

CHAPTER - 4

MATERIALS : METALS AND NON-METALS

CLASS

:- VIII

SUBJECT

:- SCIENCE

1) Occurrence of metals and non metals :-

- Out of the 92 naturally occurring elements 70 are metals and about 22 are nonmetals. Some elements show properties of both metals and non metals. They are called **metalloids**.
- Only some metals like gold, silver, platinum etc are found in the free state. Most metals are found in the combined states as **oxides, sulphides, carbonates, silicates etc.**
- Some non metals are found in the free state like helium, neon, argon etc. and some are found in free and combined states like sulphur, phosphorus etc.

2) Metallurgy :-

- Metallurgy:- is science of extraction of metals from their ores and their purification.
- Minerals:- are naturally occurring substances containing one or more elements or their compounds.
- Ore:- is a mineral from which one or more metals can be extracted profitably.
- Metallurgical processes:- consists of three main steps. They are :- i) Concentration of the ore ii) Reduction iii) Refining
- **Concentration of the ore**:- is the removal of impurities from the ore.
- **Reduction**:- the process of obtaining the metal from its compound.
- **Refining**:- is the process of purification of the impure metals to obtain the pure metal.

3) Physical properties of metals and non metals :-

• Metals

- Metals are solids (except mercury).
- Metals are hard (except sodium, potassium etc).
- Metals have metallic lustre.
- Metals have high melting points and boiling points.
- Metals are malleable (can be made into thin sheets).
- Metals are ductile (can be made into thin wires).
- Metals are good conductors of heat and electricity.
- Metals are sonorous (produces sound).

• Non metals

- Non metals may be solids, liquids or gases.
- Non metals which are solids are brittle (diamond is the hardest).
- Non metals do not have lustre some have a dull luster.
- Non metals have low melting points.
- Non metals are not malleable.
- Non metals are not ductile.
- Non metals are bad conductors of heat and electricity (except graphite).
- Non metals are not sonorous.

4) Chemical properties of metals and non metals :-

a) Reaction with oxygen :-

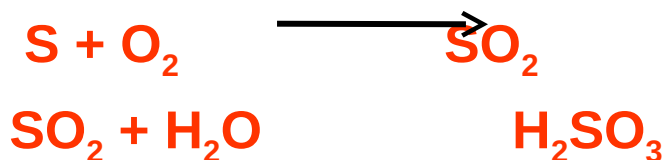
Metals react with oxygen to form metallic oxides. These oxides are basic oxides because they react with water to form bases.

Eg. Magnesium burns in air to form magnesium oxide. Magnesium reacts with water to form magnesium hydroxide.



Non metals react with oxygen to form non metallic oxides. These oxides are acidic oxides because they react with water to form acids.

Eg. Sulphur burns in air to form sulphur dioxide. Sulphur dioxide reacts with water to form sulphurous acid.



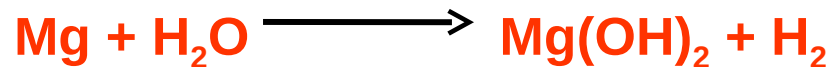
b) Reaction with water :-

Metals react with water to form metal hydroxides and hydrogen.

Eg. Sodium reacts with water to form sodium hydroxide and hydrogen.



Magnesium reacts with water to form magnesium hydroxide and hydrogen.

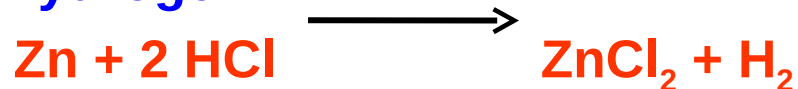


Non metals do not react with water.

c) REACTION WITH ACIDS:-

Metals react with acids to form metallic salts and hydrogen.

Eg. Zinc reacts with dilute hydrochloric acid to form zinc chloride and hydrogen.



Most non metals do not react with acids. Some non metals like sulphur reacts with concentrated nitric acid to form sulphur dioxide, nitrogen dioxide and water.



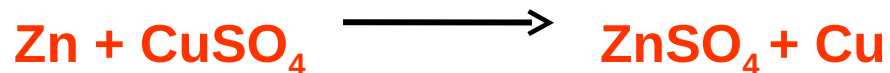
d) Metals replace metals :-

A more reactive metal replaces a less reactive metal from its salt solution.

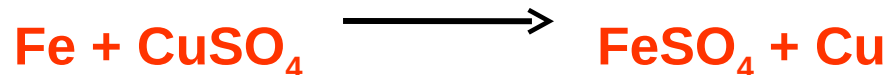
Eg. Magnesium replaces copper from copper sulphate solution to form magnesium sulphate and copper.



Zinc replaces copper from copper sulphate solution to form zinc sulphate and copper.



Iron replaces copper from copper sulphate solution to form iron sulphate and copper



Based on the reactivity of metals, they can be arranged in the decreasing order of their activity.

5) Activity series of metals :-

The arranging of metals in the decreasing order of their reactivity is called activity series of metals.

Potassium

Sodium

Magnesium

Aluminium

Zinc

Iron

Lead

Copper

Silver

Gold



Decreasing
order of
reactivity

6) Noble metals :-

Metals like gold, silver, platinum etc. retain their lustre because they do not react with air, water or acids. So they are called noble metals.

Gold dissolves in aqua regia. Aqua regia is a mixture of concentrated nitric acid and concentrated hydrochloric acid in the ratio 1:3.

Pure is 24 carat gold. It is very soft and cannot be used for making ornaments. So it is mixed with some silver or copper to make it hard.

7) Uses of metals :-

Iron :- is used for making pins, nails, nuts, bolts, tools, machines, construction of buildings, bridges etc.

Aluminium :- is used for making utensils, wires, furniture, parts of aircrafts, vehicles, machines, for packing food and medicines etc.

Copper :- is used for making wires, vessels, electric gadgets etc.

Gold :- is used for making jewellery, coins medals etc

Silver :- is used for making jewellery. Coins, medals etc.

Platinum :- is used for making jewellery, electric gadgets, plugs in vehicles etc.

Sodium :- compounds are used as common salt, chemicals etc.

Calcium :- compounds are used for making cement, glass etc

8) Uses of non metals :-

Sulphur :- is used for making sulphuric acid, salts of metals etc.

Oxygen :- is used for respiration by living things, burning of fuels etc.

Nitrogen :- is used for making ammonia which is used for making fertilizers.

Hydrogen :- is used for making ammonia which is used for making fertilizers, as fuel in rockets, for welding etc.

Chlorine :- is used to kill germs in water.

Iodine :- is used as tincture iodine which is an antiseptic.

9) Alloys :-

An alloy is a homogeneous mixture of a metal with other metals or non metal.

Alloy	Constituents	Uses
Steel	iron, carbon	construction of tools, machines, tanks, vehicles, ships, rails, building, bridges, dams etc.
Stainless steel	iron, chromium	utensils, cutlery, surgical instruments etc.
Brass	copper, zinc	utensils, handicrafts musical instruments etc.
Bronze	copper, tin	statues, medals, bells ornaments etc.
Alnico	iron, aluminium nickel, cobalt	making of magnets
Duralium	aluminium, copper magnesium	making utensils, pressure cookers, parts of vehicles, aircrafts etc.

10) Corrosion :-

The surface of some metals gets corroded when exposed to moist air for a long time. This is called corrosion.

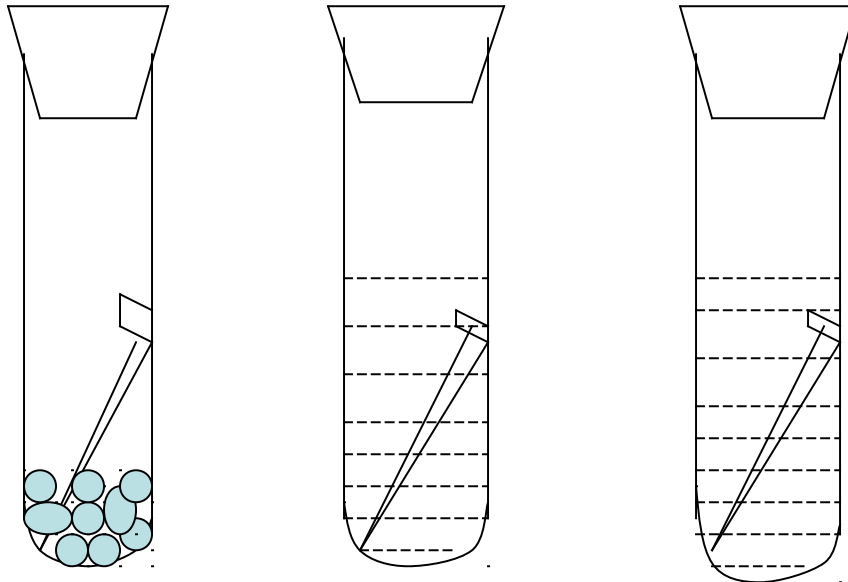
Prevention of corrosion of metals :-

The corrosion of metals can be prevented by:-

- i) Applying oil or grease.
- ii) Applying paint
- iii) Galvanisation (coating of metals with non corrosive metals like zinc)
- iv) Electroplating (coating of metals with non corrosive metals like chromium tin by passing electricity)
- v) Alloying (Eg. When iron is alloyed with chromium and nickel, it forms stainless steel which is resistant to corrosion)

11) Activity to show that air and water are necessary for rusting of iron :-

Take three test tubes and put one iron nail in each. Put some anhydrous calcium chloride in one test tube to absorb moisture. Pour some boiled water from which dissolved oxygen has been removed in the second test tube. Pour some water in the third test tube. Cork the three test tubes and leave it for 3 – 4 days. It is seen that the nail in the first and second test tubes have not rusted. The nail in the third test tube has rusted.



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* VIDEO LINKS

<https://youtu.be/hrzV7oIfDWU>

https://youtu.be/9KS_eoCd3gw