CHAPTER FOUR

METALS, ALLOYS AND RUSTING

Even though there are different types of metals, they all have or share certain common properties.

SOME PROPERTIES OF METALS:

(1) They are solids at room temperature (i.e. when the temperature is about 26^0C).
(2) They have high melting points.
(3) They conduct heat and electricity i.e. heat and electricity can pass through them.
(4) Most metals are lustrous or have shiny surfaces.
(5) They are malleable (i.e. an hammer can be used to hammer them into various shapes or forms).
(6) They have high density.

NON METALS: They are gases at room temperature.

PROPERTIES:

(1) They are poor conductors of heat and electricity.
(2) They have low density.
(3) They are not lustrous.
(4) They are not malleable.

REACTIVE AND NON REACTIVE METALS:

A metal which can easily react or combine with oxygen, water or acid is said to be a reactive metal. On the other hand a metal which does not easily react or combine with oxygen, water or acid, is said to be a non reactive metal.

DIFFERENCES BETWEEN METALS AND NON METALS

METAL	NON METAL
High density	Low density
Malleable	Non malleable

Good conductors of heat and electricity	Bad conductors of electricity and heat
High melting point	Low melting point
Lustrous	Not lustrous

USES OF CERTAIN METALS AND NON METALS:

METALS:

- Copper is used in making electrical wire and ornament
- Aluminum is used in the making of cooking utensils, roofing sheets and window frames.
- Gold is used for jewelry and ornament.

NON METAL:

- Chlorine is use in the purification of water.
- Oxygen is used for respiration and welding.
- Phosphorus is used for the manufacture of fertilizer.

SEMI CONDUCTORS:

- These are a group of materials which are also referred to as semi metals. -
They are neither good conductors nor good insulators. -
Under certain conditions they act as conductors, and under other conditions they act as insulators.

Use: They are used in making electronic devices such transistor, diode and rectifier.

ALLOYS: This is a mixture or a combination of two or more metals, or a metal and other materials . Many pure metals have certain disadvantages or bad properties, and some of these are that they may be too soft or rust too easily. In order to overcome or remove these disadvantages, these metals are combined with other metals or materials to form alloys. Most alloys are formed by melting the two or more metals, mixing them together and allowing them to harden.

ALLOYS OF IRON:

- Alloys which contain iron are called ferrous alloys.
- Pure iron rusts too easily and for this reason, it is not good or advisable to use it in making items.
- The pure iron is therefore converted into an alloy called stainless steel, by mixing it

while it is in the molten or liquid form with a small amount of carbon, and a large amount of nickel and chromium.

- Stainless steel has the ability to resist rust or does not easily rust.

ALLOYS OF STRENGTH AND LIGHTNESS:

- The material which is used to make or construct vehicles such as aircraft must be strong enough for safety reasons.
- Apart from that, it must also be light to enable the vehicle such as the aircraft move very fast.
- Even though pure aluminum is light for such a purpose, it is too weak for such a purpose and for most constructional purposes. - For this reason, several other metals are mixed with aluminum to form an alloy called duralumin, which is even though as light as aluminum but is as strong as steel.

SOME ALLOYS AND THEIR COMPOSITION:

Alloys	Composition or Constituents	Special properties	Uses
Solder	Tin and lead.	Low melting point.	Joining wires
Bronze	Copper and tin.	Does not corrode easily.	Statues, ornaments and church bells.
Brass	Copper and zinc.	Does not corrode.	Musical instruments.
Stainless steel	Iron , chromium and copper.	Does not easily rust.	Car parts, kitchen sink and cutlery.

Duralumin	Aluminum and copper.	Light weight but as strong as steel.	Aircraft.

CORROSION:

- This is the process in which a metal wastes away, when it is exposed to the right conditions such as air and water.
- When iron is exposed to moist air, the iron combines with oxygen to form a brown material called hydrated iron (III) oxide (Fe_2O_3).
- It is this brown hydrated iron (III) oxide which is commonly referred to as rus*t*.

PREVENTION OF CORROSION OR RUSTING:

(1) Painting or greasing:

- For a metal to rust, both water (moisture) and air (oxygen) must come into contact with it.
- When a metal such as iron is painted or covered with grease, corrosion or rusting does not occur, since the paint or the grease will prevent air, moisture or water from coming into contact with the metal.