

CLASS 10

SCIENCE

EXTRA QUESTIONS

Extra Questions: Class 10 Science Chapter 3 Metals and Non-metals

These go beyond the standard exercise into genuine HOTS (Higher Order Thinking Skills) territory -- assertion-reason, distinguishing tests, extraction/refining process reasoning, and a quantitative problem. See the standard-level Solutions first if you haven't already.

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How These Differ From the Textbook Exercises

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Extra Questions (HOTS Level): Metals and Non-metals (Class 10 Science Chapter 3)

Q1. Assertion (A): Sodium metal is stored under kerosene oil. Reason (R): Sodium reacts vigorously with atmospheric oxygen and moisture, and kerosene, being unreactive with sodium and immiscible with water, keeps air and water away from it. Which is correct?

Both statements are individually true. Sodium is highly reactive and can catch fire on exposure to moist air. Kerosene forms a physical barrier that does not itself react with sodium, so it is an effective way to isolate the metal from air and water.

Both A and R are true, and R is the correct explanation of A.

Q2. You are given two white powders in unlabelled bottles: one is zinc oxide (ZnO) and the other is calcium oxide (CaO). Using only dilute sodium hydroxide solution, how would you identify which is which?

Add dilute NaOH solution to a small sample of each powder. Zinc oxide is amphoteric, so it reacts with the base and dissolves to form a clear solution of sodium zincate: $\text{ZnO} + 2\text{NaOH} \rightarrow \text{Na}_2\text{ZnO}_2 + \text{H}_2\text{O}$. Calcium oxide is a basic oxide, not amphoteric, so it does not dissolve in NaOH — it just remains as an insoluble white residue (it would instead react with water to form a $\text{Ca}(\text{OH})_2$ suspension). **The powder that dissolves in NaOH is ZnO; the one that stays undissolved is CaO.**

Q3. A freshly cut piece of sodium metal loses its shiny appearance within seconds when left in air, while a freshly cut piece of gold retains its shine indefinitely under the same conditions. Explain this difference using the reactivity series.

Sodium lies very high in the reactivity series and reacts almost instantly with the oxygen and moisture present in air, forming a dull layer of sodium oxide/hydroxide on its surface. Gold lies at the very bottom of the reactivity series and is one of the least reactive metals known — it does not react with atmospheric oxygen or moisture at all, so its surface stays bright and untarnished indefinitely.

Q4. An ore of a metal M is a sulphide, and M lies in the middle of the reactivity series. Describe, step by step, how the pure metal would be extracted from this ore, including the equations for the key steps.

Step 1 — Concentration: the powdered ore is concentrated by the froth flotation process, which separates the sulphide ore particles from the gangue (rocky impurities) using their differing wettability.

Step 2 — Roasting: the concentrated sulphide ore is heated strongly in excess air to convert it into the metal oxide: $2\text{MS} + 3\text{O}_2 \rightarrow 2\text{MO} + 2\text{SO}_2$.

Step 3 — Reduction: the metal oxide is then reduced to the free metal by heating it with carbon (as coke): $\text{MO} + \text{C} \rightarrow \text{M} + \text{CO}$.

Step 4 — Refining: the extracted metal, which still contains impurities, is purified by electrolytic refining to obtain the pure metal M.

This is why sulphide ores are always roasted to the oxide before reduction, rather than reduced directly.

Q5. On strong heating, 100 g of a metal carbonate (MCO_3) decomposes completely into a metal oxide and carbon dioxide gas, releasing 44 g of CO_2 . (a) Calculate the mass of the metal oxide formed. (b) Given that the molar mass of MCO_3 is 100 g/mol, work out the molar mass of the metal oxide, and suggest which common metal M could be.

(a) By the law of conservation of mass: mass of oxide = mass of carbonate – mass of CO_2 = 100 g – 44 g =

56 g.

(b) 44 g of CO_2 is exactly 1 mole (molar mass of $\text{CO}_2 = 44 \text{ g/mol}$), so 1 mole of carbonate (100 g) produces 1 mole of oxide, meaning the oxide's molar mass is also 56 g/mol. A carbonate of molar mass 100 g/mol with an oxide of molar mass 56 g/mol matches calcium: CaCO_3 ($40 + 12 + 48 = 100 \text{ g/mol}$) decomposing to CaO ($40 + 16 = 56 \text{ g/mol}$).

**M is most likely calcium.****Q6. Why do ionic compounds conduct electricity when molten or dissolved in water, but not when in the solid state?**

Electrical conductivity requires charged particles (ions) that are free to move. In the solid state, the ions in an ionic compound are locked tightly in a rigid crystal lattice by strong electrostatic forces and cannot move, so no current flows. When the compound is melted or dissolved in water, the lattice breaks down and the ions become free to move throughout the liquid, allowing them to carry electric charge — so the substance conducts electricity only in the molten or dissolved state.

How These Differ From the Textbook Exercises

The standard exercise checks whether you know the core facts — the reactivity series, amphoteric oxides, extraction steps. These HOTS questions push further: they ask you to apply that same knowledge to identify unlabelled substances experimentally, reason through a multi-step extraction process from scratch, and work backward from numerical data to identify an unknown metal — exactly the style CBSE uses in its higher-mark (3–5 mark) case-based and application questions.