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METALS AND NON-METALS

- Metals are lustrous whereas non-metals have no lustre. Metals are malleable and ductile. Non-metals do not have these properties.
- Metals are good conductors of heat and electricity but non-metals are poor Conductors.
- On burning, metals react with oxygen to produce metal oxides which are basic in nature. Non-metals react with oxygen to produce non-metallic oxides which are acidic in nature.
- Some metals react with water to produce metal hydroxides and hydrogen gas. Generally, non-metals do not react with water.
- Metals react with acids and produce metal salts and hydrogen gas. Generally, non-metals do not react with acids.
- Some metals react with bases to produce hydrogen gas.

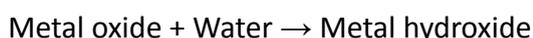
Metals

- Metals, in their pure state, have a shining surface. This property is called metallic lustre.
- Metals can be beaten into thin sheets. This property is called malleability. **Gold and silver are most malleable metal.**
- Ability of metals to be drawn into thin wires is called ductility. **Gold is the most ductile metal.** You will be surprised to know that a wire of about 2 km length can be drawn from one gram of gold.
- Metals are good conductors of heat and have high melting points. The best conductors of heat are **silver and copper**. Lead and mercury are comparatively poor conductors of heats.
- Metals are good conductors of electricity. The **best conductors of electricity is silver**.
- When an **acid reacts with a metal, hydrogen gas** is evolved and a corresponding salt is formed
$$\text{Acid} + \text{Metal} \rightarrow \text{Salt} + \text{Hydrogen gas}$$
- All metals except **mercury exist as solids at room temperature**.
- **Gallium and cesium have very low melting points.** These two metals will melt if you keep them on your palm.
- Alkali metals (**lithium, sodium, potassium**) are so soft that they can be **cut with a knife**. They have low densities and low melting points.
- **Concentrated Acid:** It has relatively large amount of acid dissolved in a solvent.
- **Dilute Acid:** It has relatively smaller amount of acid dissolved in solvent.
- Almost all metals combine with oxygen to form metal oxides.
$$\text{Metal} + \text{Oxygen} \rightarrow \text{Metal oxide}$$
- All metals do not react with oxygen at the same rate. Different metals show different reactivities towards oxygen. **Metals such as potassium and sodium react so vigorously.**
- **Metals such as potassium and sodium** react so vigorously that they catch fire if kept in the open. Hence, to protect them and to prevent accidental fires, they are kept immersed in **kerosene oil**.
- **Anodising** is a process of forming a thick oxide layer of aluminium.
- Aluminium develops a thin oxide layer when exposed to air. This aluminium oxide coat makes it resistant to further corrosion.

- Silver and gold do not react with oxygen even at high temperatures.

When Metals react with Water?

- Metals react with water and produce a metal oxide and hydrogen gas. Metal oxides that are soluble in water dissolve in it to further form metal hydroxide. But all metals do not react with water.



- Metals like **potassium and sodium** react **violently with cold water**. In case of sodium and potassium, the reaction is so violent and exothermic that the evolved hydrogen immediately **catches fire**.
- The **reaction of calcium** with water is **less violent**. The heat evolved is not sufficient for the hydrogen to catch fire. **Calcium starts floating** because the bubbles of hydrogen gas formed stick to the surface of the metal.
- **Magnesium does not react with cold water**. It reacts with hot water to form magnesium hydroxide and hydrogen. It also starts floating due to the bubbles of hydrogen gas sticking to its surface.
- Metals like aluminium, iron and zinc do not react either with cold or hot water. But they react with steam to form the metal oxide and hydrogen.
- Metals such as lead, copper, silver and gold do not react with water at all.

When Metals react with Acids?

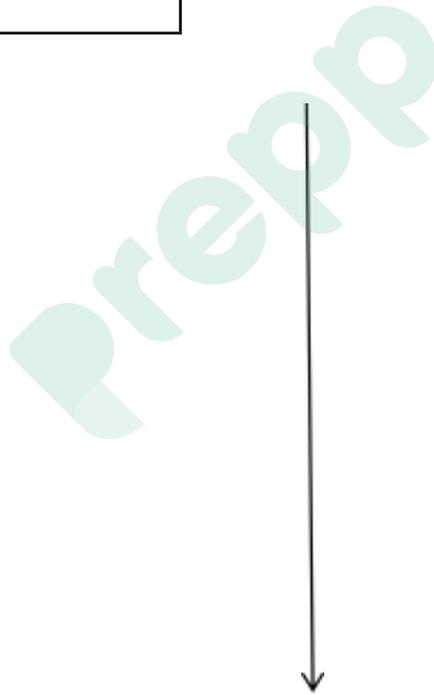
- Metals react with acids to give a salt and hydrogen gas.
Metal + Acid \rightarrow Salt + Hydrogen
- **Hydrogen gas is not evolved** when a metal reacts with **nitric acid**. It is because HNO_3 is a strong oxidising agent. It oxidises the H_2 produced to water and itself gets reduced to any of the nitrogen oxides (N_2O , NO , NO_2). But magnesium (Mg) and manganese (Mn) react with very dilute HNO_3 to evolve H_2 gas.
- **Aqua regia** is a freshly prepared mixture of concentrated **hydrochloric acid** and concentrated **nitric acid** in the ratio of **3:1**. Aqua regia is a highly corrosive, fuming liquid. It is one of the few reagents that is able to dissolve **gold and platinum**. It is used for cleaning and refining gold.

The Reactivity Series

The reactivity series is a list of metals arranged in the order of their decreasing activities.

Symbol	Metal
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Sk	Potassium
Na	Sodium
Ca	Calcium
Mg	Magnesium
Al	Aluminum
Zn	Zinc
Fe	Iron
Pb	Lead
H	Hydrogen
Cu	Copper
Hg	Mercury
Ag	Silver
Au	Gold



List Of Metal and Their Ores

METALS	ORES
Sodium	Trona, Borax, Common Salt
Aluminum	Bauxite
Potassium	Nitrate, Carnallite
Magnesium	Magnesite, Dolomite Epsom salt
Silver	Ruby silver, Horn silver
Mercury	Cinnabar
Tin	Cassiterite
Lead	Galena
Gold	Calaverite, Sylvanites
Calcium	Dolomite Gypsum Fluorspar, Asbestos
Iron	Haematite, Magnetite
Bismuth	Bismuthate

Non-Metals

- Examples of non-metals are carbon, sulphur, iodine, oxygen, hydrogen, etc.
- Non-metals are either solids or gases except bromine which is a liquid at room temperature.
- Iodine is a non-metal but it is lustrous.
- Carbon is a non-metal that can exist in different forms. Each form is called an allotrope.
- **Diamond, an allotrope of carbon**, is the hardest natural substance known and has a very high melting and boiling point.
- **Graphite**, another allotrope of carbon, is a conductor of electricity.
- Non-metals produce acidic oxides when dissolve in water.

Corrosion

When a metal is attacked by substances around it such as moisture, acids, etc., it is said to corrode and this process is called corrosion. The **black coating on silver** and the **green coating on copper** are other examples of corrosion.

Prevention Of Corrosion

- Rusting of iron can be prevented by painting, oiling, greasing, galvanizing, chrome plating, anodizing or making alloys.

- Galvanization is a method of protecting steel and iron from rusting by coating them with a thin layer of zinc.

Alloying

- Alloying is a very good **method of improving the properties of a metal**.
- Alloy is a homogeneous mixture of two or more metals, or a metal and a Non-metal.
- Iron is the most widely used metal. But it is never used in its pure state. This is because pure iron is very soft and stretches easily when hot. But, if it is **mixed with a small amount of carbon**, it becomes hard and strong. When iron is mixed with nickel and chromium, we get stainless steel, which is hard and does not rust.
- Pure gold is very soft. It is, not suitable for making jewelry. It is alloyed with either silver or copper to make it hard.

Important Alloys

Alloy	Combinations
Solder	Lead and Tin
Brass	Copper and zinc

Stainless steel	Iron, Chromium and Nickel
Bronze	Copper and Tin
Invar	Iron and Nickel
Constantan	Copper and Nickel
Gun metal	Copper, tin and zinc
Sterling silver	Silver and copper
German silver	Copper, zinc and Nickel

- An amalgam is an alloy of mercury.
- Electrical conductivity and melting point of an alloy is less than that of pure metals.
- Some alloys have lower melting point than pure metals (Example: Solder is an alloy of lead and tin which has lower melting point than each of the metals).
- Solder is used for welding electrical wires together.
- Alloys do not get corroded or get corroded to very less extent

Important Chemical and Its Uses

Chemical name	Common name	Uses
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Aluminium		Used in Heat resistant clothing, Cookware and manufacturing of aircraft
Acetic Acid	Vinegar	Cooking, baking and pickling
Acetylsalicylic Acid	Aspirin	Medical
Argon		Used in incandescent lighting equipment's such as Bulbs, CFLs
Ammonium Phosphate	Fertilizer	Used as a fertilizer in Agricultural
Aluminium potassium Sulphate	Alum	Used in Water Purification, Some types of Toothpastes and Pickling Agent
Ammonium Nitrate		Fertilizers and Explosives
Bismuth		Fire detection systems and bullets
Calcium Carbonate	Limestone	Marble, Limestone and Precipitated Chalk
Calcium oxide	Quicklime	Cement Production
Carbon		Graphite, Fossil Fuels, Clay, Charcoal and Diamond
Copper		Manufacturing of Electrical Wires & cables
Glycerin		Making of Skin Products
Ethanol		Antiseptic, Rocket Fuels, Fuel cells and Engine Fuel
Helium		Treating Asthma and Barcode Reading
Lithium		Portable Battery and Making of Optical devices
Mercury	Quicksilver	Barometers and Thermometer
Sodium Nitrate		Gunpowder making and treating of dentine hypersensitivity
Sulphuric acid	Vitriol	Electrolyte and Industrial Cleaning agent

Zinc		Galvanizing
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