CUET 2025 June 2 Chemistry Question Paper With Solutions

Time Allowed :1 Hours	**Maximum Marks :**250	**Total questions :**50

General Instructions

Read the following instructions very carefully and strictly follow them:

1. The test is of 1 hour duration.
2. The question paper consists of 50 questions. The maximum marks are 250.
3. 5 marks are awarded for every correct answer, and 1 mark is deducted for every wrong answer.

1. How many molecules are present in 11.2 L of CO_2 at STP?

(1) 6.022×10^{22}

(2) 3.011×10^{23}

(3) 6.022×10^{23}

(4) 3.011×10^{22}

Correct Answer: (2) 3.011×10^{23}

Solution:

Step 1: At STP (Standard Temperature and Pressure), 1 mole of any ideal gas occupies 22.4 L.

Step 2: Therefore, the number of moles in 11.2 L of CO_2 is:

$$\text{Moles} = \frac{11.2}{22.4} = 0.5 \text{ mol}$$

Step 3: 1 mole contains 6.022×10^{23} molecules (Avogadro's number). So,

$$\text{Number of molecules} = 0.5 \times 6.022 \times 10^{23} = 3.011 \times 10^{23}$$

Quick Tip

Remember that 1 mole of any gas at STP occupies 22.4 L and contains 6.022×10^{23} molecules. Use simple proportions to solve such questions.

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2. Which metal is extracted by electrolytic reduction?

(1) Zinc

(2) Iron

(3) Sodium

(4) Copper

Correct Answer: (3) Sodium

Solution:

Step 1: Metals high in the reactivity series (like sodium, potassium, calcium, etc.) cannot be extracted using conventional chemical reduction methods (e.g., using carbon or carbon monoxide).

Step 2: These highly reactive metals are extracted by electrolytic reduction, where their molten salts (like molten NaCl) are electrolyzed.

Step 3: In the case of sodium, molten sodium chloride is electrolyzed to produce sodium metal at the cathode:

$$Na^+ + e^- \rightarrow Na \text{ (at cathode)}$$

Step 4: Metals like zinc and iron can be extracted by reduction with carbon, while copper is usually extracted from its ore by roasting and refining. Hence, only sodium is extracted using electrolytic reduction.

Quick Tip

Highly reactive metals (high in the reactivity series) are extracted by electrolytic reduction of their molten salts, while moderately reactive metals can be extracted using reducing agents like carbon.

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3. Which of the following is an example of an addition reaction?

(1) Ethene + $Br_2 \rightarrow$ 1,2-dibromoethane

(2) Ethanol $\rightarrow$ Ethene + H_2O

(3) $CH_4 + Cl_2 \rightarrow CH_3Cl + HCl$

(4) Benzene + $Br_2 \rightarrow$ Bromobenzene

Correct Answer: (1) Ethene + $Br_2 \rightarrow$ 1,2-dibromoethane

Solution:

Step 1: An addition reaction involves two reactants combining to form a single product, typically observed in compounds with double or triple bonds (like alkenes or alkynes).

Step 2: In Option (1), ethene (an alkene) reacts with bromine (Br_2) across the double bond, resulting in the formation of 1,2-dibromoethane. This is a classic example of an electrophilic addition reaction.

Step 3: The other options represent different types of reactions: - Option (2) is a dehydration (elimination) reaction.

- Option (3) is a substitution reaction.

- Option (4) is an example of aromatic electrophilic substitution.

Hence, only Option (1) qualifies as an addition reaction.

Quick Tip

Addition reactions typically occur with unsaturated hydrocarbons like alkenes and alkynes, where new atoms or groups are added to the carbon atoms of a double or triple bond.

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4. A compound contains 40% carbon, 6.7% hydrogen, and 53.3% oxygen by mass. What is its empirical formula?

(Atomic masses: C = 12, H = 1, O = 16)

(1) CH_2O

(2) $C_2H_4O_2$

(3) $C_3H_6O_3$

(4) C_2H_2O

Correct Answer: (1) CH_2O

Solution:

Step 1: Assume 100 g of the compound. So, mass of each element is:

Carbon = 40 g, Hydrogen = 6.7 g, Oxygen = 53.3 g

Step 2: Convert mass to moles:

Moles of C = $\frac{40}{12} = 3.33$

Moles of H = $\frac{6.7}{1} = 6.7$

Moles of O = $\frac{53.3}{16} = 3.33$

Step 3: Divide each mole value by the smallest number of moles (which is 3.33):

$$\text{C: } \frac{3.33}{3.33} = 1, \quad \text{H: } \frac{6.7}{3.33} \approx 2, \quad \text{O: } \frac{3.33}{3.33} = 1$$

Step 4: The simplest ratio is C:H:O = 1:2:1, so the empirical formula is CH_2O.

> **Quick Tip**
>
> To find the empirical formula, convert percentages to grams, grams to moles, divide by the smallest mole value, and round to nearest whole numbers to get the simplest ratio.

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5. A gas occupies 500 mL at 1 atm pressure. What will be its volume at 2 atm, temperature constant?

(1) 250 mL

(2) 500 mL

(3) 1000 mL

(4) 750 mL

Correct Answer: (1) 250 mL

Solution:

Step 1: Since the temperature is constant, we apply Boyle's Law:

$$P_1V_1 = P_2V_2$$

Given:

$P_1 = 1$ atm, $V_1 = 500$ mL, $P_2 = 2$ atm, $V_2 = ?$

Step 2: Substitute values into Boyle's law:

$$1 \times 500 = 2 \times V_2 \Rightarrow V_2 = \frac{500}{2} = 250 \text{ mL}$$

Step 3: Therefore, the new volume at 2 atm is 250 mL.

> **Quick Tip**
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> Use Boyle's Law ($P_1V_1 = P_2V_2$) when pressure and volume change but temperature remains constant.

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6. For the reaction $N_2 + 3H_2 \rightleftharpoons 2NH_3$, if equilibrium concentrations are:

$[N_2] = 0.5\,M,\ [H_2] = 1.5\,M,\ [NH_3] = 1.0\,M$

What is the value of K_c?

(1) 0.44

(2) 1.2

(3) 2.96

(4) 0.593

Correct Answer: (3) 0.593

Solution:

Step 1: Write the expression for equilibrium constant K_c:

$$K_c = \frac{[NH_3]^2}{[N_2][H_2]^3}$$

Step 2: Substitute the equilibrium concentrations:

$$K_c = \frac{(1.0)^2}{(0.5)(1.5)^3} = \frac{1.0}{0.5 \times 3.375} = \frac{1.0}{1.6875} \approx 0.593$$

Step 3: Hence, the value of K_c is approximately 0.593.

Quick Tip

Always raise each concentration to the power of its stoichiometric coefficient when writing equilibrium expressions.

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7. What is the n-factor of $KMnO_4$ in acidic medium?

(1) 2

(2) 3

(3) 5

(4) 7

Correct Answer: (3) 5

Solution:

Step 1: In acidic medium, potassium permanganate $KMnO_4$ acts as an oxidizing agent.

The Mn in $KMnO_4$ has an oxidation state of +7.

Step 2: The reduction half-reaction in acidic medium is:

$$MnO_4^- \rightarrow Mn^{2+}$$

Step 3: In this process, the oxidation state of Mn changes from +7 to +2.

Step 4: Therefore, the change in oxidation number is:

$$7 - 2 = 5$$

Step 5: Hence, the n-factor, which is the number of electrons gained or lost per formula unit, is 5.

Quick Tip

The n-factor of an oxidizing agent is the total number of electrons gained per molecule or ion. For $KMnO_4$ in acidic medium, Mn goes from +7 to +2, so n-factor = 5.

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8. The enthalpy of combustion of methane is -890 kJ/mol. What is the enthalpy change when 8 g of methane is burned?

(Molar mass = 16 g/mol)

(1) -890 kJ

(2) -445 kJ

(3) -222.5 kJ

(4) -556 kJ

Correct Answer: (2) -445 kJ

Solution:

Step 1: Given enthalpy of combustion of methane (ΔH_c) for 1 mole = -890 kJ/mol.

Molar mass of methane (CH_4) = 16 g/mol.

Step 2: Calculate the number of moles in 8 g of methane:

$$n = \frac{\text{mass}}{\text{molar mass}} = \frac{8}{16} = 0.5 \text{ mol}$$

Step 3: Calculate the enthalpy change for 0.5 mole:

$$\Delta H = n \times \Delta H_c = 0.5 \times (-890) = -445\,\text{kJ}$$

Step 4: Therefore, the enthalpy change when 8 g of methane is burned is $-445\,\text{kJ}$.

Quick Tip

Use the relation: $\Delta H = n \times \Delta H_{\text{molar}}$, where n is moles and ΔH_{molar} is the molar enthalpy change.

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9. What is the percentage of carbon in ethanol (C_2H_5OH)?

(Atomic masses: C = 12, H = 1, O = 16)

(1) 52.2%

(2) 40.0%

(3) 60.0%

(4) 46.1%

Correct Answer: (1) 52.2%

Solution:

Step 1: Calculate the molar mass of ethanol (C_2H_5OH):

$$= 2 \times 12 + 6 \times 1 + 1 \times 16 = 24 + 6 + 16 = 46\,\text{g/mol}$$

Step 2: Calculate the total mass of carbon in one mole of ethanol:

$$= 2 \times 12 = 24\,\text{g}$$

Step 3: Calculate the percentage of carbon:

$$\text{Percentage of C} = \frac{24}{46} \times 100 = 52.17\% \approx 52.2\%$$

Step 4: Hence, the percentage of carbon in ethanol is approximately 52.2%.

Quick Tip

To find the percentage of an element in a compound, divide the total mass of that element by the molar mass of the compound and multiply by 100.

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10. Given:

$E^\circ_{Zn^{2+}/Zn} = -0.76\,\text{V}$

$E^\circ_{Cu^{2+}/Cu} = +0.34\,\text{V}$

What is the EMF of the galvanic cell:

Zn | Zn^{2+} || Cu^{2+} | Cu?

(1) $+1.10\,\text{V}$

(2) $-1.10\,\text{V}$

(3) $+0.42\,\text{V}$

(4) $+0.76\,\text{V}$

Correct Answer: (1) $+1.10\,\text{V}$

Solution:

Step 1: Identify the anode and cathode:

- Zinc electrode (Zn) undergoes oxidation:

$$\text{Zn} \rightarrow \text{Zn}^{2+} + 2e^-$$

- Copper electrode (Cu^{2+}) undergoes reduction:

$$\text{Cu}^{2+} + 2e^- \rightarrow \text{Cu}$$

Step 2: Use standard electrode potentials:

$$E^\circ_{\text{cathode}} = +0.34\,\text{V}$$

$$E^\circ_{\text{anode}} = -0.76\,\text{V}$$

Step 3: Calculate the EMF of the cell:

$$E^\circ_{\text{cell}} = E^\circ_{\text{cathode}} - E^\circ_{\text{anode}} = 0.34 - (-0.76) = 0.34 + 0.76 = 1.10\,\text{V}$$

Step 4: Therefore, the EMF of the galvanic cell is $+1.10\,\text{V}$.

Quick Tip

EMF of a galvanic cell = $E^\circ_{\text{cathode}} - E^\circ_{\text{anode}}$. Remember to identify correctly which electrode is anode and cathode based on the standard potentials.

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11. How much water should be added to 100 mL of 1 M HCl to make it 0.25 M?

(1) 100 mL

(2) 200 mL

(3) 300 mL

(4) 400 mL

Correct Answer: (3) 300 mL

Solution:

Step 1: Use the dilution formula:

$$C_1V_1 = C_2V_2$$

where,

$C_1 = 1\,M$ (initial concentration),

$V_1 = 100\,\text{mL}$ (initial volume),

$C_2 = 0.25\,M$ (final concentration),

$V_2 = ?$ (final volume).

Step 2: Calculate V_2:

$$V_2 = \frac{C_1V_1}{C_2} = \frac{1 \times 100}{0.25} = 400\,\text{mL}$$

Step 3: Volume of water to be added = Final volume - Initial volume

$$= 400 - 100 = 300\,\text{mL}$$

Step 4: Therefore, 300 mL of water should be added.

Quick Tip

Use the dilution equation $C_1V_1 = C_2V_2$ to find the final volume and subtract initial volume to find how much solvent to add.
