

St. Andrews Scots Sr. Sec. School

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Session: 2022-2023 - Notes

Class: VIII

Subject: Science

Topic: Metals and Non-metals

Lesson: 4

1. Metals:

Those materials which possess the characteristic of being hard, shiny, malleable, fusible, ductile, etc. are termed as metal. Few examples of metals are iron, gold, silver, aluminium, copper, etc.

Physical Properties of Metals:

(a) Malleability:

It is that property of metals which allows them to be beaten into the thin sheets.



Malleability of metals

Due to presence of this property, the shape of iron nail and aluminium wire can be changed on beating. The silver foils used for decorating sweets and the aluminium foil used for wrapping food are possible because of malleability property of metals.

(b) Conductivity:

It is that property of metals which allows the current and heat to pass through them easily.

Example- Metals like iron rod, nail, copper wire, etc. are good conductors of electricity.

(c) Ductility:

It is that property of metals which allows them to be drawn into the wires.

Example: Metals like aluminium and copper wires are used in electric connection.

(d) Sonorous:

It is that property of metals which produces ringing sounds on hitting.



Ringing property of Metal

(e) Lustrous:

It is that property of metals which makes them shine and their structures are capable of reflecting incident light.



Lustrous Property of Metal

Notes: Metals like sodium and potassium are soft and can be cut with a knife.

Mercury is the only metal which is found in liquid state at room temperature. These are exceptions

Exceptions in Physical Properties

- Alkali metals (Na, K, Li) can be cut using a knife.
- Mercury is a liquid metal.
- Lead and mercury are poor conductors of heat.
- Mercury expands significantly for the slightest change in temperature.
- Gallium and cesium have a very low melting point

- Iodine is non-metal but it has lustre.
- Graphite conducts electricity.
- Diamond conducts heat and has a very high melting point.

2. Non -Metals:

Those materials which do not possess the characteristics of metals are termed as non-metal. Materials like coal and sulphur are soft and dull in appearance. They break down into powdery mass on tapping with hammer. They are non-sonorous and are poor conductors of heat and electricity. Few examples of non metals are sulphur, carbon, oxygen etc.

Physical Properties of Metals and Non-metals

Physical Properties	Metals	Non-Metals
Conductivity	Metals (such as iron or copper) are good conductors of heat and electricity.	Non-metals (such as coal or sulphur) are poor conductors of heat and electricity. Graphite is an exception as it is a good conductor of electricity.
Ductility	Metals (such as aluminium and copper) are ductile, which means that they can be drawn into wires.	Non-metals are brittle (break down when struck) and hence, they cannot be drawn into wires.
Hardness	All metals are hard though there are some exceptions. Sodium and potassium are soft and can be cut with a knife.	Most non-metals are soft. Diamonds are exceptions as they are the hardest material found on Earth. However, they are also very brittle and break when struck with a hammer.
Lustre	Metals (such as gold, silver and copper) are lustrous, which means that they reflect light from their surface and can be polished.	Non-metals (such as coal) are generally dull and do not reflect light. Hence, they lack metallic lustre.
Malleability	Metals (such as silver and aluminium) are malleable, which means that they can be beaten into thin sheets.	Since non-metals break easily, they cannot be pounded into sheets.

Physical State	Most metals remain solid at room temperature, except mercury and gallium which remain liquid at room temperature.	Most non-metals exist in two of the three states of matter at room temperature: Gases (such as oxygen), and Solids (such as carbon).
Sonorous	Metals produce ringing sounds when they are struck and hence, they are sonorous, except Mercury which is liquid in nature.	Non-metals are non-sonorous and do not produce the typical metallic sound when they are struck.
Examples	Iron, copper, aluminium, calcium, magnesium, etc.	Sulphur, carbon, oxygen, phosphorus, etc.

Chemical Properties of Metals & Non-Metals:

1. Reaction with Oxygen

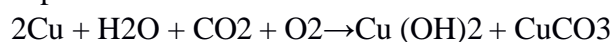
(a) For Metals:

Generally, when metals are reacted with oxygen they will form metallic oxides. And these metallic oxides are basic in nature.

Example-1: Rusting of Iron. Following is the reaction to express it.

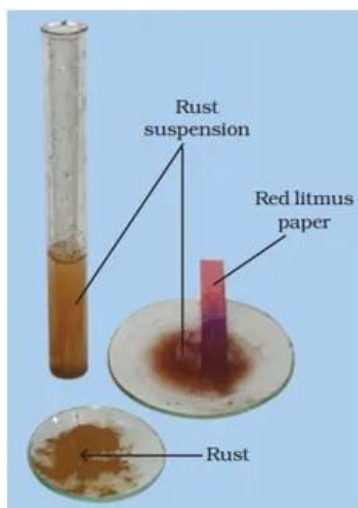


Example-2: If a copper vessel is left open in presence of the moist air, then, a dull green coating will be observed on it. The green material is a mixture of copper hydroxide (Cu(OH)_2) and copper carbonate (CuCO_3). Following is the reaction to express it:



Testing of nature of Rusting:

- (i) Collect a spoonful of rust and dissolve it in a very little 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.



Testing Nature of Rust

(b) For Non-metals:

Generally, non-metals also produce oxides when reacted with oxygen. But, in contrast to metals, these oxides are acidic in nature.

Testing the nature of non metal:

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



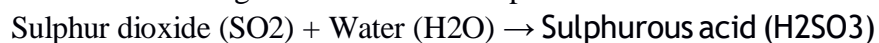
Burning of Sulphur Powder

(iv) 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

(v) The name of the product formed in the reaction of sulphur and oxygen is sulphur dioxide gas. When sulphur dioxide is dissolved in water sulphurous acid is formed. Following is the reaction to express it:



(vi) The sulphurous acid turns blue litmus paper red.
Generally, oxides of non-metals are acidic in nature.

2. Reaction with Water:

(a) For Metals:

Some metals react vigorously with water like in case of sodium. It is stored in kerosene.. While, some metals reacts very slowly with water like in case of iron.



Reaction of Sodium with Water

(b) For Non-metals:

Generally, most non-metals do not react with water but there are some non-metals which are quite reactive in air like phosphorous, which is very reactive and is kept in water to prevent explosion.

3. Reaction with Acids:

(a) For Metals:

Generally, a metal reacts with acids and releases hydrogen gas with a 'pop' sound. The presence of hydrogen gas is confirmed by bringing a burning matchstick or candle near the gas. And when the burning matchstick or candle produces pop sound then it means that hydrogen gas has evolved.

It is found that, copper does not react with hydrochloric acid while it reacts with a sulphuric acid.

(b) For Non-metals:

Generally, non-metals do not react with acids.

4. Reaction with Bases:

(a) For Metals:

Generally, reactions of metals with bases release hydrogen gas, like in case of many metals they react with sodium hydroxide to produce hydrogen gas.

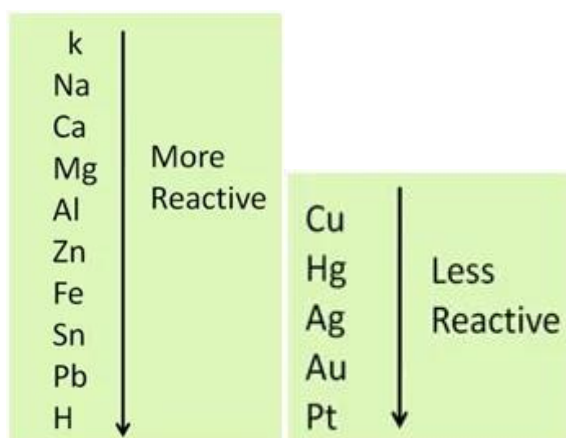
(b) For Non-metals:

Generally, reactions of non-metals with bases are complex.

5. Displacement Reaction:

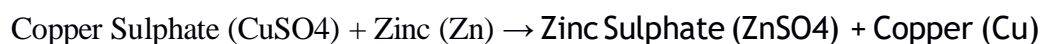
During reaction if a metal replaces another metal from its compound then such reactions are called displacement reaction.

Metals can actually be arranged as per their reactivity order, thus, a more reactive metal will always displace a less reactive metal from its compound but a less reactive one cannot replace a more reactive metal.



Reactivity series of metals

Example : When zinc is reacted with copper sulphate solution, then copper will be displaced by zinc as zinc is more reactive than copper. The blue colour of copper sulphate disappears and a powdery red mass of copper is deposited at the bottom of the beaker. The reaction-



Uses of Metals and Non-metals

As discussed above, metals are hard, malleable, ductile, and sonorous and are hence, can be used for:

- Making machinery
- Making automobiles, trains, and aeroplanes
- Making cooking utensils and water boilers
- Making industrial gadgets and satellites etc.

Non-metals also have several uses, such as:

- Essential for life (such as oxygen)
- Used as fertilizers (such as nitrogen and phosphorus)
- Used to purify water (such as chlorine)
- Applied on wounds as an antiseptic (such as purple-coloured iodine solution)
- Used in crackers (such as sulphur)