have been achieved by the transfer of

(A) Genes

(B) Hormones

(C) Enzymes

(D) Microorganisms

Correct Answer: (A) Genes

Solution:

Step 1: The improvement in oil content and quality of crops like soybean, oil palm, rapeseed, and sunflower has been achieved through genetic modification. By transferring specific genes, scientists can enhance the oil-producing capacity of these crops.

Step 2: - (B) Hormones regulate plant growth but do not directly affect oil content.

- (C) Enzymes catalyze biochemical reactions but are not used for transferring oil traits.

- (D) Microorganisms are used in fermentation processes but not for improving oil content in crops.

Conclusion: Genetic transfer of specific genes has led to improvements in oil content and quality.

Quick Tip

Genetic engineering has enabled the development of oil crops with enhanced nutritional value and better oil extraction efficiency.

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6. Human skin colour is an example of

(A) Mendelian Inheritance

(B) Polygenic Inheritance

(C) Incomplete Dominance

(D) Codominance

Correct Answer: (B) Polygenic Inheritance

Solution:

Step 1: Human skin color is determined by multiple genes, with each gene contributing to the final phenotype. This type of inheritance is called polygenic inheritance, where multiple genes influence a single trait.

Step 2:

- (A) Mendelian inheritance involves single-gene traits, such as flower color in pea plants.

- (C) Incomplete dominance involves a blending of traits, such as flower color in certain

plants.

- (D) Codominance occurs when both alleles are expressed equally, such as in AB blood type.

Conclusion: Skin color is an example of polygenic inheritance.

Quick Tip

Polygenic inheritance involves multiple genes influencing a single trait, such as skin color, height, or eye color in humans.

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7. Pyruvate dehydrogenase activity during aerobic respiration requires

(A) Magnesium

(B) Calcium

(C) Zinc

(D) Iron

Correct Answer: (A) Magnesium

Solution:

Step 1: Pyruvate dehydrogenase is an enzyme complex that plays a critical role in converting pyruvate to acetyl-CoA during aerobic respiration. Magnesium ions are required as cofactors for the enzyme's activity.

Step 2:

- (B) Calcium, while important in other cellular processes, is not involved in pyruvate dehydrogenase activity.

- (C) Zinc and (D) Iron are cofactors for other enzymes but not for pyruvate dehydrogenase.

Conclusion: Magnesium is required for pyruvate dehydrogenase activity.

Quick Tip

Magnesium ions act as essential cofactors for several enzymes involved in energy production, including pyruvate dehydrogenase.

Chemistry

1. Cross Cannizzaro of formaldehyde and benzaldehyde give a mixture of:

(A) Benzyl alcohol and sodium formate

(B) Benzyl alcohol and formic acid

(C) Benzaldehyde and sodium acetate

(D) Benzaldehyde and sodium formate

Correct Answer: (A) Benzyl alcohol and sodium formate

Solution:

Step 1: The Cannizzaro reaction involves the disproportionation of non-enolizable aldehydes in the presence of a strong base. Formaldehyde undergoes reduction, and benzaldehyde undergoes oxidation to form a mixture of products. In this case, the products are benzyl alcohol and sodium formate.

Conclusion: The correct answer is benzyl alcohol and sodium formate.

Quick Tip

The Cannizzaro reaction is typical for aldehydes that do not have an alpha hydrogen and cannot undergo aldol condensation.

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2. Which of the following represents the expression for the 3/4th life of a 1st-order reaction?

(A) $t_{1/4} = \frac{2.303}{k} \log\left(\frac{1}{3}\right)$

(B) $t_{1/4} = \frac{2.303}{k} \log\left(\frac{4}{3}\right)$

(C) $t_{1/4} = \frac{0.693}{k}$

(D) $t_{1/4} = \frac{2.303}{k} \log\left(\frac{2}{3}\right)$

Correct Answer: (B) $t_{1/4} = \frac{2.303}{k} \log\left(\frac{4}{3}\right)$

Solution:

Step 1: For a first-order reaction, the half-life $t_{1/2}$ is given by $t_{1/2} = \frac{0.693}{k}$. To find the expression for $t_{1/4}$, we use the following relationship for first-order reactions:

$$t_{1/4} = \frac{2.303}{k} \log\left(\frac{4}{3}\right)$$

Conclusion: The correct expression for the 3/4th life of a first-order reaction is given by option (B).

Quick Tip

For first-order reactions, the half-life and quarter-life are related by logarithmic expressions that depend on the rate constant.

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3. Which of the following halides undergoes hydrolysis on warming with water/aqueous NaOH?

(A) 1-chloro-2,4,6-trinitrobenzene

(B) Chloroform

(C) Bromoethane

(D) Iodoform

Correct Answer: (A) 1-chloro-2,4,6-trinitrobenzene

Solution:

Step 1: 1-Chloro-2,4,6-trinitrobenzene undergoes hydrolysis when warmed with water or aqueous NaOH due to the presence of the electrophilic chlorine atom attached to an aromatic ring. The reaction involves nucleophilic substitution.

Step 2: - (B) Chloroform does not undergo hydrolysis under normal conditions.

- (C) Bromoethane undergoes nucleophilic substitution, but hydrolysis is not a typical reaction.

- (D) Iodoform undergoes reaction with alkali to give a precipitate, but it is not typically hydrolyzed in the presence of water or NaOH.

Conclusion: 1-chloro-2,4,6-trinitrobenzene undergoes hydrolysis.

Quick Tip

Electrophilic halides on aromatic rings are susceptible to hydrolysis, where the halogen is replaced by a hydroxyl group.

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4. Antibonding molecular orbital is formed by

(A) Addition of two atomic orbitals

(B) Subtraction of two atomic orbitals

(C) Interaction of two atomic orbitals

(D) Combination of two atomic orbitals

Correct Answer: (B) Subtraction of two atomic orbitals

Solution:

Step 1: Antibonding molecular orbitals are formed when two atomic orbitals combine in such a way that they cancel each other out, leading to destructive interference. This process is known as the subtraction of atomic orbitals.

Step 2: - (A) Addition of atomic orbitals forms bonding molecular orbitals.

- (C) Interaction of atomic orbitals is a general term, but it doesn't specify the formation of antibonding orbitals.

- (D) Combination refers to both bonding and antibonding orbital formation, but antibonding orbitals specifically form by subtraction.

Conclusion: Antibonding molecular orbitals are formed by the subtraction of atomic orbitals.

Quick Tip

Antibonding orbitals have higher energy than the atomic orbitals from which they form, and they tend to destabilize the molecule.

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5. Hot concentrated sulphuric acid is a moderately strong oxidizing agent, which of the following reactions does not show oxidizing behaviour?

(A) $2H_2SO_4 + H_2O_2 \rightarrow H_3O^+ + SO_4^{2-} + H_2O$

(B) Oxidation of SO2 to SO3

(C) Dehydration of alcohols to alkenes

(D) Reaction with metals to form metal sulfates

Correct Answer: (A) $2H_2SO_4 + H_2O_2 \rightarrow H_3O^+ + SO_4^{2-} + H_2O$

Solution:

Step 1: In this reaction, sulfuric acid is acting as a catalyst and does not undergo a change in

oxidation state, so it does not exhibit oxidizing behavior. It is simply facilitating the reaction.

Step 2: - (B) Sulfuric acid oxidizes sulfur dioxide (SO2) to sulfur trioxide (SO3), showing oxidizing behavior.

- (C) Sulfuric acid dehydrates alcohols to form alkenes, but it does not show oxidizing behavior.

- (D) Sulfuric acid reacts with metals to form metal sulfates, which is typically an oxidation process.

Conclusion: Reaction (A) does not exhibit oxidizing behavior.

Quick Tip

Sulfuric acid is a strong dehydrating agent but also acts as an oxidizer in several reactions, such as the oxidation of SO2 to SO3.
