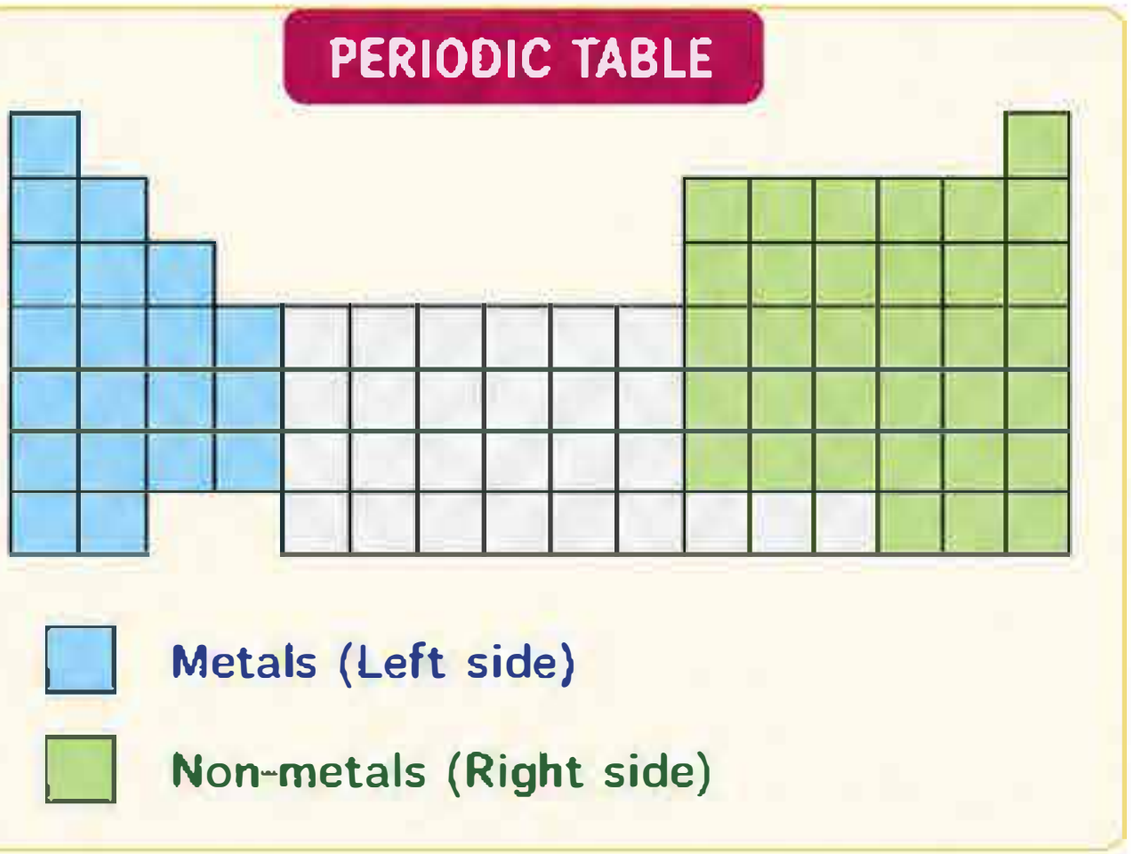
METALS AND NON-METALS

PART 1 : INTRODUCTION TO METALS & NON-METALS

1 WHAT ARE METALS ?

- Metals are elements that lose electrons to form **positive ions (cations)**.
- They are generally **hard, lustrous** and **good conductors** of heat and electricity.
- Metals are found on the **left side** of the periodic table.

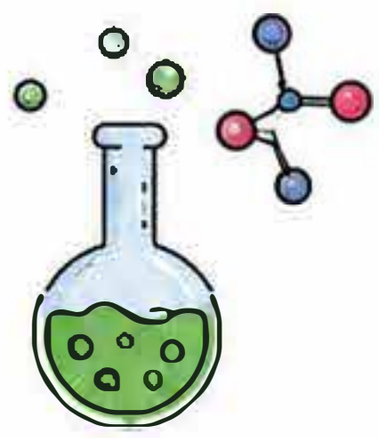
EXAMPLES Iron (Fe), Copper (Cu), Aluminium (Al), Zinc (Zn), Sodium (Na)



2 WHAT ARE NON-METALS ?

- Non-metals are elements that gain electrons to form **negative ions (anions)**.
- They are generally **dull, brittle** and **poor conductors** of heat and electricity.
- Non-metals are found on the **right side** of the periodic table.

EXAMPLES
- Oxygen (O)
- Nitrogen (N)
- Sulphur (S)
- Chlorine (Cl)
- Carbon (C)



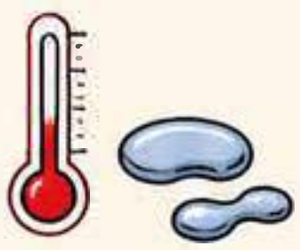
3 METALLOIDS

- Some elements show properties of both metals and non-metals. They are called **metalloids**.

EXAMPLES
- Silicon (Si)
- Germanium (Ge)

EXCEPTIONS (NOT TRUE FOR ALL METALS)

- ★ **Mercury (Hg)** → It is a liquid metal at room temperature.
- ★ **Sodium (Na) and Potassium (K)** → These are very soft metals.
- ★ **Lead (Pb)** → It is a poor conductor of heat and electricity.



QUICK NOTE

- Metals are on the **left side** of the periodic table.
- Non-metals are on the **right side** of the periodic table.

PART 2 PHYSICAL PROPERTIES OF METALS

Metals have the following physical properties.

1 LUSTROUS (SHINY)

Metals have a shiny surface when polished.

EXAMPLES


Silver


Copper

2 MALLEABLE

Metals can be beaten into thin sheets without breaking.

EXAMPLES


Gold


Aluminium

3 DUCTILE

Metals can be drawn into thin wires without breaking.

EXAMPLES


Copper


Aluminium

4 GOOD CONDUCTORS OF HEAT AND ELECTRICITY

Metals are good conductors of heat and electricity.

EXAMPLES


Copper


Aluminium

5 HIGH MELTING AND BOILING POINTS

Metals have generally high melting and boiling points.

EXAMPLES


Iron


Tungsten

6 SONOROUS

Metals produce a ringing sound when struck.

EXAMPLES


Bell (Brass)


Tuning Fork (Steel)

EXCEPTIONS (NOT TRUE FOR ALL METALS)

★ **Mercury (Hg)**

It is a liquid metal at room temperature.

★ **Sodium (Na) and Potassium (K)**

These are very soft metals.

★ **Lead (Pb)**

It is a poor conductor of heat and electricity.

QUICK NOTE

- Metals are generally hard, shiny, malleable, ductile, good conductors of heat and electricity, have high melting and boiling points and are sonorous.
- These properties make metals very useful in our daily life.

CHEMICAL PROPERTIES OF METALS

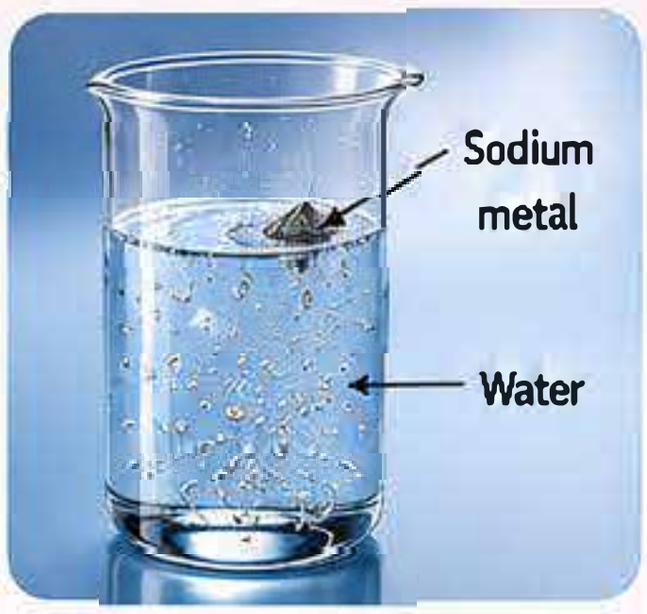
Metals show the following chemical properties.

2 REACTION WITH WATER

- Metals react with water to form **metal hydroxides** and **hydrogen gas.**

$$2Na + 2H_2O \longrightarrow 2NaOH + H_2\uparrow$$

Sodium + Water → Sodium hydroxide + Hydrogen gas



OBSERVATION

- ✓ More reactive metals react vigorously with water.
  (e.g., Na, K, Ca)

3 REACTION WITH ACIDS

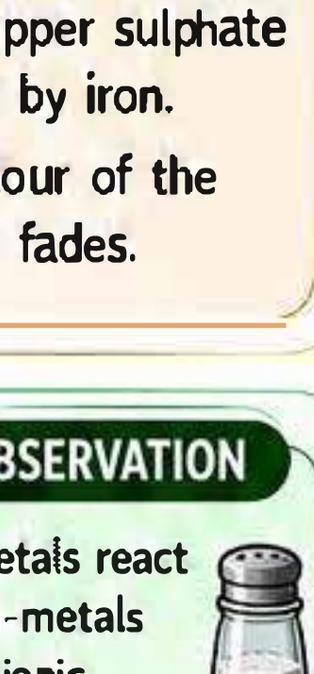
- Metals react with dilute acids to form **salt** and **hydrogen gas.**

$$Zn + 2HCl \longrightarrow ZnCl_2 + H_2\uparrow$$

Zinc + Hydrochloric acid → Zinc chloride + Hydrogen gas

OBSERVATION

- ✓ Hydrogen gas is produced with a 'pop' sound.

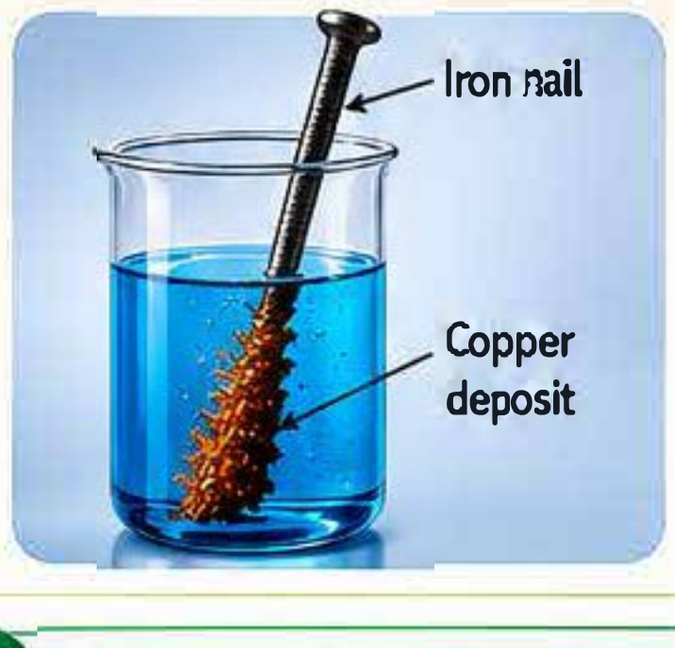


4 REACTION WITH SALTS

- A more reactive metal **displaces** a less reactive metal from its salt solution.

$$Fe + CuSO_4 \longrightarrow FeSO_4 + Cu$$

Iron + Copper sulphate → Iron sulphate + Copper



OBSERVATION

- ✓ Copper is displaced from copper sulphate solution by iron.
- ✓ Blue colour of the solution fades.

5 REACTION WITH NON-METALS

- Metals also react with non-metals like chlorine to form **ionic compounds.**

$$2Na + Cl_2 \longrightarrow 2NaCl$$

Sodium + Chlorine → Sodium chloride

OBSERVATION

- ✓ Many metals react with non-metals to form ionic compounds. (e.g., NaCl)

KEY TAKEAWAY

- ✓ Metals react with oxygen, water, acids, salts and non-metals.
- ✓ Metal oxides are basic in nature.
- ✓ More reactive metals react more vigorously.
- ✓ Chemical properties help us understand the reactivity of metals.

PART 3 PHYSICAL PROPERTIES OF NON-METALS

Non-metals have the following **physical properties.**

1 NON-LUSTROUS (DULL)

Non-metals do not have a shiny surface.

EXAMPLES

Sulphur, Phosphorus

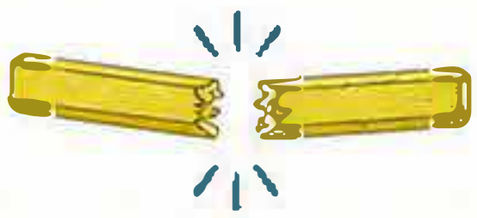
Sulphur Phosphorus

2 BRITTLE

Non-metals are brittle. They break into pieces on applying force.

EXAMPLES

Sulphur, Phosphorus



3 NOT MALLEABLE OR DUCTILE

Non-metals cannot be beaten into thin sheets or drawn into wires.

EXAMPLES

Sulphur, Iodine

4 POOR CONDUCTORS OF HEAT AND ELECTRICITY

Non-metals do not allow heat or electricity to pass through them.

EXAMPLES

Wood, Sulphur, Phosphorus

Bulb does not glow.

5 LOW MELTING AND BOILING POINTS

Non-metals generally have low melting and boiling points.

EXAMPLES

Sulphur, Iodine

6 NON-SONOROUS

Non-metals do not produce a ringing sound when struck.

EXAMPLES

Glass, Sulphur

No sound

EXCEPTIONS
(NOT TRUE FOR ALL NON-METALS)

★ **Iodine (I)**

It is a lustrous non-metal.

★ **Graphite (a form of Carbon)**

It is a good conductor of electricity.

★ **Diamond (a form of Carbon)**

It is the hardest natural substance.

QUICK NOTE

- Non-metals are generally dull, brittle, not malleable or ductile, poor conductors of heat and electricity, have low melting and boiling points and are non-sonorous.
- These properties make non-metals less useful in many applications but some non-metals are very important.

CLASS 10 SCIENCE PART 5

METALS AND NON-METALS

CHEMICAL PROPERTIES OF NON-METALS

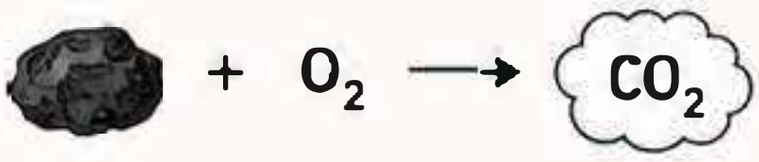
Non-metals show the following chemical properties.

1 REACTION WITH OXYGEN :

Non-metals react with **oxygen** to form non-metal oxides.

$$C + O_2 \longrightarrow CO_2$$

Carbon + Oxygen → Carbon dioxide



Carbon Oxygen Carbon dioxide

Example : Carbon burning in air.

OBSERVATION

Non-metal oxides are **acidic** in nature.

2 REACTION WITH HYDROGEN :

Non-metals react with **hydrogen** to form covalent compounds.

$$H_2 + Cl_2 \longrightarrow 2HCl$$

Hydrogen + Chlorine → Hydrogen chloride

Hydrogen Chlorine Hydrogen chloride

Example : Formation of hydrogen chloride gas.

3 REACTION WITH METALS :

Non-metals react with **metals** to form ionic compounds (salts).

$$2Na + Cl_2 \longrightarrow 2NaCl$$

Sodium + Chlorine → Sodium chloride

Sodium Chlorine Sodium chloride (Common salt)

Example : Formation of sodium chloride.

KEY POINTS

- Non-metals generally **gain electrons** in reactions.
- They form negative ions (**anions**).
- Their oxides are **acidic**.
- Compounds formed by non-metals are mostly **covalent**.
- They are **poor conductors** of heat and electricity.

EXAMPLES OF NON-METALS

→	Oxygen	(O)	O_2
→	Nitrogen	(N)	N_2
→	Sulphur	(S)	S
→	Chlorine	(Cl)	Cl_2
→	Carbon	(C)	C
→	Phosphorus	(P)	P

CLASS 10 SCIENCE PART 6

METALS AND NON-METALS

REACTIVITY SERIES

1 Definition

- Reactivity series is the arrangement of metals in the decreasing order of their reactivity.

2 Key Concepts

- Metals higher in the series are more reactive.
- A more reactive metal displaces a less reactive metal from its salt solution.
- Metals below hydrogen cannot displace hydrogen from dilute acids.

Important Reactivity Series

K > Na > Ca > Mg > Al > Zn > Fe > Pb > Cu > Ag > Au

Most reactive ← Least reactive

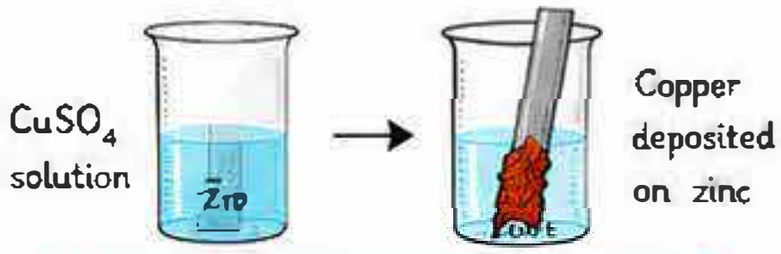
How to use the Series ?

If metal A is above metal B in the series, then A is more reactive than B.
Therefore,

Metal A displaces Metal B from the solution of its salt.

3 Examples

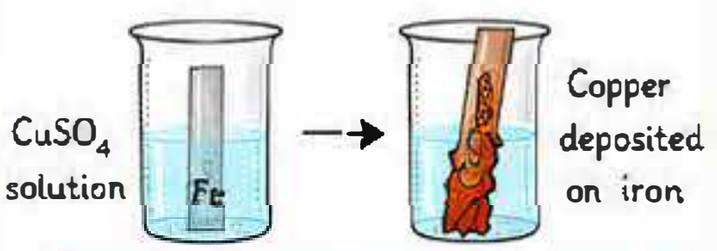
(1) Zinc is above copper in the series.



$Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$

(Zinc displaces Copper)

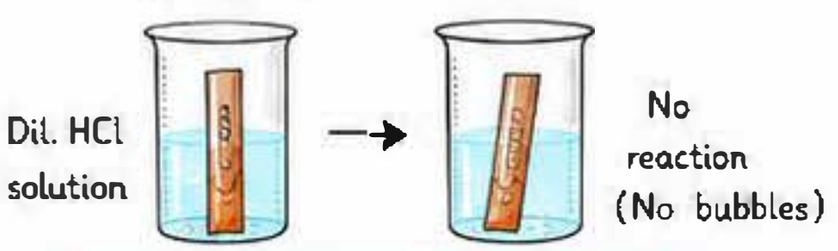
(2) Iron is above copper in the series.



$Fe + CuSO_4 \rightarrow FeSO_4 + Cu$

(Iron displaces Copper)

(3) Copper is below hydrogen in the series.



$Cu + 2HCl \rightarrow$ No Reaction

(Copper cannot displace Hydrogen)

Important Points

- ★ K is the most reactive metal.
- ★ Au (Gold) is the least reactive metal.
- ★ Metals above hydrogen can displace hydrogen from dilute acids.
- ★ Metals below hydrogen cannot displace hydrogen from dilute acids.

Think !

Will silver displace copper from copper sulphate solution?

Ans: No, because silver (Ag) is below copper (Cu) in the reactivity series.

PART 7 IONIC COMPOUNDS

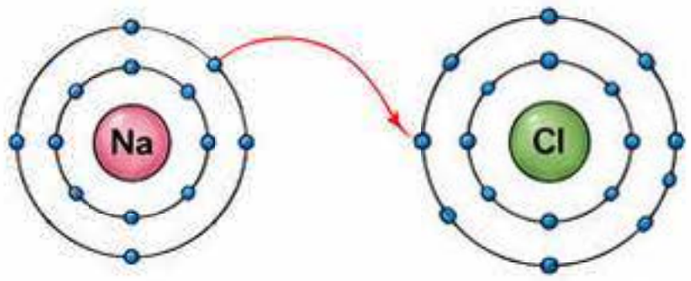
1 FORMATION OF IONIC COMPOUNDS

- Ionic compounds are formed by the complete transfer of electrons from a metal to a non-metal.
- The metal loses electron(s) and becomes a positive ion (cation).
- The non-metal gains electron(s) and becomes a negative ion (anion).
- The electrostatic attraction between oppositely charged ions holds them together to form an ionic compound.

EXAMPLES

(A) Formation of Sodium chloride (NaCl)

Na (2, 8, 1) Cl (2, 8, 7)



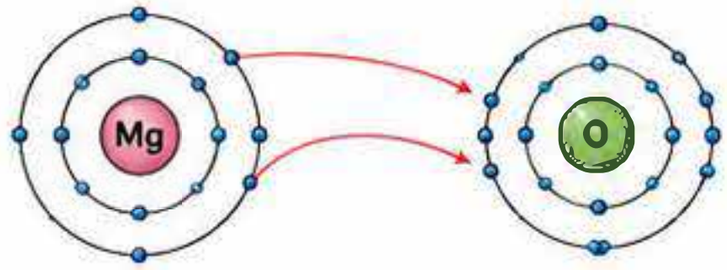
$Na \rightarrow Na^+ + e^-$ $Cl + e^- \rightarrow Cl^-$

$Na^+ + Cl^- \rightarrow NaCl$

(Sodium ion) (Chloride ion) (Sodium chloride)

(B) Formation of Magnesium oxide (MgO)

Mg (2, 8, 2) O (2, 6)



$Mg \rightarrow Mg^{2+} + 2e^-$ $O + 2e^- \rightarrow O^{2-}$

$Mg^{2+} + O^{2-} \rightarrow MgO$

(Magnesium ion) (Oxide ion) (Magnesium oxide)

GENERAL REPRESENTATION

Metal (M) $\rightarrow M^{n+} + n\,e^-$ Non-metal (X) $+ n\,e^- \rightarrow X^{n-}$ $M^{n+} + X^{n-} \rightarrow M_xX_y$ (Ionic Compound)

2 PROPERTIES OF IONIC COMPOUNDS

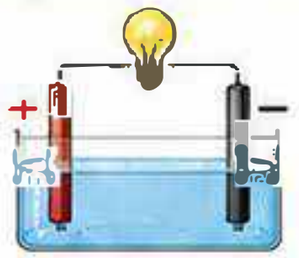
- They are hard and brittle.
- They have high melting and boiling points.
- They are soluble in water but insoluble in organic solvents.
- They conduct electricity in molten state or in aqueous solution but not in solid state.

Hard and Brittle

High Melting and Boiling Points

Soluble in Water

Conduct Electricity in Molten State or Aqueous Solution



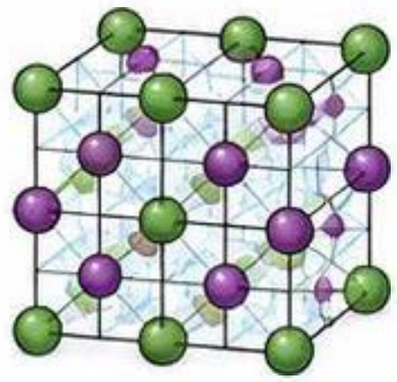
Do not conduct in solid state

3 EXAMPLES OF IONIC COMPOUNDS

IONIC COMPOUND	IONS PRESENT
Sodium chloride (NaCl)	Na^+ , Cl^-
Magnesium oxide (MgO)	Mg^{2+} , O^{2-}
Calcium chloride ($CaCl_2$)	Ca^{2+} , $2Cl^-$
Aluminium oxide (Al_2O_3)	$2Al^{3+}$, $3O^{2-}$
Potassium bromide (KBr)	K^+ , Br^-

IMPORTANT POINTS

- Ionic compounds are generally formed between a metal and a non-metal.
- They have strong electrostatic forces of attraction between ions.
- Because of strong forces, they are solid and have high melting and boiling points.
- In solid state ions are fixed in position and cannot move, so they do not conduct electricity.
- When molten or dissolved in water, ions are free to move and conduct electricity.



Positive ion (Cation) Negative ion (Anion)

QUICK NOTE

- Ionic compounds are neutral as the total positive charge equals the total negative charge.

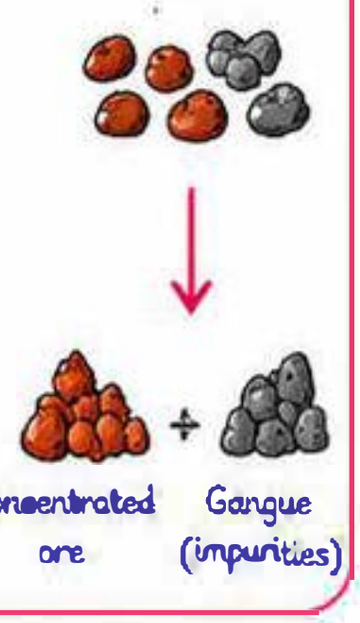
- Common ionic compounds in daily life: NaCl (table salt), $CaCO_3$ (limestone), $NaHCO_3$ (baking soda).

BASIC METALLURGICAL PROCESSES

The process of extraction of metals from their ores is called metallurgy. It involves the following main steps :

1 Concentration of Ore

- Ores obtained from the earth contain impurities called gangue.
- The first step is to separate the ore from gangue.
- This is done by physical methods like hand picking, gravity separation, magnetic separation, froth flotation etc.



2 Roasting

- Heating of sulphide ore in the presence of excess air or oxygen is called roasting.
- During roasting, the ore is converted into oxide.
- It is used for sulphide ores.

Example :

$$2ZnS + 3O_2 \xrightarrow{\text{Heat}} 2ZnO + 2SO_2$$

Zinc sulphide + Oxygen → Zinc oxide + Sulphur dioxide

3 Calcination

- Heating of carbonate or hydrated ores in the absence of air or oxygen is called calcination.
- The ore is converted into oxide.
- It is used for carbonate and hydrated ores.

Example :

$$ZnCO_3 \xrightarrow{\text{Heat}} ZnO + CO_2$$

Zinc carbonate → Zinc oxide + Carbon dioxide

4 Reduction

- The metal oxide obtained after roasting or calcination is reduced to the free metal.
- This is done by using a reducing agent like carbon, hydrogen or carbon monoxide.
- The process is called reduction.

Example :

$$ZnO + C \xrightarrow{\text{Heat}} Zn + CO$$

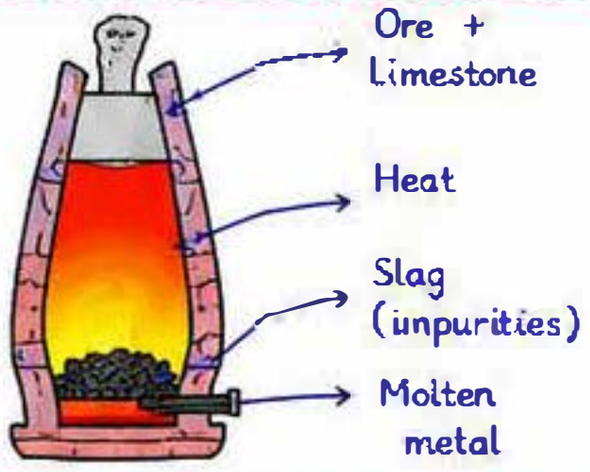
Zinc oxide + Carbon → Zinc (metal) + Carbon monoxide

STEPS IN EXTRACTION OF METALS (SUMMARY)

Concentration of ore — Removal of gangue (impurities) from the ore. →
Roasting — Heating in presence of excess air. →
Calcination — Heating in absence of air. →
Reduction — Reduction of metal oxide to free metal. →
Refining — Purification of the obtained metal.

IMPORTANT POINTS :

- ★ Ores are naturally occurring substances from which metals can be extracted profitably.
- ★ Gangue are unwanted earthy impurities present in the ore.
- ★ Different methods are used to extract metals depending on the type of ore.
- ★ Extracted metals are then purified by refining.



CLASS 10 SCIENCE PART 9

METALS AND NON-METALS

CORROSION

1 DEFINITION

Corrosion is the **slow** destruction of metals by chemical reaction with their **environment**.

EXAMPLE :

Rusting of iron

2 RUSTING OF IRON :

- When iron is exposed to moist air for a long time, it develops a reddish-brown coating called **rust**.
- Rust is a flaky substance and **does not** protect iron from further corrosion.
- Therefore, the corrosion **continues**.

3 CONDITIONS NECESSARY FOR RUSTING :

The following **two** conditions are necessary for rusting of iron :

★ Presence of oxygen (O_2) in air

★ Presence of water (moisture)

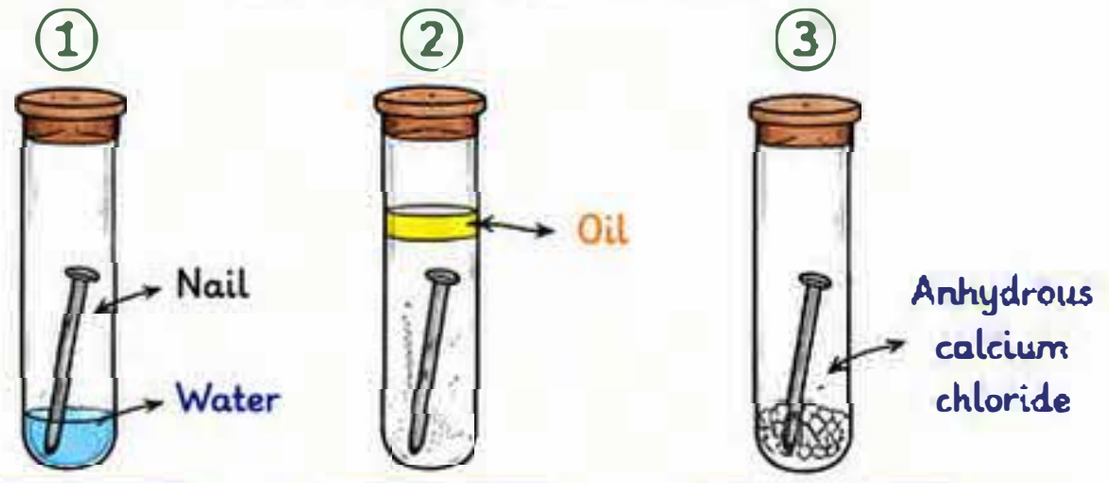
4 CHEMICAL REACTION :

Iron reacts with **oxygen** in the presence of **water** to form rust.

$$4Fe + 3O_2 + xH_2O \longrightarrow 2Fe_2O_3 \cdot xH_2O$$

Iron — Oxygen — Water — Rust (Hydrated iron(III) oxide)

ACTIVITY TO SHOW RUSTING REQUIRES BOTH AIR AND WATER

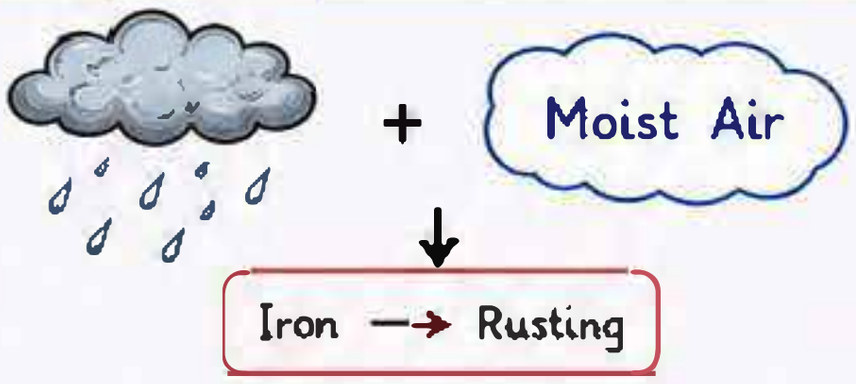


5 EFFECTS OF CORROSION :

- It **weakens** the metal objects.
- It causes **damage** to machinery, buildings, bridges, vehicles, etc.
- It leads to huge **economic loss**.

KEY POINTS TO REMEMBER

★ Corrosion is a natural process.
★ Rusting is a type of corrosion.
★ Rusting requires both **oxygen** and **water**.
★ Rust is reddish-brown, flaky and **porous**.
★ Rusting can be prevented by **painting**, **oiling**, **galvanization**, **greasing**, **coating**, etc.



METALS AND NON-METALS

PREVENTION OF CORROSION

Corrosion can be prevented by applying a protective coating on the surface of the metals or by using alloys.

Following are the methods used to prevent corrosion :

1 PAINTING

- A layer of paint is applied on the surface of the metal.
- It prevents the metal from coming in contact with air and moisture.

Example :
Painting of iron gates, railings, bicycles, etc.

2 OILING AND GREASING

- A thin layer of oil or grease is applied on the surface of metal.
- It prevents the metal from coming in contact with air and moisture.

Example :
Oiling of machine parts, tools, locks, etc.

3 GALVANISATION (ZINC COATING)

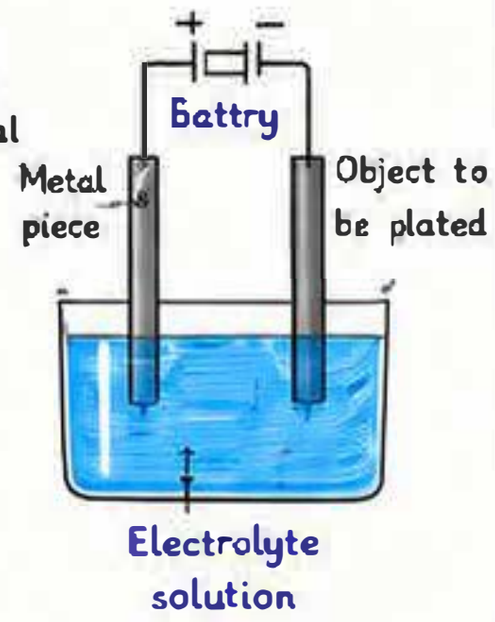
- A thin layer of zinc is coated on iron or steel.
- Zinc prevents iron from rusting as it does not allow air and moisture to reach the iron.
- Zinc also acts as a sacrificial metal. (It corrodes in place of iron.)

Example :
Galvanised iron sheets, water pipes, buckets, etc.

4 ELECTROPLATING

- A thin layer of another metal is deposited on the surface of a metal by passing electric current.
- The coating prevents the base metal from corrosion.

Example :
Chromium plating on car parts, nickel plating on taps, silver plating on cutlery, etc.



5 ALLOYING

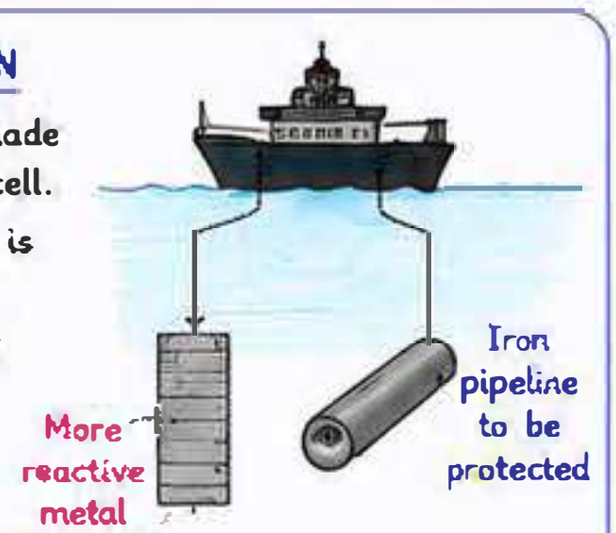
- Alloying means mixing a metal with one or more other metals.
- Alloys are generally more resistant to corrosion than the pure metals.

Example :
Stainless steel (iron + chromium + nickel) is used in making utensils, surgical instruments, etc.

6 CATHODIC PROTECTION

- The metal to be protected is made the cathode of an electrolytic cell.
- A more reactive metal (anode) is connected to it.
- The anode corrodes in place of the metal to be protected.

Example :
Protection of ships, pipelines, underground tanks, etc.



IMPORTANT POINTS

- Corrosion is the slow destruction of metals by the action of air, moisture and other substances.
- Rusting is a type of corrosion that occurs in iron.
- Corrosion causes economic loss and weakens metal structures.
- Prevention of corrosion increases the life of metals and saves resources.

SUMMARY CHART

Method	How it Prevents Corrosion
Painting	Paint layer blocks air and moisture.
Oiling and Greasing	Oil/grease layer blocks air and moisture.
Galvanisation	Zinc coating protects iron from rusting.
Electroplating	Another metal coating prevents corrosion
Alloying	Alloys are more corrosion resistant
Cathodic Protection	More reactive metal corrodes instead.

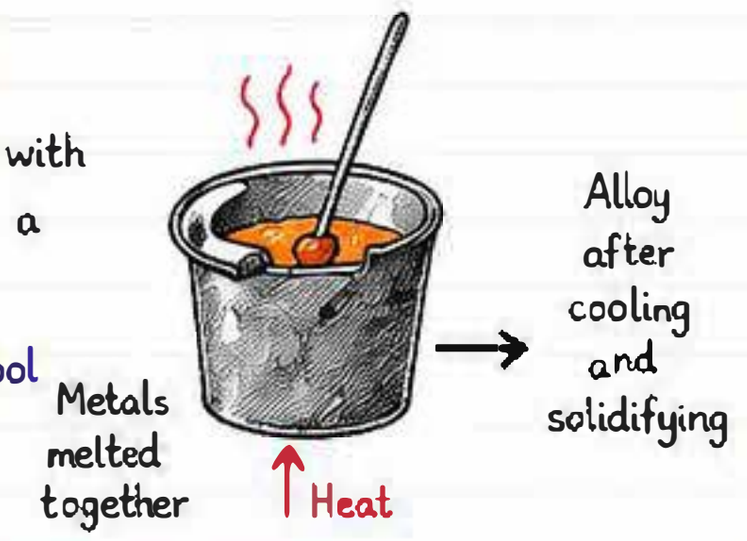
ALLOYS

1. Definition :

- An alloy is a homogeneous mixture of two or more metals, or a metal and a non-metal, in a fixed proportion.

2. How are Alloys Formed ?

- Metals are melted and then mixed with other metal(s) or non-metal(s) in a fixed proportion.
- The mixture is then allowed to cool and solidify.



3. Types of Alloys :

(i) Substitutional Alloys :

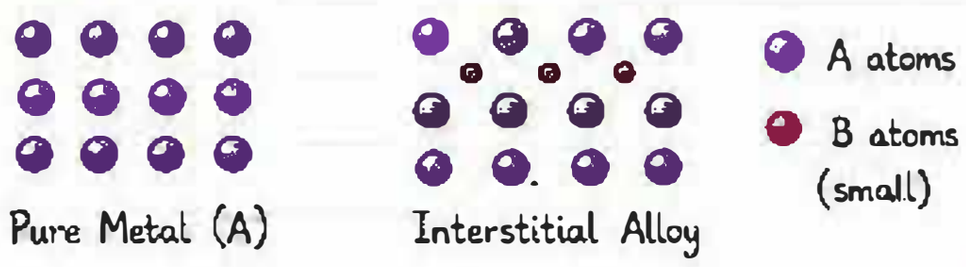
- In these alloys, atoms of one metal replace the atoms of another metal in the crystal structure.

Example : Brass (Cu + Zn)

(ii) Interstitial Alloys :

- In these alloys, smaller atoms (of another metal or non-metal) occupy the interstitial spaces (gaps) between the atoms of the main metal.

Example : Steel (Fe + C)



4. Properties of Alloys :

1. Alloys are generally harder than pure metals.
2. They are stronger and more durable.
3. Alloys are more resistant to corrosion.
4. They have lower melting points than the constituent metals.
5. Alloys have better appearance.
6. Properties of alloys can be changed by changing the composition.

5. Uses of Alloys :

- Alloys are used to improve the properties of metals for specific uses.
- They are used in making tools, machines, jewellery, coins, utensils, electrical appliances, vehicles, aerospace parts, etc.

6. Examples of Alloys :

Alloy	Constituents	Properties	Uses
Brass	Copper + Zinc	Strong, corrosion resistant	Utensils, taps, decorative items
Bronze	Copper + Tin	Hard, corrosion resistant	Statues, medals, bearings
Steel	Iron + Carbon	Very strong, hard	Buildings, bridges, tools, machines
Stainless Steel	Iron + Chromium + Nickel + Carbon	Corrosion resistant	Cutlery, surgical instruments, pipes

7. Difference Between Metals and Alloys :

	Metals	Alloys
1.	Pure substances	Mixture of metals or metal + non-metal
2.	Properties are fixed	Properties can be changed
3.	Generally softer	Generally harder
4.	More reactive	Less reactive
5.	Lower resistance to corrosion	Higher resistance to corrosion
6.	Lower melting points	Higher or lower melting points (varies)

Alloys are very important in our daily life as they have better properties than pure metals and are used in a wide variety of applications.

METALS AND NON-METALS

USES OF METALS AND NON-METALS

Metals and non-metals are very important in our daily life. They are used in many useful ways.

1. Uses of Metals

- **Iron** : Used in construction of buildings, bridges, machines, tools, railway tracks, vehicles, etc.
- **Aluminium** : Used in making utensils, aircraft, electrical wires, doors, window frames, etc.
- **Copper** : Used in electrical wires, cables, utensils, coins, electrical appliances, etc.
- **Gold** : Used in jewellery, medals, coins, electronic devices, etc.
- **Silver** : Used in jewellery, utensils, coins, mirrors, medicines, etc.
- **Zinc** : Used for galvanisation (coating of iron) to prevent rusting.
- **Lead** : Used in batteries, radiation shielding, soldering, weight making, etc.

Metal	Some Uses
Iron	Buildings, bridges, tools, machines, railway tracks, vehicles, nails, etc.
Aluminium	Utensils, aircrafts, electrical wires, doors, window frames, etc.
Copper	Electrical wires, cables, water pipes, coins, utensils, etc.
Gold	Jewellery, coins, electronic devices, medals, etc.
Silver	Jewellery, utensils, coins, mirrors, medicines, etc.
Zinc	Galvanisation of iron, batteries, brass making, etc.
Lead	Batteries, radiation shielding, soldering, weight making, etc.

2. Uses of Non-Metals

- **Oxygen** : Used for respiration, in hospitals, welding and cutting of metals.
- **Nitrogen** : Used in the manufacture of ammonia (fertilisers), in packed food packets.
- **Carbon** : Used in the form of coal (fuel), diamond (jewellery), cutting tools and graphite (pencil lead), lubricant.
- **Sulphur** : Used in the manufacture of sulphuric acid, vulcanisation of rubber.
- **Chlorine** : Used for disinfecting drinking water, in bleaching powder and disinfectants.

Non-metal	Some Uses
Oxygen (O_2)	Respiration, hospitals, welding and cutting of metals
Nitrogen (N_2)	Manufacture of ammonia (fertilisers), packed food packets
Carbon	Fuel (coal), jewellery (diamond), pencil leads (graphite), lubricant
Sulphur	Sulphuric acid, match sticks, gun powder, vulcanisation of rubber
Chlorine (Cl_2)	Disinfecting water, bleaching powder, disinfectants

3. Comparison of Uses

Metals	Non-metals
★ Used in making structures, machines and tools	★ Used in medicines, fertilisers, bleaching and disinfectants.
★ Good conductors of heat and electricity and are used in electrical appliances.	★ Used as fuels (coal, in match sticks) and in chemical industries.
★ Many metals are used for making coins, medals and utensils.	★ Some non-metals are used in the form of gases (O_2, N_2).
★ Some metals (like gold and silver) are used for jewellery and ornaments.	★ Important for life processes (e.g., oxygen).

Important Points

- ★ Metals are mostly used in construction, machinery, transport, electrical appliances, etc.
- ★ Non-metals are widely used in medicines, fertilisers, fuels, plastics, and food industry.
- ★ Both metals and non-metals are essential for our daily life.
- ★ Their proper use makes our life easy and comfortable.

EXAMPLES


Aluminium
Utensils


Copper
Electrical wires


Gold
Jewellery


Oxygen
Medical use


Nitrogen
Fertilisers


Carbon (Coal)
Fuel

Chlorine
Bleaching powder


Sulphur
Rubber vulcanisation

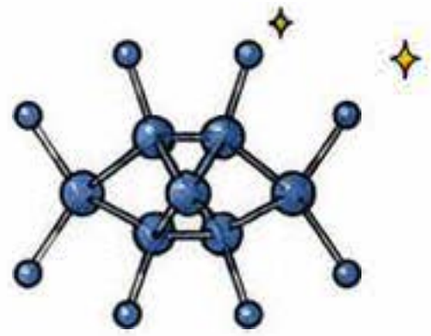
PART 4 METALLOIDS (PROPERTIES AND EXAMPLES)

1 WHAT ARE METALLOIDS ?

- Some elements show properties of both **metals** and **non-metals**.
- These elements are called **metalloids**.

EXAMPLES

- Silicon (Si)
- Germanium (Ge)



Silicon crystal

PROPERTIES OF METALLOIDS

PROPERTY	SHOWS PROPERTIES OF	EXPLANATION
Lustre	Metals	Metalloids have shiny appearance like metals but less shiny.
Malleability	Metals	Metalloids can be beaten into thin sheets like metals but not easily.
Ductility	Metals	Metalloids can be drawn into wires like metals but not easily.
Conductivity of Heat & Electricity	Both	Metalloids are semiconductors. They conduct electricity but not as good as metals and not as poor as non-metals.
Melting & Boiling Points	Both	Metalloids have intermediate melting and boiling points. Higher than non-metals but lower than metals.
Sonorous	Both	Metalloids are neither sonorous like metals nor completely non-sonorous like non-metals.

COMPARISON OF METALLOIDS WITH METALS AND NON-METALS

PROPERTY	METALS	METALLOIDS	NON-METALS
Lustre	Shiny	Less shiny	Dull
Malleability	Malleable	Not easily malleable	Non-malleable
Ductility	Ductile	Not easily ductile	Non-ductile
Conductivity	Good conductors	Semiconductors	Poor conductors
Melting & Boiling Points	High	Intermediate	Low
Sonorous	Sonorous	Less sonorous	Non-sonorous

IMPORTANCE OF METALLOIDS

- Metalloids are very important in electronics.
- Silicon (Si) is used in chips, solar cells and computer circuits.
- Germanium (Ge) is used in diodes, transistors and semiconductors.

Solar cell (Silicon)

Computer chip (Silicon)

Transistor (Germanium)

EXCEPTIONS (NOT TRUE FOR ALL METALLOIDS)

Boron (B) → It is brittle and non-conducting.

Arsenic (As) → It is less shiny.

QUICK NOTE

Metalloids act as a bridge between metals and non-metals.

PART 5 OCCURRENCE OF METALS & NON-METALS

1 OCCURRENCE OF METALS

- Metals are found in nature in the form of ores.
- Most metals occur in the earth's crust.
- Some common ores are :

METAL	ORE
Iron	Hematite (Fe_2O_3), Magnetite (Fe_3O_4)
Aluminium	Bauxite ($Al_2O_3 \cdot 2H_2O$)
Copper	Copper pyrites ($CuFeS_2$)
Zinc	Zinc blende (ZnS)
Silver	Argentite (Ag_2S)
Lead	Galena (PbS)

EXAMPLES OF ORES

Hematite (Iron ore) | Magnetite (Iron ore) | Bauxite (Aluminium ore)

Copper pyrites (Copper ore) | Zinc blende (Zinc ore) | Galena (Lead ore)

IMPORTANT FACTS

- Metals exist in nature in the form of compounds called ores.
- They are extracted from their ores by various methods.
- Some metals like Gold (Au) and Platinum (Pt) occur in a free state.
- Non-metals occur in free state as well as in combined state.

2 OCCURRENCE OF NON-METALS

- Non-metals occur in nature in free state as well as in combined state.
- They are found in air, water, soil and living organisms.
- Some non-metals occur in large quantities.

FORMS IN WHICH NON-METALS OCCUR

(A) IN FREE STATE

Some non-metals are found in nature in free (uncombined) state.

Examples :

Oxygen (O_2) | Nitrogen (N_2) | Sulphur (S)

(B) IN COMBINED STATE

Most non-metals are found in nature in combined state with metals or other non-metals.

Examples :

Water (H_2O) | Common salt ($NaCl$) | Carbon dioxide (CO_2)

COMPARISON : OCCURRENCE OF METALS AND NON-METALS

BASIS	METALS	NON-METALS
Form in nature	Found in the form of ores (compounds).	Found in free state as well as in combined state.
Place	Mostly found in the earth's crust.	Found in air, water, soil and living organisms.
Examples	Iron, Aluminium, Copper, Zinc, etc.	Oxygen, Nitrogen, Sulphur, Carbon, etc.
Quantity	Generally less in free state.	Some (like Oxygen, Nitrogen) occur in large quantities.
Extraction	Extracted from ores by various physical and chemical methods.	Obtained by simple physical methods or from natural sources.

QUICK NOTE

★ Metals are obtained from ores, while non-metals are obtained from air, water, soil or by simple methods.

★ Understanding occurrence helps in understanding how these elements are available for daily use.

CLASS 10 SCIENCE PART 13

METALS AND NON-METALS

TOP HARD LEVEL MCQS

1 Which metal does not react with cold water, but reacts with steam?

(A) Na (B) Mg (C) Al (D) Cu

Answer
(D) Cu
✓ Correct

2 Which of the following is a non-metal that remains liquid at room temperature?

(A) Bromine (B) Chlorine (C) Iodine (D) Sulphur

(A) Bromine
✓ Correct

3 Which metal is the best conductor of electicity?

(A) Silver (B) Copper (C) Gold (D) Aluminium

(A) Silver
✓ Correct

4 Which of the following metals reacts with dilute hydrochloric acid to liberate H_2 most vigorously?

(A) Zn (B) Fe (C) Mg (D) Cu

(C) Mg
✓ Correct

5 Identify the metal which can displace hydrogen from dilute acids but cannot displace copper from copper sulphate solution.

(A) Zn (B) Fe (C) Mg (D) Ag

(A) Zn
✓ Correct

6 Which oxide is amphoteric in nature?

(A) Na_2O (B) CaO (C) Al_2O_3 (D) K_2O

(C) Al_2O_3
✓ Correct

7 Which of the following non-metals has the highest melting point?

(A) Carbon (B) Silicon (C) Sulphur (D) Phosphorus

(A) Carbon
✓ Correct

8 Which metal is used in thermite reaction to join railway tracks?

(A) Aluminium (B) Magnesium (C) Iron (D) Copper

(A) Aluminium
✓ Correct

9 Which property is shown by non-metals but not by metals?

(A) Malleability (B) Ductility (C) Brittleness (D) Sonority

(C) Britleness
✓ Correct

10 Which of the following is used as a catalyst in the Haber process for the manufacture of ammonia?

(A) Iron (B) Nickel (C) Platinum (D) Vanadium

(B) Nickel
✓ Correct

ANSWER KEY

1	2	3	4	5	6	7	8	9	10
D	A	A	C	A	C	A	A	C	B