# CUET 2025 Chemistry Memory based Question Paper with Solution

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**1. Arrange the following in decreasing order of number of molecules contained in:**

(A) 16 g of $O_2$

(B) 16 g of $CO_2$

(C) 16 g of $CO$

(D) 16 g of $H_2$

**Correct Answer:** (D) 16 g of $H_2$, (A) 16 g of $O_2$, (C) 16 g of $CO$, (B) 16 g of $CO_2$

**Solution:**

The number of molecules is inversely proportional to the molar mass. To calculate the number of molecules, we need to divide the given mass by the molar mass of the substance and then multiply by Avogadro's number $N_A$.

1. For $16\,\text{g}\,O_2$:

$$\text{Moles of } O_2 = \frac{16}{32} = 0.5\,\text{mol}$$

Number of molecules:

$$0.5 \times N_A$$

2. For $16\,\text{g}\,CO_2$:

$$\text{Moles of } CO_2 = \frac{16}{44} = 0.3636\,\text{mol}$$

Number of molecules:

$$0.3636 \times N_A$$

3. For $16\,\text{g}\,CO$:

$$\text{Moles of } CO = \frac{16}{28} = 0.5714\,\text{mol}$$

Number of molecules:

$$0.5714 \times N_A$$

4. For $16\,\text{g}\,H_2$:

$$\text{Moles of } H_2 = \frac{16}{2} = 8\,\text{mol}$$

Number of molecules:

$$8 \times N_A$$

Thus, the order of number of molecules is:

$$H_2 > O_2 > CO > CO_2$$

**Quick Tip**

To determine the number of molecules in a given mass of a substance, use the formula moles $= \frac{\text{mass}}{\text{molar mass}}$ and multiply by Avogadro's number $N_A$. The substance with the smallest molar mass will have the largest number of molecules.

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**2. Which of the following compounds will be repelled when placed in an external magnetic field?**

(A) $FeCl_3$

(B) $FeSO_4$

(C) NaCl

(D) $CuSO_4$

**Correct Answer:** (C) NaCl

**Solution:**

In the context of magnetic behavior, compounds are classified based on their response to an external magnetic field. These substances can be classified as diamagnetic, paramagnetic, or ferromagnetic:

1. Diamagnetic substances: These materials are weakly repelled by a magnetic field and do not have unpaired electrons. The electrons in diamagnetic substances are all paired, so there is no net magnetic moment. Therefore, diamagnetic compounds are repelled by an external magnetic field. An example of this is NaCl, which is a diamagnetic substance.

2. Paramagnetic substances: These materials are weakly attracted to a magnetic field because they contain unpaired electrons that align with the field. However, their magnetic effect is weaker compared to ferromagnetic substances. $FeCl_3$ is an example of a paramagnetic substance, as it contains unpaired electrons in the iron ion ($Fe^{3+}$).

3. Ferromagnetic substances: These substances have a strong attraction to magnetic fields due to the alignment of unpaired electrons in a coordinated manner. This phenomenon occurs in materials like iron, cobalt, and nickel.

Now, analyzing the options:

- $FeCl_3$ is paramagnetic and will be attracted to an external magnetic field because of the unpaired electrons in iron

. - $FeSO_4$ is also paramagnetic due to the unpaired electrons in $Fe^{2+}$, and will be attracted to the magnetic field.

- NaCl is diamagnetic, which means it is repelled by the external magnetic field due to all paired electrons in the sodium and chloride ions.

- $CuSO_4$ is paramagnetic because copper in the $Cu^{2+}$ state has unpaired electrons, so it will also be attracted to the magnetic field.

Thus, the correct answer is NaCl, as it will be repelled due to its diamagnetic nature.

**Quick Tip**

Substances with unpaired electrons are paramagnetic and are attracted to a magnetic field, while substances without unpaired electrons are diamagnetic and are repelled. A quick way to determine this is by checking the electron configuration of the atoms or ions involved.

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**3. The total number of ions produced from the complex $[Cr(NH_3)_6]Cl_3$ in aqueous solution will be?**

(A) 3

(B) 6

(C) 9

(D) 12

**Correct Answer:** (B) 6

**Solution:**

We are asked to find the total number of ions produced when the complex $[Cr(NH_3)_6]Cl_3$

dissociates in aqueous solution.

The given complex is $[Cr(NH_3)_6]Cl_3$. This complex consists of a central metal ion $Cr^{3+}$ coordinated with six ammonia molecules (denoted as $NH_3$) and three chloride ions $Cl^-$ as counterions.

Step 1: Dissociation in water When the complex $[Cr(NH_3)_6]Cl_3$ is placed in water, it dissociates into its components. The dissociation reaction is as follows:

$$[Cr(NH_3)_6]Cl_3 \rightarrow [Cr(NH_3)_6]^{3+} + 3Cl^-$$

Here: - $[Cr(NH_3)_6]^{3+}$ is the complex ion. - The 3 $Cl^-$ ions are the counterions.

Step 2: Counting the ions produced The dissociation produces: - 1 ion of $[Cr(NH_3)_6]^{3+}$ - 3 ions of $Cl^-$

Thus, the total number of ions produced is:

$$1\,\text{(from the complex ion)} + 3\,\text{(from the chloride ions)} = 6\,\text{ions}$$

Conclusion: The total number of ions produced from the dissociation of $[Cr(NH_3)_6]Cl_3$ is 6.

**Quick Tip**

When a coordination complex dissociates in water, the total number of ions is equal to the sum of the ions produced from the complex and its counterions (such as $Cl^-$ or other anions).

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**4. The gold number range of some of the lyophilic colloids is given below:**

**A:** 0.005 - 0.01, **B:** 0.15 - 0.25, **C:** 0.04 - 1.0, **D:** 15 - 25.

**Solution:**

The gold number is a measure of the protective power of colloids. The lower the gold number, the more effective the colloid is in preventing the coagulation of gold.

- A lower gold number indicates better protection (A has the best protective power).
- Higher values of gold number are observed for less protective colloids (D has the lowest protective power).

Quick Tip

Lyophilic colloids with lower gold numbers have greater protective power and are more effective in stabilizing the dispersed phase.

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**5. The oxidation number of Co in complex $[Co(H_2NCH_2CH_2NH_2)_3]_2(SO_4)_3$ is?**

(A) +2

(B) +3

(C) +1

(D) +4

**Correct Answer:** (B) +3

**Solution:**

In the complex $[Co(H_2NCH_2CH_2NH_2)_3]_2(SO_4)_3$, the $SO_4^{2-}$ ions contribute -2 charge each. Since there are three $SO_4^{2-}$ ions per complex, the total negative charge is $3 \times (-2) = -6$. Let the oxidation number of Co be $x$. Since the complex is neutral, the sum of charges must equal zero. For each Co complex, we have:

$$2x + (-6) = 0$$

$$2x = 6$$

$$x = 3$$

Thus, the oxidation number of Co is +3.

Quick Tip

To determine the oxidation number of an element in a coordination complex, balance the charges of the ligands and counterions. Use the fact that the total charge of the complex must equal zero.

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