

CHAPTER 4 MATERIALS -METALS AND NON-METALS

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An important classification of elements is in terms of metals and non-metals. Most of the elements are metals. The remaining are either non-metals or metalloids. Metalloids possess character of both metals and non-metals.

- Materials are mainly of two types:

1) Metals

- i) **Definition:** These are substances characterized by high electrical and thermal conductivity. They also possess properties like malleability, ductility and light reflectivity.
- ii) **Examples:** Aluminum, copper, iron, tin, gold. Around 90 naturally found elements are metals.

iii) **Physical Properties:**

- (1) Good conductors of heat and electricity
- (2) Ductility: The property of metals by which they can be drawn into wires.
- (3) Malleability: The property by which metals can be beaten into thin sheets is called malleability.
- (4) Metals are sonorous. It means they produce a ringing sound when they are struck with a hard object or beaten.
- (5) Metals are usually hard and they are lustrous or have a shiny appearance. An exception to this is Metals like sodium and potassium are soft.
- (6) Metals are normally found in solid state except Mercury is the only metal which is found in liquid state at room temperature.

iv) **Chemical properties:**

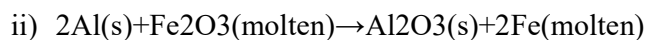
- (1) **Reaction with air:** Metals react with oxygen to form basic metallic oxides. Burning of magnesium ribbon in presence of oxygen produces magnesium oxides.
- (2) **Reaction with water:** Some metals react vigorously with water, Example: Sodium. There are other metals which react slowly with water, example: iron. Apart from these metallic oxides are easily dissolved in water and form alkalis.
- (3) **Reactions with Acids:** Metals are generally reactive with acids and produces hydrogen gas, more reactive metals displace the hydrogen from its dilute acid form metallic salt and hydrogen gas which makes a popping sound.
- (4) **Reactions with Bases:** Some Metals react with bases
Example: $2\text{NaOH(aq.)} + \text{Zn(s)} \rightarrow \text{Na}_2\text{ZnO}_2\text{(aq.)} + \text{H}_2\text{(g)}$.

➤ **Displacement reaction:**

Metals have the capability to displace another less reactive metal in aqueous environment. The product of such a reaction is salt solution

Example:

- i) Copper Sulphate (CuSO_4) + Zinc (Zn) \rightarrow Zinc Sulphate (ZnSO_4) + Copper (Cu)



➤ **Uses:**

- 1) Metals are used in making heavy machinery, automobiles, Aeroplan's, trains, satellites, industrial gadgets, cooking utensils, water boilers, etc.
- 2) Metals are used to make electrical wires and high in tensile strength metal sheets.
- 3) Aluminum foils are used in packaging medicines, cigarettes and food materials.
- 4) Silver and gold are used to make jewelry, coins etc.

2) Non- metals

i) **Definition:** Non-metals are those compound's which do not have the attributes of metals.

ii) **Examples:** Hydrogen, Nitrogen, Oxygen, Fluorine, Chlorine, Bromine, Iodine, Carbon, Sulphur, Silicon etc.

iii) **Physical Properties:**

- (1) Poor conductor of heat and electricity (except graphite) and can act as insulators.
- (2) They are non- malleable and non-ductile.
- (3) They are soft, brittle and appear dull i.e., they lack luster.
- (4) They are not sonorous
- (5) They are converted into a powder like material when struck with a hard object
- (6) They can occur in any state of matter viz. solid, liquid or gas

iv) **Chemical properties:**

1) **Reaction with air:** Generally, oxides of non-metals are acidic in nature.

Example: Sulphur dioxide (SO_2) + Water (H_2O) → Sulphurous acid (H_2SO_3)

2) **Reaction with water:** Generally, non-metals do not react with water. This is why non-metals are stored in water. An example is phosphorus is a very reactive non-metal. To prevent contact of phosphorus with atmospheric oxygen, it is stored in water.

3) **Reactions with acids:** They do not react with acids.

4) **Reaction with Bases:** Such reactions are complex

v) **Uses:**

- (1) Non-metal is essential for our life which all living beings inhale during breathing,
- (2) Non-metals used in fertilizers to enhance the growth of plants.
- (3) Non-metal used in water purification process.
- (4) Non-metal like iodine is applied on wounds as an antiseptic.
- (5) Non-metals used in crackers.