MHT CET 2025 11 April Shift 1 PCB Question Paper with Solutions

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: Biology - 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 Bio 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.

1. Combination of foreign DNA and vector DNA are together called as

(A) Recombinant DNA

(B) Plasmid DNA

(C) DNA ligase

(D) Transformation DNA

Correct Answer: (A) Recombinant DNA

Solution:

The process of recombinant DNA technology involves the combination of foreign DNA with vector DNA. A vector is a DNA molecule used to carry foreign genetic material into a host cell. The resulting combination of foreign DNA and vector DNA is referred to as recombinant DNA. The recombinant DNA is inserted into a host organism to study gene expression or produce proteins of interest.

Thus, the correct answer is Recombinant DNA.

Quick Tip

Recombinant DNA refers to a molecule that has been created by combining genetic material from different sources.

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2. What will be the corresponding mRNA sequence based on the given DNA template strand?

(A) 5'-AUGCGA-3'

(B) 3'-TACGCT-5'

(C) 5'-ATGCGT-3'

(D) 3'-ATGCGT-5'

Correct Answer: (A) 5'-AUGCGA-3'

Solution:

Transcription is the process by which mRNA is synthesized from a DNA template strand. During transcription, RNA is synthesized in the 5' to 3' direction, with the sequence of the

RNA being complementary to the DNA template strand. Since uracil (U) replaces thymine (T) in RNA, the corresponding mRNA sequence is complementary to the given DNA template sequence, replacing T with U.

For example, if the given DNA template strand is 3'-TACGCT-5', the corresponding mRNA sequence will be 5'-AUGCGA-3', as uracil (U) replaces thymine (T) in RNA.

Thus, the correct answer is 5'-AUGCGA-3'.

Quick Tip

Remember, during transcription, adenine (A) pairs with uracil (U) in RNA (instead of thymine), and cytosine (C) pairs with guanine (G), and vice versa.

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3. Which of the following pair of cells are haploid?

A. Nucellus and antipodals

B. Polar nuclei and Nucellus

C. Egg cell and antipodals

D. Etc

Correct Answer: C. Egg cell and antipodals

Solution:

In the context of plants and their reproductive system, haploid cells have half the number of chromosomes. The egg cell and antipodals are haploid, meaning they each contain a single set of chromosomes. The Nucellus and polar nuclei are diploid, as they contain two sets of chromosomes. Therefore, option C, which mentions the egg cell and antipodals, is the correct answer.

Quick Tip

Haploid cells contain one set of chromosomes, while diploid cells contain two sets. In plant reproduction, the egg cell and antipodal cells are examples of haploid cells.

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4. Which hormone converts into amino acid?

A. Glycine

B. Thyroxine

C. Valine

D. Leucine

Correct Answer: B. Thyroxine

Solution:

Thyroxine is a hormone produced by the thyroid gland. It is derived from the amino acid tyrosine and can be considered to convert into amino acids. The other options are amino acids or have no direct conversion relationship with hormones.

Quick Tip

Thyroxine is an example of a hormone that is derived from an amino acid. In this case, it is derived from tyrosine, which is an amino acid.

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5. Which hormone converts into amino acid?

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B. Thyroxine

C. Valine

D. Leucine

Correct Answer: B. Thyroxine

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Thyroxine is a hormone produced by the thyroid gland. It is derived from the amino acid tyrosine and can be considered to convert into amino acids. The other options are amino acids or have no direct conversion relationship with hormones.

Quick Tip

Thyroxine is an example of a hormone that is derived from an amino acid. In this case, it is derived from tyrosine, which is an amino acid.

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6. What is Transcription?

Solution:

Transcription is the first step of gene expression, where a particular segment of DNA is copied into RNA, especially messenger RNA (mRNA). This mRNA serves as a template for protein synthesis in the process known as translation. In eukaryotes, transcription occurs in the nucleus, while in prokaryotes, it takes place in the cytoplasm.

Quick Tip

In transcription, the RNA polymerase enzyme plays a key role in synthesizing RNA from a DNA template. It's important to remember that mRNA is the product of transcription and that this process is essential for protein synthesis.

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7. A solution is formed by mixing chloroform (CHCl3) and acetone (CH3COCH3). Which of the following is true regarding the nature of this solution?

A. It shows positive deviation from Raoult's law due to weak intermolecular forces

B. It shows negative deviation due to strong dipole-dipole interactions

C. It obeys Raoult's law over the entire range of composition

D. It forms an ideal solution with no enthalpy change

Correct Answer: B. It shows negative deviation due to strong dipole-dipole interactions

Solution:

When chloroform (CHCl3) and acetone (CH3COCH3) are mixed, the intermolecular forces between the molecules are stronger than the forces between the individual components. This leads to a negative deviation from Raoult's law. In solutions where dipole-dipole interactions are significant, the deviation from Raoult's law is negative, meaning the vapor pressure of the solution is lower than expected based on the mole fraction of each component. This is because the intermolecular interactions between the solute and solvent are stronger than those in the pure components.

Quick Tip

In solutions with strong dipole-dipole interactions, expect a negative deviation from Raoult's law, where the solution exhibits a lower vapor pressure than predicted.

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8. IUPAC name of the chemical compound $Ni(PPh_3)_2Cl_2$ $2+$?

Correct Answer: Bis(triphenylphosphine) dichloronickel(II)

Solution:

The IUPAC name of the given compound $Ni(PPh_3)_2Cl_2$ $2+$ is "Bis(triphenylphosphine) dichloronickel(II)". In this compound: - The nickel (Ni) is in the +2 oxidation state, - There are two triphenylphosphine (PPh3) ligands and two chloride (Cl) ligands attached to the nickel center.

In the IUPAC name: - "Bis" indicates two identical ligands (triphenylphosphine), - "Dichloro" refers to the two chloride ions, - "Nickel(II)" indicates the metal center with a +2 oxidation state.

Quick Tip

When naming coordination compounds, remember to list the ligands alphabetically, and use prefixes like "bis", "tris", etc., to indicate multiple identical ligands.

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9. Which of the following drug classes is primarily used to manage elevated LDL cholesterol levels in patients with cardiovascular risk?

(a) Beta-blockers

(b) Statins

(c) Antacids

(d) Antihistamines

Correct Answer: (b) Statins

Solution:

Statins are a class of lipid-lowering medications that reduce illness and mortality in those who are at high risk of cardiovascular disease. They function by inhibiting the enzyme *HMG-CoA reductase*, which plays a central role in the production of cholesterol in the liver. By reducing the synthesis of cholesterol, statins help lower LDL (low-density lipoprotein) cholesterol, commonly known as ”bad” cholesterol, which is a major risk factor for atherosclerosis and heart disease.

Option (a) Beta-blockers are used to manage blood pressure and heart rate but do not directly affect cholesterol levels.

Option (c) Antacids neutralize stomach acid and are used in conditions like acid reflux—not cholesterol-related.

Option (d) Antihistamines are used to treat allergic reactions and have no role in cholesterol regulation.

Hence, the correct and most appropriate option is (b) Statins.

Quick Tip

Statins are among the most prescribed drugs worldwide for lowering LDL cholesterol and preventing cardiovascular events. Common examples include Atorvastatin and Simvastatin.

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10. Which of the following enzymes is directly inhibited by statins to reduce cholesterol biosynthesis in the liver?

(a) Lipase

(b) HMG-CoA reductase

(c) Amylase

(d) Pepsin

Correct Answer: (b) HMG-CoA reductase

Solution:

Statins exert their cholesterol-lowering effect by inhibiting the enzyme **HMG-CoA reductase (3-hydroxy-3-methyl-glutaryl-coenzyme A reductase)**. This enzyme catalyzes

an early and rate-limiting step in the biosynthesis of cholesterol in the liver. By inhibiting this enzyme, statins decrease the intracellular synthesis of cholesterol, which in turn upregulates LDL receptors and increases LDL clearance from the bloodstream.

Option (a) Lipase breaks down lipids but is not involved in cholesterol biosynthesis.

Option (c) Amylase helps digest carbohydrates.

Option (d) Pepsin breaks down proteins in the stomach.

Only option (b) is linked to cholesterol synthesis, making it the correct answer.

Quick Tip

HMG-CoA reductase is the rate-limiting enzyme in the cholesterol synthesis pathway. Statins block this enzyme, reducing LDL levels significantly.

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11. Which condition is most commonly treated using cholesterol-lowering agents such as statins?

(a) Diabetes mellitus

(b) Atherosclerosis

(c) Anemia

(d) Asthma

Correct Answer: (b) Atherosclerosis

Solution:

Statins are primarily used in the treatment and prevention of **atherosclerosis**, a condition where plaque builds up in the arterial walls, leading to narrowing and hardening of the arteries. High levels of LDL cholesterol contribute significantly to plaque formation. Statins lower LDL cholesterol and stabilize existing plaques, reducing the risk of heart attacks and strokes.

Option (a) Diabetes mellitus may coexist with high cholesterol but is not directly treated with statins.

Option (c) Anemia relates to reduced hemoglobin and is not influenced by statins.

Option (d) Asthma is a respiratory condition unrelated to cholesterol metabolism.

Therefore, **atherosclerosis** is the correct answer.

Quick Tip

Cholesterol-lowering drugs like statins reduce the risk of heart attacks and strokes by slowing the progression of atherosclerosis.

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12. Which of the following lifestyle changes complements the action of statins in managing high cholesterol?

(a) High-fat diet

(b) Sedentary lifestyle

(c) Regular exercise and a fiber-rich diet

(d) Smoking

Correct Answer: (c) Regular exercise and a fiber-rich diet

Solution:

Statins are pharmacological agents, but their efficacy can be significantly improved when combined with **lifestyle changes**. Regular physical activity, such as brisk walking or aerobic exercise, improves cardiovascular health and helps raise HDL ("good") cholesterol. A fiber-rich diet binds cholesterol in the digestive tract and reduces its absorption, thereby lowering LDL levels.

Option (a) A high-fat diet can worsen cholesterol levels.

Option (b) Sedentary behavior is associated with cardiovascular risk.

Option (d) Smoking damages blood vessels and increases the risk of heart disease.

Hence, the best complementary option is **(c)**.

Quick Tip

Diet and exercise play a crucial role in cholesterol control. Soluble fiber (like oats, fruits, and legumes) and aerobic exercise help reduce LDL and improve overall heart health.

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13. A car starts from rest and accelerates uniformly at 3 m/s^2. What will be its velocity after 5 seconds?

(a) 10 m/s

(b) 15 m/s

(c) 20 m/s

(d) 30 m/s

Correct Answer: (b) 15 m/s

Solution:

Given: Initial velocity $u = 0$ m/s (since the car starts from rest)

Acceleration $a = 3$ m/s^2

Time $t = 5$ s

We use the first equation of motion:

$$v = u + at$$

Substituting the values:

$$v = 0 + (3)(5) = 15 \text{ m/s}$$

Option (b) is correct.

Quick Tip

Use the equation $v = u + at$ when acceleration is constant and you know the initial velocity and time.

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14. A block of mass 2 kg is acted upon by a net force of 10 N. What is its acceleration?

(a) 2 m/s^2

(b) 5 m/s^2

(c) 10 m/s^2

(d) 20 m/s^2

Correct Answer: (b) 5 m/s^2

Solution:

According to Newton's Second Law:

$$F = ma$$

Given: Force $F = 10\,\text{N}$, Mass $m = 2\,\text{kg}$

Rearranging to solve for acceleration:

$$a = \frac{F}{m} = \frac{10}{2} = 5\,\text{m/s}^2$$

Option (b) is correct.

Quick Tip

Newton's Second Law is a core concept: Always remember $a = \frac{F}{m}$ when net force and mass are given.

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15. A body of mass 4 kg is lifted to a height of 5 meters. What is the potential energy gained by the body? (Take $g = 9.8\,\text{m/s}^2$)

(a) 20 J

(b) 49 J

(c) 98 J

(d) 196 J

Correct Answer: (d) 196 J

Solution:

Potential energy is calculated using the formula:

$$PE = mgh$$

Where: $m = 4\,\text{kg}$, $g = 9.8\,\text{m/s}^2$, $h = 5\,\text{m}$

$$PE = 4 \times 9.8 \times 5 = 196\,\text{J}$$

Hence, the body gains a potential energy of **196 joules**.

Quick Tip

Gravitational potential energy is directly proportional to mass and height: $PE = mgh$. Always use standard $g = 9.8\,\text{m/s}^2$ unless mentioned otherwise.

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16. A 10 kg box is pulled with a horizontal force of 50 N on a surface offering a frictional force of 20 N. What is the net acceleration of the box? (Take $g = 10\,\text{m/s}^2$)

(a) 2 m/s^2

(b) 3 m/s^2

(c) 5 m/s^2

(d) 7 m/s^2

Correct Answer: (a) 3 m/s^2

Solution:

Net force acting on the body is:

$$F_{\text{net}} = F_{\text{applied}} - F_{\text{friction}} = 50\,\text{N} - 20\,\text{N} = 30\,\text{N}$$

Using Newton's Second Law:

$$a = \frac{F_{\text{net}}}{m} = \frac{30}{10} = 3\,\text{m/s}^2$$

Option (b) is incorrect because it confuses net and applied force. **Option (a)** is correct.

Quick Tip

Always subtract friction from the applied force to find the net force before using $a = \frac{F}{m}$. Friction resists motion!

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17. What is the gravitational force between two 5 kg masses placed 2 meters apart? (Take $G = 6.67 \times 10^{-11}\,\text{Nm}^2/\text{kg}^2$)

(a) $4.17 \times 10^{-10}\,\text{N}$

(b) $8.34 \times 10^{-10}\,\text{N}$

(c) $1.67 \times 10^{-10}\,\text{N}$

(d) $2.50 \times 10^{-11}\,\text{N}$

Correct Answer: (b) $8.34 \times 10^{-10}\,\text{N}$

Solution:

Use Newton's law of universal gravitation:

$$F = \frac{Gm_1m_2}{r^2}$$

Given: $m_1 = m_2 = 5\,\text{kg}$, $r = 2\,\text{m}$, $G = 6.67 \times 10^{-11}\,\text{Nm}^2/\text{kg}^2$

$$F = \frac{6.67 \times 10^{-11} \times 5 \times 5}{2^2} = \frac{6.67 \times 25 \times 10^{-11}}{4}$$

$$F = \frac{166.75 \times 10^{-11}}{4} = 41.6875 \times 10^{-11} = 8.34 \times 10^{-10}\,\text{N}$$

Option (b) is correct.

Quick Tip

Gravitational force is extremely weak unless very massive bodies are involved. Always use $F = \frac{Gm_1m_2}{r^2}$ and keep track of units.

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18. A particle is moving in a circle of radius 2 m with a constant speed of 4 m/s. What is the centripetal acceleration?

(a) 2 m/s^2

(b) 4 m/s^2

(c) 8 m/s^2

(d) 16 m/s^2

Correct Answer: (c) 8 m/s^2

Solution:

Centripetal acceleration is given by:

$$a = \frac{v^2}{r}$$

Given: Speed $v = 4\,\text{m/s}$, Radius $r = 2\,\text{m}$

$$a = \frac{4^2}{2} = \frac{16}{2} = 8\,\text{m/s}^2$$

Hence, the correct answer is **(c)**.

Quick Tip

In uniform circular motion, even with constant speed, acceleration exists due to the continuous change in direction. Always use $a = \frac{v^2}{r}$ for centripetal acceleration.

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19. Which of the following elements has the highest electronegativity?

(a) Oxygen

(b) Nitrogen

(c) Fluorine

(d) Chlorine

Correct Answer: (c) Fluorine

Solution:

Electronegativity is the tendency of an atom to attract a shared pair of electrons in a covalent bond. In the periodic table, electronegativity increases across a period and decreases down a group. Fluorine, being at the top right of the periodic table (excluding noble gases), has the **highest electronegativity value of 3.98 (Pauling scale)**.

Other options: **(a)** Oxygen (3.44) — high, but less than fluorine.

(b) Nitrogen (3.04) — lower.

(d) Chlorine (3.16) — high among halogens but still less than fluorine.

Quick Tip

Fluorine is the most electronegative element. Remember the trend: across a period $\rightarrow$ increases, down a group $\rightarrow$ decreases.

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20. Which of the following compounds contains a coordinate (dative) covalent bond?

(a) HCl

(b) NH_3

(c) H_2O

(d) NH_4^+

Correct Answer: (d) NH_4^+

Solution:

A coordinate covalent bond is a type of covalent bond in which both electrons in the shared pair come from the same atom. In the ammonium ion (NH_4^+), one lone pair from nitrogen is donated to a hydrogen ion (H^+), forming a coordinate bond. The other three N–H bonds are regular covalent bonds.

Other options: **(a)** HCl — polar covalent bond.

(b) NH_3 — only covalent bonds.

(c) H_2O — only covalent bonds.

Quick Tip

Coordinate bonds occur when one atom donates both electrons for bonding. Watch for ions like NH_4^+ or H_3O^+.

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21. What is the pH of a solution with a hydrogen ion concentration of 1×10^{-4} mol/L?

(a) 3

(b) 4

(c) 5

(d) 6

Correct Answer: (b) 4

Solution:

The pH of a solution is calculated using the formula:

$$\text{pH} = -\log[H^+]$$

Given:

$$[H^+] = 1 \times 10^{-4}$$

$$\text{pH} = -\log(1 \times 10^{-4}) = 4$$

So, the solution has a pH of 4, indicating it's acidic.

Quick Tip

Use $\text{pH} = -\log[H^+]$ directly when hydrogen ion concentration is in the form 10^{-n}. The pH will be simply n.

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22. In the reaction:

$$\text{Zn} + \text{CuSO}_4 \rightarrow \text{ZnSO}_4 + \text{Cu}$$

Which substance is oxidized?

(a) Zn

(b) CuSO_4

(c) ZnSO_4

(d) Cu

Correct Answer: (a) Zn

Solution:

In a redox reaction, oxidation is the loss of electrons. In the given reaction:

$$\text{Zn} \rightarrow \text{Zn}^{2+} + 2e^- \quad \text{(Oxidation)}$$

$$\text{Cu}^{2+} + 2e^- \rightarrow \text{Cu} \quad \text{(Reduction)}$$

Zinc loses electrons and is thus oxidized. Copper ions gain electrons and are reduced.

Quick Tip

LEO the lion says GER: **Loss of Electrons is Oxidation, Gain of Electrons is Reduction**.

23. Which of the following quantum numbers determines the shape of an orbital?

(a) Principal quantum number (n)

(b) Azimuthal quantum number (l)

(c) Magnetic quantum number (m)

(d) Spin quantum number (s)

Correct Answer: (b) Azimuthal quantum number (l)

Solution:

The azimuthal quantum number l defines the shape of the orbital: - $l = 0 \rightarrow$ s orbital (spherical) - $l = 1 \rightarrow$ p orbital (dumbbell) - $l = 2 \rightarrow$ d orbital (cloverleaf) - $l = 3 \rightarrow$ f orbital (complex)

(a) Principal quantum number n determines energy level and size.

(c) Magnetic quantum number m determines orientation.

(d) Spin quantum number s represents the spin of electron (±½).

Quick Tip

Remember: - n = size, - l = shape, - m = orientation, - s = spin

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24. What is the enthalpy change (ΔH) for an exothermic reaction?

(a) Positive

(b) Negative

(c) Zero

(d) Infinite

Correct Answer: (b) Negative

Solution:

In an exothermic reaction, heat is released into the surroundings. As a result, the system loses energy, and the enthalpy change ΔH is negative.

Examples: - Combustion of fuels - Neutralization reactions

Endothermic reactions absorb heat, hence $\Delta H > 0$.

Quick Tip

Exothermic $\rightarrow$ Heat exits $\rightarrow \Delta H < 0$ Endothermic $\rightarrow$ Heat enters $\rightarrow \Delta H > 0$

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25. Which of the following is an example of an alkene?

(a) Ethane

(b) Ethene

(c) Ethyne

(d) Benzene

Correct Answer: (b) Ethene

Solution:

Alkenes are unsaturated hydrocarbons that contain at least one carbon-carbon double bond.

Ethene (C_2H_4) is the simplest alkene and contains a C=C double bond.

Other options: **(a)** Ethane (C_2H_6) is an alkane with all single bonds.

(c) Ethyne (C_2H_2) is an alkyne with a triple bond.

(d) Benzene is an aromatic compound with alternating double bonds in a ring, not a straight-chain alkene.

Quick Tip

Remember: - Alkane: single bond $\rightarrow$ suffix "–ane" - Alkene: double bond $\rightarrow$ suffix "–ene" - Alkyne: triple bond $\rightarrow$ suffix "–yne"

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26. What is the molarity of a solution that contains 0.5 mol of NaCl in 250 mL of solution?

(a) 1 M

(b) 2 M

(c) 0.5 M

(d) 0.25 M

Correct Answer: (b) 2 M

Solution:

Molarity (M) is defined as:

$$M = \frac{\text{moles of solute}}{\text{volume of solution in L}}$$

Given: Moles of NaCl = 0.5 mol

Volume of solution = 250 mL = 0.25 L

$$M = \frac{0.5}{0.25} = 2\,\text{mol/L} = 2\,\text{M}$$

Option (b) is correct.

Quick Tip

Always convert volume to liters when calculating molarity: $1000\,\text{mL} = 1\,\text{L}$. Molarity = Moles / Liters

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