



INDIAN SCHOOL AL WADI AL KABIR
DEPARTMENT OF SCIENCE 2023-24
CLASS:8
MATERIALS: METALS AND NON-METALS
HANDOUT



Materials around us can be broadly grouped into metals and non-metals.

Physical Properties of Metals

- **Lustre:** Metals in the pure state generally shine. The shine on the metallic surface is called the metallic lustre.
 - **Malleability:** The property of metals by which they can be beaten into thin sheets is known as malleability.
For example, silver metal is beaten to make silver foil used for decorating sweets.
 - **Ductility:** It is one of the properties of metals by virtue of which they can be drawn into wires. For example, copper and iron can be drawn into wires.
 - **Conductivity:** Metals are good conductors of heat and electricity. Heat and electricity can pass through them.
 - **Sonorous:** Metals produce a ringing sound when struck hard. So, they are called sonorous.
 - **Solid:** All metals are solid except Mercury, the only metal which is liquid at room temperature.
 - We can cut Sodium (Na) and Potassium (K) metals with the help of a knife.
- Mercury, Sodium and Potassium are exceptional metals. Examples of metals: are iron, copper, gold, aluminium, silver, calcium etc.

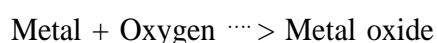
Properties of Non-Metals

- Solid non-metals are soft and dull. They break down into a powdery mass on tapping with a hammer. For example, coal and sulphur.
- Non-metals are not sonorous.
- They are poor conductors of heat and electricity. Except graphite form of carbon
- They do not possess metallic lustre.
- They possess no malleability and ductility.
- All three-physical state

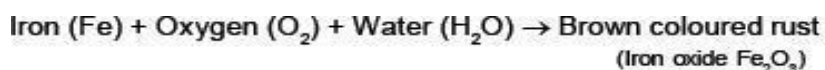
Examples of non-metals: are phosphorus, sulphur, carbon, oxygen etc.

Chemical Properties of Metals

- **Reaction with oxygen:** Metals except gold and silver (noble metals) react with oxygen to form basic oxides. Sodium also reacts vigorously with oxygen. A lot of heat is generated in this reaction.



Rusting of Iron: In the presence of moisture and air rust gets deposited over iron. (hydrated iron oxide)

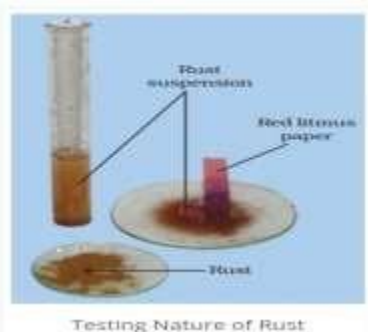


Greenish deposit on the surface of copper vessels: The dull greenish material is deposited on the surface of copper vessels when exposed to moist air for a long time. The green material is a mixture of copper hydroxide $[\text{Cu}(\text{OH})_2]$ and copper carbonate (CuCO_3) that takes place:
Copper + carbon dioxide + water + oxygen \rightarrow Copper carbonate + Copper Hydroxide

Metallic oxides are basic in nature.
They turn red litmus paper blue

Testing of the nature of Rust:

- (i) Collect a spoonful of rust and dissolve it in a very small amount of water.
- (ii) The rust remains suspended in water. Shake the suspension well.
- (iii) Test the solution with red and blue litmus papers. The red litmus turns blue. So, generally, metallic oxides are basic in nature.



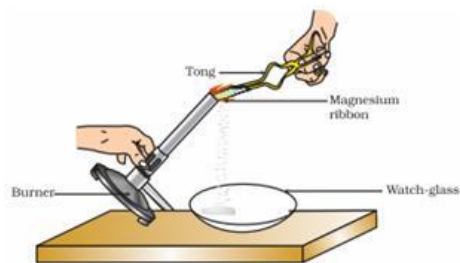
Activity:

Burning magnesium ribbon.

Magnesium + Oxygen \rightarrow Magnesium Oxide

The white ash obtained from burning magnesium ribbon is dissolved in water and tested for its acidic/basic nature.

Observation: The red litmus turns to blue. Metallic oxides are basic in nature.



- **Reaction of Metals with Water**

Some metals like sodium (Na) react vigorously with cold water at room temperature.

Potassium (K) and Calcium (Ca) are also active metals and react with water at room temperature. Such metals are stored in kerosene.

Metal + Water \rightarrow Metal hydroxide + Hydrogen

Some other metals react with hot water or steam and some metals do not react at all.

. For example, iron reacts with steam slowly.

Gold, silver no reaction with cold or hot water



- **Reaction with Acids:** Acids react with metals to liberate hydrogen and the corresponding salt of the metal.



Acids react with metals to liberate hydrogen and the corresponding salt of the metal.



Metals react with acids to produce hydrogen gas. If a matchstick is brought near the mouth of the tube containing the product then we hear a pop sound. It is this hydrogen gas that burns with a pop sound.

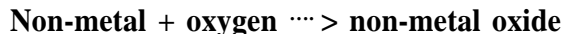


Copper does not react with hydrochloric acid but reacts with hot concentrated sulphuric acid.

Reaction with Bases: Generally, reactions of metals with bases release hydrogen gas, like in the case of many metals they react with Sodium hydroxide to produce hydrogen gas.

Chemical Properties of Non-Metals

- **Reaction with oxygen.** Non-metals react with oxygen to form **non-metal oxides which are acidic in nature.** For example, Sulphur when reacts with Oxygen forms Sulphur dioxide and Sulphur dioxide is dissolved in water to form sulphurous acid.



The sulphurous acid turns blue litmus paper red i.e. it is acidic in nature.

Testing the nature of non-metal:

- Take a small amount of powdered sulphur in a deflagrating spoon and then heat it.
- As soon as sulphur starts burning, introduce the spoon into a gas jar/ glass tumbler.
- Cover the tumbler with a lid to ensure that the gas produced does not escape.



- After some time remove the spoon. Add a small quantity of water into the tumbler and quickly replace the lid. Shake the tumbler well. Check the solution with red and blue litmus papers.



Testing of Solution with Litmus paper

• Reaction of Non-Metals with Water: Generally, non-metals do not react with water though they may be very reactive in air.

Phosphorus is a very reactive non-metal. It catches fire if exposed to air. To prevent contact with atmospheric oxygen it's stored in water.

Displacement Reactions: The reaction in which a high reactive metal displaces a low reactive metal from its salt solution is called Displacement Reaction.

Eg. Magnesium + Copper Sulphate \rightarrow Magnesium sulphate + Copper

Thus, metals are arranged in the order of their decreasing activity. This arrangement is called the **Reactivity series**

Reactivity Series of Metals

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

K - Potassium	Most reactive
Na - Sodium	
Ca - Calcium	
Mg - Magnesium	
Al - Aluminium	
Zn - Zinc	
Fe - Iron	
Pb - Lead	
H - Hydrogen	
Cu - Copper	
Hg - Mercury	
Ag - Silver	
Au - Gold	Least reactive

↓
Reactivity decreases
↓

Remembering the reactivity series...

• Please	Potassium (K)	
• Send	Sodium (Na)	
• Lions,	Lithium (Li)	
• Cats,	Calcium (Ca)	
• Monkeys,	Magnesium (Mg)	
• And	Aluminium (Al)	
• Zebras	Zinc (Zn)	
• Into	Iron (Fe)	
• Lovely	Lead (Pb)	
• Hot	Hydrogen (H) (non-metal)	
• Countries,	Copper (Cu)	
• Signed	Silver (Ag),	
• General	Gold (Au)	
• Penguin.	Platinum (Pt)	

Uses of Metals

- Metals are used in making wires and sheets, which are used for various purposes. For example,
Copper and Aluminium wires are used for the conduction of electricity, in electrical equipment etc.
Iron wires are used for fencing and various other purposes. Iron sheets are often used for making roof sheds.
- Metals are used in making machinery, automobiles, utensils, industrial gadgets, water boilers etc.

Uses of Non-Metals

Non-metals are widely used in our daily life. Many non-metals like Iodine, Chlorine, and Sulphur are used in medicine. Phosphorus is essential for our bones and teeth.

Some of the interesting uses of non-metals are:

- Non-metal (oxygen) is essential for our life, as Oxygen is required for respiration.
- Carbon dioxide is essential for green plants to carry out photosynthesis.
- Non-metals like Nitrogen and Phosphorus are used in fertilisers for better plant growth.
- Non-metal like Chlorine is used in the water purification process.
- Non-metal Iodine is used in the purple-coloured solution (Iodine solution) on wounds as an antiseptic.
- Non-metal such as Sulphur is used in crackers.

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