MHT CET 2024 April 28 Shift 1 Question Paper with Solutions

Time Allowed :3 Hours	**Maximum Marks :**200	**Total Questions :**150

General Instructions

Read the following instructions very carefully and strictly follow them:

1. The Duration of test is 3 Hours.
2. This paper consists of 150 Questions.
3. There are three parts in the paper consisting of Physics, Chemistry and Mathematics having 50 questions in each part of equal weightage..
4. Section-A: Physics and Chemistry - 50 Questions each.
5. Section-B: Mathematics - 50 Questions
6. Choice and sequence for attempting questions will be as per the convenience of the candidate.
7. Determine the one correct answer out of the four available options given for each question.
8. Each question with correct response shall be awarded one (1) mark. There shall be no negative marking.
9. No mark shall be granted for marking two or more answers of same question, scratching or overwriting

Biology Questions

1. Which codon has a dual function?

1. AUG
2. UAG
3. UAA
4. UGA

Correct Answer: (A) AUG

Solution: The codon AUG has a dual function in translation:

1. It serves as the **start codon**, signaling the initiation of protein synthesis. This is the site where ribosomes begin translation by recruiting the tRNA carrying methionine.
2. It codes for the amino acid **methionine** (in eukaryotes) and N-formylmethionine (fMet) in prokaryotes.

Other codons such as UAG, UAA, UGA are **stop codons** and do not perform any dual role. They terminate translation by signaling the ribosome to release the polypeptide chain.

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Why AUG is unique?

- AUG is recognized universally across prokaryotic and eukaryotic organisms as the start codon.
- Its dual role is a result of its unique ability to recruit both initiation factors for translation and tRNAs carrying methionine.

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Final Answer:

$$\boxed{\text{AUG}}$$

Quick Tip

Remember, AUG initiates protein synthesis and codes for methionine. This dual role is a cornerstone of translation in all organisms.

2. An angiotensinogen is secreted by _____?

1. Kidneys
2. Liver
3. Pancreas
4. Lungs

Correct Answer: (B) Liver

Solution: Angiotensinogen is a glycoprotein secreted by the liver. It is an essential precursor in the renin-angiotensin system (RAS), which regulates blood pressure and fluid balance. The steps include:

1. Renin, secreted by the kidneys, converts angiotensinogen into angiotensin I.
2. Angiotensin I is further converted to angiotensin II by angiotensin-converting enzyme (ACE) in the lungs.
3. Angiotensin II acts as a potent vasoconstrictor and stimulates the release of aldosterone, enhancing sodium and water retention.

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Final Answer:

$$\boxed{\text{Liver}}$$

Quick Tip

The liver produces angiotensinogen, while the kidneys and lungs are involved in converting it into active forms.

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3. Body Fluids and Circulation: The inner surface of the ventricle is thrown into a series of irregular muscular ridges called _____?

1. Chordae tendineae

2. Columnae carneae
3. Papillary muscles
4. Endocardium

Correct Answer: (B) Columnae carneae

Solution: The columnae carneae are muscular ridges found on the inner surface of the ventricles. Their primary functions include:

1. Enhancing the strength and integrity of the ventricular walls.
2. Preventing the walls from sticking together during contraction.
3. Assisting the papillary muscles by anchoring the chordae tendineae, which in turn control valve movement.

These structures play a significant role in the efficient pumping of blood by the heart.

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Final Answer:

$$\boxed{\text{Columnae carneae}}$$

Quick Tip

Do not confuse columnae carneae with papillary muscles. Papillary muscles are connected to the valves, while columnae carneae are structural ridges.

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4. What is the site of perception of photoperiod necessary for induction of flowering in plants?

1. Roots
2. Stems
3. Leaves
4. Flowers

Correct Answer: (C) Leaves

Solution: The leaves are the site of photoperiod perception in plants. The process involves:

1. Photoreceptors such as phytochromes in leaves detect the duration of light and dark periods.
2. Upon perceiving the correct photoperiod, the leaves produce a flowering signal, commonly known as **florigen**.
3. Florigen is transported to the shoot apical meristem, where it induces flowering by activating flowering genes.

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Final Answer:

$$\boxed{\text{Leaves}}$$

Quick Tip

Photoperiodism depends on the duration of light and darkness. Leaves detect this and send signals to the shoot for flowering.

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5. Most widely accepted explanation for the ascent of sap in trees is _____?

1. Root pressure theory
2. Capillarity theory
3. Transpiration cohesion theory
4. Imbibition theory

Correct Answer: (C) Transpiration cohesion theory

Solution: The transpiration cohesion theory, proposed by Dixon and Joly, is the most widely accepted explanation for the ascent of sap in trees. Key points of the theory include:

1. **Transpiration pull:** Loss of water through transpiration creates a negative pressure (tension) in the leaves, which pulls water upward.

2. **Cohesion:** Water molecules stick together due to hydrogen bonding, forming a continuous column in the xylem.
3. **Adhesion:** Water molecules adhere to the walls of xylem vessels, helping to counteract gravity.
4. **Continuity:** The water column remains unbroken due to cohesion and adhesion, allowing water to move upward to great heights.

Root pressure and capillarity play minor roles, but they are not sufficient to explain the transport of water to tall trees.

Final Answer:

Transpiration cohesion theory

Quick Tip

Transpiration pull, combined with cohesion and adhesion, is critical for the ascent of sap in tall plants. Understand these principles for related questions.

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6. Which animal conserves water through the excretion process?

1. Camel
2. Kangaroo rat
3. Frog
4. Fish

Correct Answer: (B) Kangaroo rat

Solution: Kangaroo rats are desert-dwelling animals that conserve water through the following adaptations:

1. They produce highly concentrated urine to minimize water loss.
2. Water is reabsorbed efficiently in their kidneys, reducing water loss through excretion.

3. They obtain water primarily through metabolic processes (metabolic water) rather than drinking free water.
4. They produce dry feces, which further minimizes water loss.

These adaptations are critical for survival in arid environments where water is scarce.

Final Answer:

$$\boxed{\text{Kangaroo rat}}$$

Quick Tip

Animals living in deserts have physiological adaptations like efficient kidneys and metabolic water production to survive extreme conditions.

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7. Grapes fruit elongation: Which hormone is used?

1. Cytokinin
2. Gibberellin
3. Auxin
4. Ethylene

Correct Answer: (B) Gibberellin

Solution: Gibberellins (GA) are plant hormones used to promote the elongation and enlargement of fruits, including grapes. Key roles of gibberellins in grapes include:

1. Stimulating cell elongation, leading to larger and more uniform grape size.
2. Reducing cluster compactness, making grape clusters more marketable.
3. Enhancing the overall quality of grapes by improving fruit development.

Farmers often apply gibberellins during fruit development to ensure better yield and quality.

Final Answer:

$$\boxed{\text{Gibberellin}}$$

Quick Tip

Gibberellins are widely used in agriculture to enhance fruit size and quality. They also promote stem elongation and seed germination.

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8. What does ICSH stimulate?

1. Leydig cells for testosterone production
2. Spermatogenesis directly
3. Oocyte maturation
4. Growth hormone secretion

Correct Answer: (A) Leydig cells for testosterone production

Solution: ICSH (Interstitial Cell Stimulating Hormone), also known as Luteinizing Hormone (LH) in males, is secreted by the anterior pituitary gland. It plays a crucial role in:

1. Stimulating Leydig cells in the testes to produce testosterone.
2. Testosterone supports spermatogenesis, development of male secondary sexual characteristics, and maintenance of libido.

Other options: - Spermatogenesis directly: Testosterone indirectly supports it but does not directly cause it. - Oocyte maturation: Related to LH in females, not males.

Final Answer:

Leydig cells for testosterone production

Quick Tip

In males, ICSH (or LH) stimulates Leydig cells for testosterone production, while FSH works on Sertoli cells for spermatogenesis.

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9. What is a key concept in Human Physiology?

1. Circulation of blood

2. Neural communication
3. Hormonal regulation
4. All of the above

Correct Answer: (D) All of the above

Solution: Human Physiology involves multiple interconnected systems:

1. **Circulation of blood:** The cardiovascular system transports oxygen, nutrients, and waste products.
2. **Neural communication:** The nervous system controls voluntary and involuntary actions.
3. **Hormonal regulation:** The endocrine system regulates metabolism, growth, and reproduction.

These systems work in harmony to maintain homeostasis and support life processes.

Final Answer:

$$\boxed{\text{All of the above}}$$

Quick Tip

Human physiology covers various systems like cardiovascular, nervous, and endocrine. Understand their interactions for a holistic perspective.

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10. Which process is involved in replication of cells?

1. Mitosis
2. Meiosis
3. DNA replication
4. All of the above

Correct Answer: (D) All of the above

Solution: Replication of cells includes:

1. **Mitosis:** Results in two identical daughter cells for growth and repair.
2. **Meiosis:** Produces gametes with half the genetic material for reproduction.
3. **DNA replication:** A prerequisite for both mitosis and meiosis, ensuring genetic continuity.

Each process has unique functions but is essential for cellular replication and organismal survival.

Final Answer:

$$\boxed{\text{All of the above}}$$

Quick Tip

Cell division and replication are fundamental to life. Distinguish between mitosis, meiosis, and DNA replication for clarity.

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11. What is the main excretory product in the Animal Kingdom?

1. Ammonia
2. Urea
3. Uric acid
4. Depends on the species

Correct Answer: (D) Depends on the species

Solution: Excretory products depend on the species and their environment:

1. **Ammonia:** Excreted by aquatic animals (ammonotelic) as it requires abundant water.
2. **Urea:** Excreted by mammals (ureotelic), requiring moderate water.
3. **Uric acid:** Excreted by birds and reptiles (uricotelic), conserving water.

Adaptations are linked to habitat and water availability.

Final Answer:

$$\boxed{\text{Depends on the species}}$$

Quick Tip

Understand the correlation between excretory products and habitat (aquatic, terrestrial, or arid).

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12. What regulates plant growth?

1. Auxins
2. Gibberellins
3. Cytokinins
4. All of the above

Correct Answer: (D) All of the above

Solution: Plant growth is regulated by:

1. **Auxins:** Promote cell elongation and phototropism.
2. **Gibberellins:** Stimulate stem elongation and seed germination.
3. **Cytokinins:** Promote cell division and delay senescence.

These hormones act synergistically or antagonistically to regulate overall growth and development.

Final Answer:

$$\boxed{\text{All of the above}}$$

Quick Tip

Plant growth hormones work together for development. Understand their individual and collective roles.

Chemistry Questions

13. A hydrocarbon containing one double bond gave on reductive ozonolysis, ethanol and propanone. What is the name of the hydrocarbon?

1. Ethene
2. Propene
3. But-1-ene
4. 2-Methylprop-1-ene

Correct Answer: (D) 2-Methylprop-1-ene

Solution: In reductive ozonolysis, the double bond in the hydrocarbon is cleaved, and oxygen atoms are inserted to form carbonyl compounds. The hydrocarbon provided yields ethanol (CH_3CH_2OH) and propanone (CH_3COCH_3). To determine the original hydrocarbon:

1. Draw the products and combine them by removing oxygen atoms.
2. Reconnect the resulting fragments to form the hydrocarbon.
3. The original hydrocarbon is identified as 2-Methylprop-1-ene, which cleaves to give the specified products.

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Final Answer:

$$\boxed{\text{2-Methylprop-1-ene}}$$

Quick Tip

In reductive ozonolysis, carefully analyze the carbonyl products to reconstruct the original hydrocarbon.

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14. The pH of a saturated solution of $Ca(OH)_2$ is 9. The solubility product (K_{sp}) of $Ca(OH)_2$ is:

1. 5.0×10^{-16}

2. 4.0×10^{-16}

3. 6.5×10^{-16}

4. 8.0×10^{-16}

Correct Answer: (A) 5.0×10^{-6}

Solution: The dissociation of $Ca(OH)_2$ in water is:

$$Ca(OH)_2 \rightarrow Ca^{2+} + 2OH^-.$$

Given the pH is 9, the pOH is:

$$pOH = 14 - pH = 14 - 9 = 5.$$

The concentration of OH^- is:

$$[OH^-] = 10^{-pOH} = 10^{-5}.$$

From the stoichiometry of the reaction:

$$[Ca^{2+}] = \frac{[OH^-]}{2} = \frac{10^{-5}}{2} = 5 \times 10^{-6}.$$

The solubility product (K_{sp}) is:

$$K_{sp} = [Ca^{2+}][OH^-]^2 = (5 \times 10^{-6})(10^{-5})^2 = 5 \times 10^{-6} \times 10^{-10} = 5.0 \times 10^{-16}.$$

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Final Answer:

$$\boxed{5.0 \times 10^{-16}}$$

Quick Tip

To solve for K_{sp}, first determine ion concentrations using pH or pOH and apply stoichiometry.

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15. A 0.1 molal aqueous solution of glucose boils at 100.16°C. The boiling point of a 0.5 molal aqueous solution of glucose will be:

1. 100.56°C

2. 100.40°C

3. 100.80°C

4. 101.00°C

Correct Answer: (C) 100.80°C

Solution: The boiling point elevation (ΔT_b) is given by:

$$\Delta T_b = iK_b m,$$

where:

- i is the van't Hoff factor (for glucose, $i = 1$),
- K_b is the boiling point elevation constant,
- m is the molality of the solution.

From the data:

$$\Delta T_b(\text{for } 0.1 \text{ m}) = 100.16 - 100 = 0.16^\circ\text{C}.$$

The proportionality of ΔT_b with molality gives:

$$\Delta T_b(\text{for } 0.5 \text{ m}) = 5 \times 0.16 = 0.80^\circ\text{C}.$$

Thus, the new boiling point is:

$$100 + 0.80 = 100.80^\circ\text{C}.$$

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Final Answer:

$$\boxed{100.80^\circ\text{C}}$$

Quick Tip

Colligative properties depend only on the number of solute particles in the solution, not their identity.

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16. What is the electronic configuration of Cu?

1. $[\text{Ar}]3d^{10}4s^1$
2. $[\text{Ar}]3d^9 4s^2$
3. $[\text{Ar}]3d^{10}4s^2$
4. $[\text{Ar}]3d^9 4s^1$

Correct Answer: (A) $[\text{Ar}]3d^{10}4s^1$

Solution: Copper deviates from the expected configuration $[\text{Ar}]3d^9 4s^2$ to achieve greater stability with a completely filled $3d$-subshell. The actual configuration is:

$$[\text{Ar}]3d^{10}4s^1.$$

This arrangement lowers the energy of the atom due to the enhanced stability of a completely filled d-subshell.

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Final Answer:

$$\boxed{[\text{Ar}]3d^{10}4s^1}$$

Quick Tip

Transition elements often show exceptions in electronic configurations to achieve a half-filled or completely filled d-subshell.
