

MHT CET 2024 28 April Shift 2 Question Paper with Solutions

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

1. Stem cutting
2. Leaf cutting
3. Root cutting

Column - II

- a. Blackberry
- b. Rose
- 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: Different types of plant propagation methods involve using cuttings from different parts of the plant:

- Stem cutting: Often used for propagating plants such as blackberry (Column II - a).

- Leaf cutting: This technique is typically used for propagating rose (Column II - b).
- Root cutting: Commonly used for plants like sansevieria (Column II - c).

Step 2: The correct matches are:

1. Stem cutting → Blackberry
2. Leaf cutting → Rose
3. Root cutting → Sansevieria

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

💡 Quick Tip

Understanding the appropriate cutting method for various plant types is essential for successful plant propagation, ensuring optimal growth and rooting.

2. Which hormone is used for fruit elongation in grapes?

- (A) Auxins
- (B) Cytokinins
- (C) Gibberellins
- (D) Ethylene

Correct Answer: (C) Gibberellins

Solution:

Step 1: Gibberellins are plant growth hormones that promote cell elongation, including the elongation of grape fruits. They are commonly applied to increase the size of fruits.

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

- (B) Cytokinins stimulate cell division and encourage shoot development.

- (D) Ethylene is associated with ripening but does not promote elongation.

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

💡 Quick Tip

Gibberellins are essential for stimulating cell elongation and are commonly used in agricultural practices to enhance fruit size and quality.

3. _____ is the middle layer of the adrenal cortex.

- (A) Zona reticularis
- (B) Zona glomerulosa
- (C) Zona fasciculata
- (D) Medulla

Correct Answer: (C) Zona fasciculata

Solution:

Step 1: The adrenal cortex consists of three distinct layers: - Zona glomerulosa (outermost) produces mineralocorticoids. - Zona fasciculata (middle) produces glucocorticoids like cortisol. - Zona reticularis (innermost) produces sex hormones.

Step 2: - (A) Zona reticularis is responsible for producing sex hormones, not glucocorticoids.

- (B) Zona glomerulosa produces mineralocorticoids such as aldosterone.

- (D) The medulla is responsible for producing catecholamines like adrenaline.

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

 Quick Tip

The adrenal cortex regulates various bodily functions through hormone production, influencing metabolism, blood pressure, and stress response.

4. What vitamin is produced by 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 known for producing vitamin B-12, an essential vitamin for DNA synthesis, red blood cell formation, and maintaining the nervous system.

Step 2: - (A) Vitamin A is produced from carotenoids found in plants.

- (C) Vitamin D is synthesized in the skin upon exposure to sunlight.

- (D) Vitamin E functions as an antioxidant but is not produced by Erenothecium ashbyi.

Conclusion: Erenothecium ashbyi is responsible for the production of vitamin B-12.

 Quick Tip

Vitamin B-12 is crucial for maintaining the health of the nervous system and producing red blood cells. Certain bacteria, like Erenothecium ashbyi, play an important role in its production.

5. The improved oil content and 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: Genetic modification has allowed scientists to improve the oil content and quality of oil crops. By transferring specific genes, scientists can enhance oil production in crops such as soybean, rapeseed, and sunflower.

Step 2: - (B) Hormones play a role in plant growth but do not directly affect oil content.

- (C) Enzymes are involved in metabolic processes but not in enhancing oil content.

- (D) Microorganisms are used for fermentation but not for genetic enhancement of oil crops.

Conclusion: The transfer of genes has led to improved oil content and quality in oil crops.

💡 Quick Tip

Genetic engineering techniques have revolutionized agriculture by enhancing traits such as oil content, disease resistance, and crop yields.

6. Human skin color is an example of

- (A) Mendelian Inheritance
- (B) Polygenic Inheritance
- (C) Incomplete Dominance
- (D) Codominance

Correct Answer: (B) Polygenic Inheritance

Solution:

Step 1: Skin color in humans is determined by multiple genes, making it a classic example of polygenic inheritance, where more than one gene contributes to the final phenotype.

Step 2: - (A) Mendelian inheritance typically involves a single gene determining a trait.

- (C) Incomplete dominance refers to traits blending together, which is not the case for skin color.

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

Conclusion: Human skin color is an example of polygenic inheritance.

💡 Quick Tip

Polygenic inheritance is when multiple genes contribute to a single trait, such as skin color, height, and eye color in humans.

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, an enzyme complex in the citric acid cycle, requires magnesium ions as cofactors for its activity. Magnesium facilitates the enzyme's function in converting pyruvate to acetyl-CoA.

Step 2: - (B) Calcium is important in many other cellular processes but not in pyruvate dehydrogenase activity.

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

Conclusion: Magnesium is necessary for the activity of pyruvate dehydrogenase.

💡 Quick Tip

Magnesium ions act as cofactors for numerous enzymes, playing a vital role in cellular energy production, including pyruvate dehydrogenase activity.

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 aldehydes without an alpha-hydrogen, where one molecule is reduced, and the other is oxidized. In the case of formaldehyde and benzaldehyde, formaldehyde is reduced, and benzaldehyde is oxidized to form benzyl alcohol and sodium formate.

Conclusion: The products of this reaction are benzyl alcohol and sodium formate.

 Quick Tip

The Cannizzaro reaction occurs with non-enolizable aldehydes, where the hydrogen atoms in the alpha position cannot participate in aldol condensation.

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 related to the rate constant k by the formula $t_{1/2} = \frac{0.693}{k}$. For the 3/4th life, the corresponding expression is:

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

Conclusion: The expression for the 3/4th life of a first-order reaction is $t_{1/4} = \frac{2.303}{k} \log \left(\frac{4}{3} \right)$, making option (B) correct.

 Quick Tip

In first-order reactions, the time for the completion of specific fractions of the reaction (like half or quarter) is governed by logarithmic relationships with the rate constant.

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 is an electrophilic halide that readily undergoes hydrolysis when warmed with water or aqueous NaOH, resulting in a nucleophilic substitution where chlorine is replaced by a hydroxyl group.

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

- (C) Bromoethane undergoes nucleophilic substitution but not typical hydrolysis under these conditions.

- (D) Iodoform reacts with alkali but not in the form of a typical hydrolysis reaction.

Conclusion: 1-Chloro-2,4,6-trinitrobenzene undergoes hydrolysis with water or NaOH.

 Quick Tip

Aromatic electrophilic halides like 1-chloro-2,4,6-trinitrobenzene undergo hydrolysis when exposed to water or bases, replacing the halogen with a hydroxyl group.

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 form when two atomic orbitals combine in such a way that they cancel each other out. This process, known as subtraction or destructive interference, results in an orbital that destabilizes the molecule.

Step 2: - (A) Addition of atomic orbitals forms bonding molecular orbitals, not antibonding.

- (C) Interaction of atomic orbitals is a general term, not specific to antibonding orbital formation.

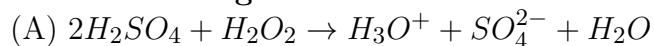
- (D) Combination refers to both bonding and antibonding orbitals but antibonding orbitals are specifically formed by subtraction.

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

 Quick Tip

Antibonding orbitals are typically higher in energy and can destabilize a molecule, leading to weaker bonds.

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



(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 reaction (A), sulfuric acid acts as a catalyst, not as an oxidizing agent. It facilitates the reaction without undergoing oxidation itself.

Step 2: - (B) Sulfuric acid oxidizes SO₂ to SO₃, demonstrating oxidizing behavior.

- (C) Sulfuric acid dehydrates alcohols to form alkenes, a dehydration process.

- (D) The reaction of sulfuric acid with metals to form metal sulfates involves oxidation.

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

 Quick Tip

Sulfuric acid can act as both a dehydrating agent and an oxidizer, but it does not always exhibit oxidizing properties in all reactions.