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 posses' 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 oxidesare 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: $2NaOH(aq.)+Zn(s)\rightarrow Na2ZnO2(aq.)+H2(g)$.

➢ **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 ($CuSO4$) + Zinc (Zn)→Zinc Sulphate ($ZnSO4$) + Copper (Cu)

ii) $2Al(s)+Fe_2O_3(molten) \rightarrow Al_2O_3(s)+2Fe(molten)$

- **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 heigh 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 wen 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 reactwith water. This is why non-metals arestored in water. An example isphosphorus is a very reactive non-metal. To prevent contact of phosphorus withatmospheric 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.