

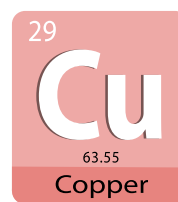
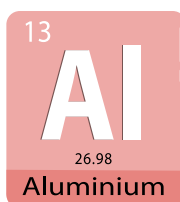
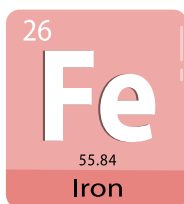
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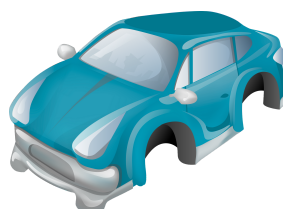
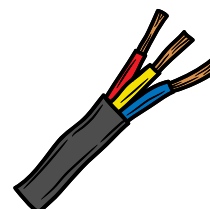
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1. Introduction

- **Metals** are shiny, strong and good conductor of heat and electricity making them useful for tools, wires, and structures.
- Metals are naturally found in the Earth's crust combined with other elements in mineral deposits called ores, which are then extracted through mining and refined for use.
- Some common metals:



Daily-life examples where metals are used:



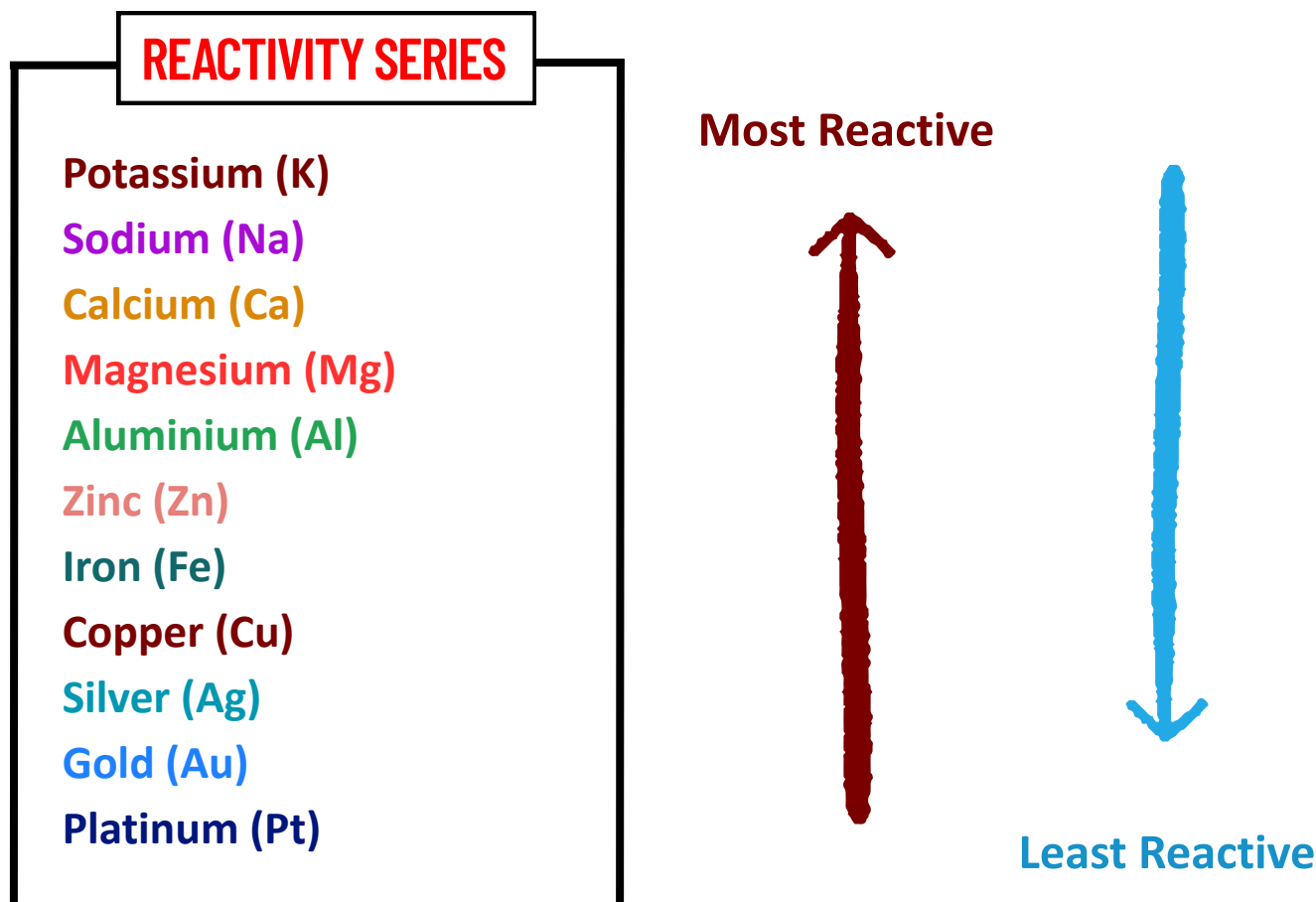
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2. The Reactivity Series of Metals

- **Reactivity** is the ability of a substance, especially a metal, to undergo a chemical reaction with other substances like water, acids, or oxygen.
- It shows how easily a metal can lose electrons to form positive ions.
- If a metal reacts quickly, it is highly reactive.
- If it reacts slowly or not at all, it is less reactive or unreactive.

Reactivity Series of Metals:

- The reactivity series is a list of metals that shows how easily different metals react.
- It is arranged in order of their reactivity, from most to least reactive.
- A common series is:



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Extraction of Metals:

Method	Reason	Metals
Electrolysis	Metals are very highly reactive. Their oxides are too stable, so they cannot be reduced by carbon or hydrogen.	Potassium (K), Sodium (Na), Calcium (Ca), Magnesium (Mg), Aluminium (Al)
Reduction by Carbon	Metals are moderately reactive. Their oxides are less stable, so carbon is a strong enough reducing agent.	Zinc (Zn), Iron (Fe), Tin (Sn), Lead (Pb)
Reduction by Hydrogen / Found Native	Metals are less reactive or very unreactive, so their oxides can be reduced by hydrogen or heat, or they occur in native (pure) form.	Copper (Cu), Mercury (Hg), Silver (Ag), Gold (Au), Platinum (Pt)

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3. What are Oxidation and Reduction?

- Oxidation and reduction are the reactions which always happen together in a redox reaction.
- They involve moving electrons from one substance to another.

Oxidation

- Oxidation is the gain of oxygen by a substance or the loss of electrons during a reaction.

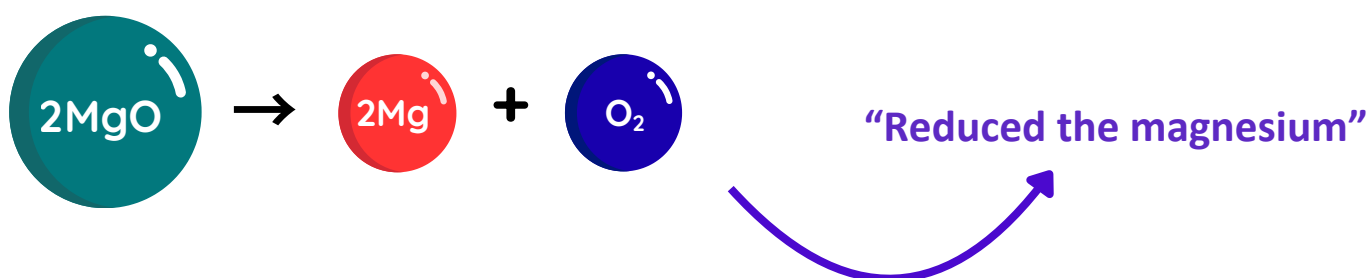


Where:

- **Mg** = **Magnesium**
- **O** = **Oxygen**

Reduction

- Reduction is the loss of oxygen by a substance or the gain of electrons during a reaction.



Where:

- **Mg** = **Magnesium**
- **O** = **Oxygen**

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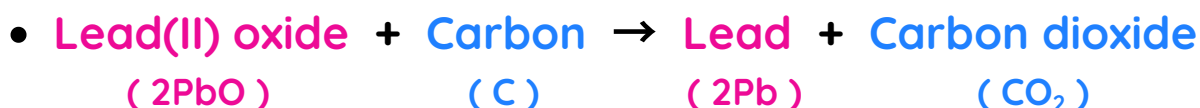
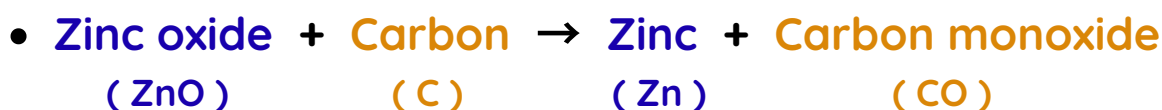
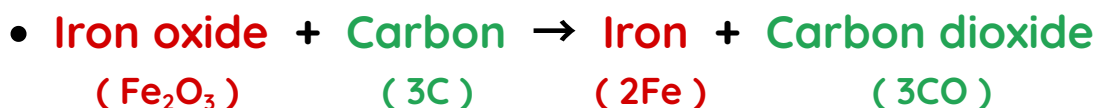
4. How are Oxidation and Reduction used to extract Metals?

- Most metals are found in nature combined with oxygen or other elements, not as pure metals.
- To get the pure metal, we need to remove the oxygen from these compounds.
- This is done using a process called **reduction**.
- In simple words, reduction helps us take away oxygen, so we get the pure metal we need.
- We can use carbon or hydrogen as reducing agents to take away the oxygen.

Extraction of Metals from Oxides using Carbon:

- Metals below carbon in the reactivity series are - zinc, iron, lead, copper and these metals can be extracted from their oxides using carbon.
- Carbon removes oxygen from the metal oxide to form pure metal, while carbon itself gets oxidised to carbon dioxide.

Examples:



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Extraction of Metals from Oxides using Hydrogen:

- Metals below hydrogen in the reactivity series are - copper, silver etc. are less reactive and so these metals can be extracted from their oxides using hydrogen.
- Hydrogen removes oxygen from the metal oxide to form pure metal, while hydrogen itself is oxidised to water.

Examples:

- Copper oxide** + **Hydrogen** → **Copper** + **Water**
(CuO) (H₂) (Cu) (H₂O)
- Tungsten(VI) oxide** + **Hydrogen** → **Tungsten** + **Water**
(WO₃) (3H₂) (W) (3H₂O)
- Lead oxide** + **Hydrogen** → **Lead** + **Water**
(PbO) (H₂) (Pb) (H₂O)

For highly reactive metals:

- Metals like aluminium and sodium are very reactive, so they are high up in the reactivity series.
- They form strong bonds with oxygen, making very stable compounds.
- Carbon is not reactive enough to remove the oxygen from these metals, so we cannot use carbon to extract them.
- We need to use other methods like electrolysis to get these metals

Note: To Learn about **Electrolysis**, please tap on the link

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5. FAQs

1. What is the reactivity series?

It is a list of metals arranged from most reactive to least reactive, helping us understand how metals react with water, air, acids, and how they are extracted.

2. Why are metals found as oxides in nature?

Because metals react with oxygen in air, forming stable metal oxides over time.

3. How are less reactive metals extracted?

Less reactive metals (like iron, zinc, lead, copper) are extracted from their oxides using carbon or hydrogen, which remove oxygen from the metal oxide (reduction).

4. How are highly reactive metals extracted?

Highly reactive metals (like aluminium, sodium, potassium) are extracted using electrolysis, as they are too reactive for carbon to reduce their oxides.

5. What is oxidation in metals?

When a metal gains oxygen or loses electrons during a reaction.

6. What is reduction in metals?

When a metal loses oxygen or gains electrons during a reaction, usually when extracting metals from their oxides.

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7. Why can carbon extract some metals but not all?

Carbon can only extract metals below it in the reactivity series because they are less reactive than carbon, but it cannot extract metals above it (like aluminium and sodium) as they are too reactive.

8. Why is hydrogen used in extraction?

Hydrogen can reduce metal oxides of less reactive metals (below hydrogen in the series) to obtain pure metals, forming water in the process.

9. What are Pure Metals?

These are metals that do not have any other substances mixed in them. They contain only one type of metal atom and have clear properties like a fixed melting point, good conductivity, and shine.

Example: Pure gold, pure copper, pure iron.

10. What are Impure Metals?

These are metals that have other substances mixed in them (like other metals or non-metals). They may contain impurities from extraction or mixing, making them less shiny and reducing conductivity.

Example: Cast iron (contains carbon impurities), unrefined copper, and impure gold with other metal traces.