MHT CET 2026 April 19 Shift 2

Question Paper with Solutions (Memory Based)

Conducted by CET Cell, Maharashtra

General Instructions

(i) **Duration:** The total duration of the examination is 3 hours (180 minutes).

(ii) **Total Marks:** The complete paper carries a maximum of 200 marks.

(iii) **Structure:** The paper has 3 Sections:

- **Section A:** 50 Multiple Choice Questions (Physics)
- **Section B:** 50 Multiple Choice Questions (Chemistry)
- **Section C:** 50 Multiple Choice Questions (Mathematics)

(iv) **Compulsory Questions:** All 150 questions are compulsory.

(v) Each question has four options. Only **one** option is correct.

(vi) **Right Answer:** Physics (+1 marks), Chemistry (+1 marks) and Mathematics (+2 marks).

(vii) **Incorrect Answer:** (No Negative marking).

(viii) **Unanswered/Marked for Review:** 0 marks.

1. The EAN of cobalt in the complex $[Co(NH_3)_6]^{3+}$ is:

(A) 27

(B) 30

(C) 33

(D) 36

Correct Answer: (D) 36

Solution:

Step 1: Understanding the Question:

The question asks for the Effective Atomic Number (EAN) of the central metal atom, cobalt (Co), in the coordination complex $[Co(NH_3)_6]^{3+}$.

Step 2: Key Formula or Approach:

The Effective Atomic Number (EAN) can be calculated using the formula:

$$EAN = Z - ON + (2 \times CN)$$

Where:

- Z is the atomic number of the central metal.
- ON is the oxidation state of the central metal.
- CN is the coordination number (number of ligands if they are monodentate).

Step 3: Detailed Explanation:

1. **Atomic number (Z):** For cobalt (Co), $Z = 27$.
2. **Oxidation State (ON):** Let the oxidation state of Co be x.

Ammonia (NH_3) is a neutral ligand, so its charge is 0.

Sum of charges: $x + 6(0) = +3 \Rightarrow x = +3$.

So, the oxidation state of cobalt is +3.

3. **Coordination Number (CN):** There are six NH_3 ligands attached to the cobalt atom. Since NH_3 is a monodentate ligand, the coordination number is 6.
4. **Calculate EAN:**

$$EAN = 27 - 3 + (2 \times 6)$$

$$EAN = 24 + 12 = 36$$

Step 4: Final Answer:

The EAN of cobalt in the complex $[Co(NH_3)_6]^{3+}$ is 36, which corresponds to the atomic number of the noble gas Krypton (Kr).

Quick Tip: The EAN rule (Sidgwick's rule) suggests that stable complexes often have an EAN equal to the atomic number of the next noble gas. Cobalt's next noble gas is Krypton ($Z = 36$), which helps verify your calculation.

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2. A cube of edge 4 cm has mass 256 g. The density of the material in SI unit is:

(A) 4 kg/m^3

(B) 1600 kg/m^3

(C) 4000 kg/m^3

(D) 1000 kg/m^3

Correct Answer: (C) 4000 kg/m^3

Solution:

Step 1: Understanding the Question:

The goal is to find the density of a cubic object given its mass and edge length, and then express it in the International System of Units (SI), which is kilograms per cubic meter (kg/m^3).

Step 2: Key Formula or Approach:

1. Volume of a cube: $V = l^3$, where l is the edge length.
2. Density formula: $\rho = \frac{\text{mass}}{\text{volume}}$.
3. Conversion: To convert g/cm^3 to kg/m^3, multiply by 1000.

Step 3: Detailed Explanation:

Given data:

- Edge length (l) = 4 cm
- Mass (m) = 256 g

Calculation:

1. Calculate the volume in cm^3:

$$V = (4 \text{ cm})^3 = 64 \text{ cm}^3$$

2. Calculate the density in g/cm^3:

$$\rho = \frac{256 \text{ g}}{64 \text{ cm}^3} = 4 \text{ g/cm}^3$$

3. Convert to SI units (kg/m^3):

Since $1 \text{ g} = 10^{-3} \text{ kg}$ and $1 \text{ cm}^3 = 10^{-6} \text{ m}^3$:

$$1 \text{ g/cm}^3 = \frac{10^{-3} \text{ kg}}{10^{-6} \text{ m}^3} = 1000 \text{ kg/m}^3$$

Therefore, $\rho = 4 \times 1000 \text{ kg/m}^3 = 4000 \text{ kg/m}^3$.

Step 4: Final Answer:

The density of the material is 4000 kg/m^3.

Quick Tip: Always be careful with units. You can convert to SI units at the very beginning (mass = 0.256 kg, edge = 0.04 m) or at the end. Often converting at the end is easier to avoid working with many leading zeros.

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3. The Van't Hoff factor for a solution of K_2SO_4 in water is:

(A) 1

(B) 2

(C) 3

(D) 4

Correct Answer: (C) 3

Solution:

Step 1: Understanding the Question:

The question asks for the Van't Hoff factor (i) for the electrolyte K_2SO_4 (assuming "KSO" is a typo for Potassium Sulfate, K_2SO_4, as it is a common exam example) when dissolved in water. The Van't Hoff factor represents the degree of dissociation of a solute.

Step 2: Key Formula or Approach:

For strong electrolytes that dissociate completely in dilute solutions:

$$i = \text{total number of ions produced per formula unit}$$

For an electrolyte A_xB_y that dissociates into xA^{y+} and yB^{x-}, the number of ions is $n = x + y$.

Step 3: Detailed Explanation:

When Potassium Sulfate (K_2SO_4) dissolves in water, it dissociates into its constituent ions as follows:

$$K_2SO_4(s) \rightarrow 2K^+(aq) + SO_4^{2-}(aq)$$

- Number of potassium ions (K^+) $= 2$
- Number of sulfate ions (SO_4^{2-}) $= 1$

Total number of ions produced $= 2 + 1 = 3$.

Assuming complete dissociation (ideal solution), the Van't Hoff factor i is equal to the number of ions produced.

Therefore, $i = 3$.

Step 4: Final Answer:

The Van't Hoff factor for a solution of K_2SO_4 in water is 3.

Quick Tip: For salts, just count the subscripts in the chemical formula to find the number of ions. For example, $NaCl$ has 2 ions ($i = 2$), K_2SO_4 has 3 ions ($i = 3$), and $AlCl_3$ has 4 ions ($i = 4$).

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4. Rosenmund reduction is used to convert acyl chlorides into:

(A) Alcohols

(B) Carboxylic acids

(C) Aldehydes

(D) Ketones

Correct Answer: (C) Aldehydes

Solution:

Step 1: Understanding the Question:

The question asks about the functional group transformation achieved using the Rosenmund reduction reaction.

Step 3: Detailed Explanation:

1. **Reaction Description:** Rosenmund reduction is a catalytic hydrogenation reaction where an acyl chloride (acid chloride) is selectively reduced.
2. **Reagents:** The catalyst used is hydrogen gas (H_2) over palladium (Pd) supported on barium sulfate ($BaSO_4$). The catalyst is often "poisoned" or partially deactivated with sulfur or quinoline to prevent over-reduction.
3. **Chemical Transformation:**

$$R-COCl \xrightarrow{H_2/Pd-BaSO_4} R-CHO + HCl$$

- The acyl chloride ($R-COCl$) group is converted into an aldehyde ($R-CHO$) group.
- Without the poisoned catalyst ($BaSO_4$), the aldehyde would be further reduced to a primary alcohol.

Step 4: Final Answer:

Rosenmund reduction converts acyl chlorides into aldehydes.

Quick Tip: Remember the specific reagent for Rosenmund: $Pd-BaSO_4$. It is the standard method to "stop" the reduction at the aldehyde stage.

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5. In the electrolysis of molten NaCl, the product obtained at the cathode is:

(A) Cl gas

(B) Na metal

(C) NaOH

(D) H gas

Correct Answer: (B) Na metal

Solution:

Step 1: Understanding the Question:

The question asks to identify the substance formed at the negative electrode (cathode) during the electrolysis of liquid (molten) sodium chloride.

Step 3: Detailed Explanation:

1. **Components:** Molten $NaCl$ contains only Na^+ and Cl^- ions. Unlike aqueous $NaCl$, there is no water to compete for reduction or oxidation.
2. **At the Cathode (Negative Electrode):**

Reduction occurs here. The positive Na^+ ions move toward the cathode, where they gain electrons.

$$Na^+ + e^- \rightarrow Na(l)$$

Sodium metal is deposited or formed at the cathode.

3. **At the Anode (Positive Electrode):**

Oxidation occurs here. The negative Cl^- ions move toward the anode, where they lose electrons.

$$2Cl^- \rightarrow Cl_2(g) + 2e^-$$

Chlorine gas is evolved at the anode.

Step 4: Final Answer:

The product at the cathode during the electrolysis of molten $NaCl$ is sodium (Na) metal.

Quick Tip: Always distinguish between **molten** and **aqueous** electrolysis. In aqueous $NaCl$ electrolysis, hydrogen gas (H_2) is obtained at the cathode instead of sodium metal because water is easier to reduce than sodium ions.

