

Oxides: acidic, basic and amphoteric

Classify oxides by how they react with acids and bases

- Chemical nature of oxides

- ◆ Basic oxides (mostly metallic)

Formed by most metals in low-to-moderate oxidation states: Na_2O , K_2O , CaO , MgO .

React with acids to form salt and water: $\text{MgO} + 2\text{HCl} \rightarrow \text{MgCl}_2 + \text{H}_2\text{O}$.

Some basic oxides react with water to form hydroxides: $\text{CaO} + \text{H}_2\text{O} \rightarrow \text{Ca(OH)}_2$.

- ◆ Amphoteric oxides (dual nature)

Amphoteric oxides show both acid and base behaviour; examples include Al_2O_3 and ZnO .

Al_2O_3 as a base with acid: $\text{Al}_2\text{O}_3 + 6\text{HCl} \rightarrow 2\text{AlCl}_3 + 3\text{H}_2\text{O}$.

With strong base under suitable conditions: $\text{Al}_2\text{O}_3 + 2\text{NaOH} \rightarrow 2\text{NaAlO}_2 + \text{H}_2\text{O}$.

- Acidic oxides (mostly non-metallic)

Formed by non-metals (CO_2 , SO_2 , SO_3 , P_4O_{10}) and some high-valence metals (CrO_3).

React with bases to form salt and water: $\text{CO}_2 + \text{Ca(OH)}_2 \rightarrow \text{CaCO}_3 + \text{H}_2\text{O}$.

Some react with water to form oxyacids: $\text{SO}_3 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{SO}_4$.

- Neutral oxides and periodic trend

Neutral oxides such as CO do not show the usual acid–base oxide behaviour.

Across a period (left to right), oxides shift: basic → amphoteric → acidic.

Test chemical behaviour with acid and base rather than assuming all non-metals match.

REMEMBER Classify oxides by their reactions: basic, acidic, amphoteric or neutral.