

# Section 5 Summary

## 5.1 Uses of Metals

- a) **Unreactive** metals are found **uncombined** in the Earth's crust:
- gold
  - silver
- } Expensive due to rarity
- copper
- b) Most metals are found **combined** with other elements called **ores**.
- Aluminium
  - Potassium
  - Sodium
  - Iron
- c) Some metals are **extracted** from their ores by **heating with carbon**.
- Iron
- d) Some metals are **extracted** from their ores using **electricity** (electrolysis)
- aluminium
- e) **All metal** elements are **conductors** of electricity
- non-metal elements are non-conductors of electricity.
  - carbon (graphite) is the *only* non-metal conductor
- f) The specific **properties** of metals are related to their uses.

Property	Use
low density	aluminium used in aircraft bodies
malleability	shaping steel to make armour
thermal (heat) conductivity	iron metal in a wire gauze in tripod
electrical conductivity	copper wires in electrical devices
strength	iron used in a bridge

- g) An **alloy** is a mixture of metals (can be metals with non-metals).
- h) Alloys are made to have specific uses.

<b>Alloy</b>	brass	solder	'stainless' steel	cupro-nickel
<b>Use</b>	ornaments	rejoining loose wiring	cutlery	coins
<b>Property of Alloy</b>	Does not tarnish and has good appearance	Low melting point	Does not rust	Cheaper than silver and hard-wearing



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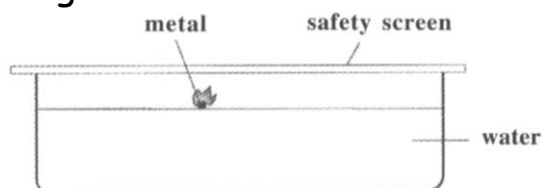
## 5.2 Reactions of Metals

a) Metal oxides are produced in the reactions of metals with oxygen:

- potassium corrodes very quickly in air
- tin corrodes very slowly in air
- gold does not corrode in air

b) **Reactions of metals with water** produce hydrogen.

- Potassium
  - Sodium
  - Lithium
  - Calcium
  - Magnesium
- } vigorously reacts with water
- Magnesium very slowly reacts with water



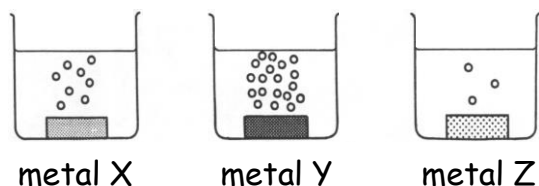
c) **Reactions of metals with dilute acid** produce a salt and hydrogen gas.

- **Magnesium** e.g. magnesium + hydrochloric acid → magnesium chloride + hydrogen
- aluminium
- zinc
- **iron** e.g. iron + sulphuric acid → iron sulphate + hydrogen
- tin
- **lead** e.g. lead + nitric acid → lead nitrate + hydrogen

d) **Unreactive metals** do not react with oxygen, dilute acid or water

- copper
- silver
- gold

e) Differences in the reactions give an indication of the **reactivity** of the metals.



Reactivity	Metal
most bubbles → most reactive	metal Y
medium reactivity	metal X
least bubbles → least reactive	metal Z

f) The **test for hydrogen** is that it burns with a "pop".

# Section 5 Summary

## 5.3 Corrosion

- a) **Corrosion** is a chemical reaction on the surface of a metal
  - metal chemically changes from an element to a compound.
- b) **Rusting** is the corrosion of iron.
- c) Rusting results in a loss of **structural strength**.
  - e.g. a old rusty metal bridge would collapse
- d) Both **water and oxygen** (from air) are required for rusting/corrosion.
- e) **Rust indicator** can be used to show the extent of the rusting process.
  - The deeper the blue colour of rust indicator, the greater the rusting
- f) **Acid rain** increases the rate of corrosion.
- g) **Salt** spread on roads increases the speed of corrosion on car bodywork.
- h) Many ways to protect against corrosion involve a **physical barrier**:

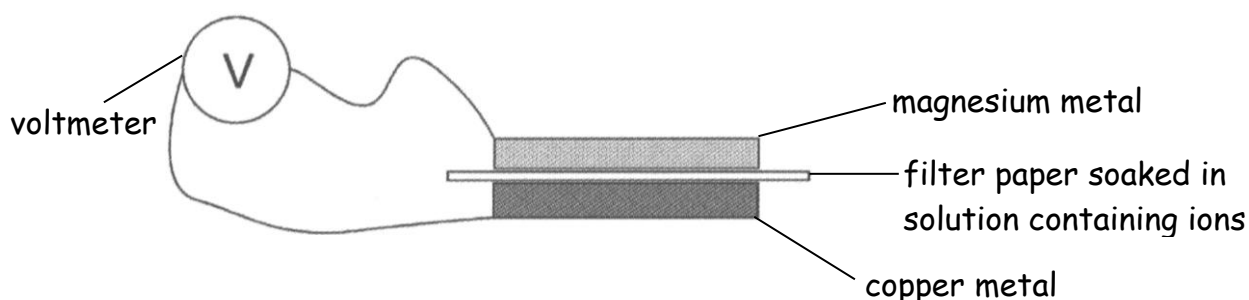
Prevention Method	Explanation of Barrier
painting	} Barrier to prevent air + water getting to metal underneath
greasing	
plastic coating	
electroplating	Coating an unreactive metal barrier over another metal
tin-plating	Unreactive tin layer on outside protects iron underneath
galvanising	Zinc layer on outside of iron protects iron underneath
anodising	Increasing the protective outer layer on aluminium

- i) Iron does not rust when **attached to more reactive metals**.
  - **Galvanising** is when zinc coats iron      e.g. galvanised rubbish bins
  - scrap magnesium attached to iron      e.g. underground iron pipes
- j) **Anodising** gives aluminium protection against corrosion
  - increases the thickness of the oxide layer on aluminium surface.

# Section 5 Summary

## 5.4 Batteries

- a) In a battery, electricity (electrical energy) is produced from a **chemical reaction**.
- b) Batteries need replacing when all the chemicals are **used up** in the chemical reaction.
- c) There are **rechargeable batteries**
- lead-acid battery used as a car battery
  - nickel-cadmium battery.
- d) Electricity can be produced by forming a **cell**:
- connecting different metals together
  - solution containing ions between the metals



- e) The purpose of the **ion solution** between the metals is to complete the circuit.
- f) The **voltage** between different pairs of metals varies:
- Bigger the difference in reactivity in metals - Bigger Voltage
  - Smaller the difference in reactivity in metals - Smaller Voltage
- NB: The metals are listed in order of reactivity on page 6 of data booklet