• Metals and Non-Metals

1. Why do ionic compounds conduct electricity in molten state and not in solid state? (CBSE 2014, 2023)

2. The reaction of metal X with Fe_2O_3 is highly exothermic and is used to join railway tracks. Identify metal X. Write the chemical equation for the reaction. (CBSE 2016, 2023)

3. Zinc is a metal found in the middle of the activity series of metals. In nature, it is found as a carbonate ore, $ZnCO_3$. Mention the steps carried out for extraction from the ore. (CBSE 2023, 2013)

4. Differentiate between roasting and calcination giving chemical equations for each. (CBSE 2013, 2023)

5. Why are copper vessels corroded with a green coating in the rainy season? (CBSE 2015, 2016, 2019)

Solutions

1. Ionic compounds do not conduct electricity in solid state because ions are not free to move. In molten state, ions are free to move.

2. X is Aluminium.

$$2Al + Fe_2O_3 \longrightarrow Al_2O_3 + 2Fe$$

3. Conversion of the carbonate ore into metal oxide: This is done by calcination (for carbonate ores). Calcination is the process of heating the ore strongly in the absence or limited supply of air. The zinc carbonate on heating decomposes to form zinc oxide as shown:

Reduction of the metal oxide to metal :As zinc is moderately reactive, zinc oxide cannot be reduced by heating alone. Hence, it is reduced to zinc by using a reducing agent such as carbon.

$$\underset{\substack{\text{Zinc carbonate}\\ \text{(Calamine-ore of Zn)}}}{ZnCO_{3(s)}} \xrightarrow[\text{(Absence of air)}]{\text{Heat}} ZnO_{(s)} + CO_{2(g)}$$

$$\underset{\text{Zinc oxide}}{ZnO_{(s)}} + \underset{\text{Coke}}{C_{(s)}} \xrightarrow{\text{Heat}} \underset{\text{Zinc}}{Zn_{(s)}} + \underset{\text{Carbon monoxide}}{CO_{(g)}}$$

4.

Roasting	***Calcination***
Ore is heated in excess of air.	Ore is heated in the absence or limited supply of air.
This is used for sulphide ores.	This is used for carbonate ores.
SO_2 is produced along with metal oxide.	CO_2 is produced along with metal oxide.
e.g. $2ZnS + 3O_2 \xrightarrow{\Delta} 2ZnO + 2SO_2$	e.g. $ZnCO_3 \xrightarrow{\Delta} ZnO + CO_2$

5. Solder is an alloy which is made up of lead and tin.
Solder has a low melting point so it is used for welding electrical wires.