

## Unit-1 some basic concepts in chemistry

Chemistry is a branch of science that involves the study of the composition, structure and properties of matter.

### **Importance and scope of chemistry:-**

One current important area of inorganic chemistry deals with the design and properties of materials involved in energy and information technology. Analytical chemistry: Analytical chemistry is the study of the composition of matter. Food is made from chemicals. Many of the changes you observe in the world around you are caused by chemical reactions. Examples include leaves changing colors, cooking food and getting you clean.

Chemistry education plays an important role in enhancing the quality of teaching, research and development as well as ensuring that students are equipped with good knowledge to produce intensive good and services to mean human needs for food, health care products.

Organic chemistry plays an important role in the pharmaceutical industry the organic compounds is used to inform research and further the discovery, research and development of new medicines

### **Classification of matter:-**

**Matter can be classified according to physical and chemical properties.**

#### **Physical classification:-**

The three states of matter are solid, liquid, and gas. A physical change involves the conversion of a substance from one state of matter to another, without changing its chemical composition.

#### **Chemical classification:-**

Matter can be classified into several categories. Two broad categories are mixtures and pure substances.

**Mixture:-**

A mixture is composed of two or more types of matter that can be present in varying amounts and can be separated by physical changes,

**Pure substances may be divided into two classes: -** elements and compounds.

**Element:-** Pure substances that cannot be broken down into simpler substances by chemical changes are called elements. .examples:- Iron, silver, gold, aluminum, sulfur, oxygen etc.

**Compound:-**

Pure substances that can be broken down by chemical changes are called compounds. Examples water, ammonia etc.

**Atom:-**

An atom is the smallest particle of an element that has the properties of that element and can enter into a chemical combination examples hydrogen, nitrogen etc.

**Molecule:-**

A molecule is an electrically neutral group of two or more atoms held together by chemical bonds.

Example:-

H<sub>2</sub>O (water)

N<sub>2</sub> (nitrogen)

O<sub>3</sub> (Ozone )

**Symbol:-**

Symbols can be defined as the short hand notations which represent single atoms of element.

**Significance of symbols:-**

(1) It represents name of the element. (2) It represents one atom of the elements. (3) It represents one mole of atoms of the element.

**write the chemical formula of compound:-**

When writing formula, the positive atom or ion comes first followed by the name of the negative ion. The chemical name for common table salt is sodium chloride. The periodic table shows that the symbol for sodium is Na and the symbol for chlorine is Cl. The chemical formula for sodium chloride is NaCl.

**-Calculate the percentage of composition of element in compound:-**

1. Find the Atomic mass of all the elements in the compound in grams per mole.
2. Find the molecular mass of the entire compound.
3. Divide the component's Atomic mass by the entire molecular mass.
4. You will now have a number between 0 and 1. Multiply it by 100% to get percent composition.

## Unit-2 Structure of atom

A typical atom consists of three subatomic particles: protons, neutrons, and electrons.

On the other hand Atoms are made up of three particles: protons, neutrons and electron

### **Electron:-**

Lightest stable subatomic particle known. It carries a negative charge of  $1.602 \times 10^{-19}$  coulomb. The rest mass of the electron is  $9.11 \times 10^{-31}$  kg.

### **Proton:**

Stable subatomic particle that has a positive charge equal in magnitude to a unit of electron charge and a rest mass of  $1.67262 \times 10^{-27}$  kg.

### **Neutron:-**

Neutron has no electric charge and a rest mass equal to  $1.67493 \times 10^{-27}$  kg .

### **postulates of bohr's model of atom:-**

- (1) An electron moves around the nucleus in a circular orbit.
- (2) An electron's angular momentum in the orbit is quantized.
- (3) The change in an electron's energy as it makes a quantum jump from one orbit to another.
- (4) In an atom, there are small, heavy positively charged nuclei in the center and the electrons revolve around it in circular orbits.
- (5) Each orbit or shell has a fixed energy and these circular orbits are known as orbital shells.

**Atomic number:-**

The atomic number is the number of protons in the nucleus of an atom. The number of protons in the nucleus of an atom determines an element's atomic number. For example, all hydrogen atoms, and only hydrogen atoms, contain one proton and have an atomic number of 1.

**Mass number:-**

The number of protons and the number of neutron determine an element's mass number. The sum of the numbers of protons and neutrons in the nucleus is called the mass number.

**ISOTOPES:-**

Atoms which have the same atomic number but different mass number are called as isotopes. For example: - Hydrogen has three atomic species, namely protium, deuterium, tritium.

**Isobars:-**

Isobars are atoms of different elements with the same mass number but different atomic numbers. For example, two elements calcium and argon.

**Isotones:-**

Isotones are atomic species that share the same number of neutrons, and differ in the number of protons. Examples of isotones include carbon-12, nitrogen-13 and oxygen-14. These atoms all have six neutrons and six, seven and eight protons.

### **Difference between orbit and orbital:-**

#### **Orbit:-**

An orbit is a fixed path on which electrons revolve around the nucleus.

An orbit is a planar representation.

#### **Orbital:-**

An orbital is the Probable area of finding the maximum density of electrons in an atom.

An orbital refers to the dimensional motion of an electron around the nucleus in a three-dimensional motion.

An orbital can simply be defined as the space or the region where the electron is likely to be found the most.

#### **Electronic configuration:-**

The electron configuration of an atom, describes the arrangement of electrons in space around the nucleus. The electrons are distributed over different energy level.

### **Unit-3 Chemical bonding**

Chemical Bonding refers to the formation of a chemical bond between two or more atoms, molecules, or ions to give rise to a chemical compound.

#### **Octet-rule:-**

The octet rule states that an atom tends to have eight electrons in its outermost valence shell by forming covalent bonds through gain or loss or mutual sharing electrons from its outermost shell.

Elements that obey octet rules are main group elements which are oxygen, carbon, nitrogen.

#### **Chemical bonds include covalent and ionic bonds:-**

#### **Ionic bond:-**

Ionic bond is a type of chemical bond that occurs between two oppositely charged ions.

.Example:-

NaF - Sodium Fluoride.

NaCl - Sodium Chloride.

NaBr - Sodium Bromide.

NaI - Sodium Iodide.

### **Characteristics of ionic compound**

1. They form crystals.
2. They have high melting and high boiling points.
3. They are hard and brittle.
4. They have higher enthalpies of fusion and vaporization than molecular compounds.
5. They conduct electricity when dissolved in water.
6. Ionic solids do not conduct electricity so they are good insulators also.

### **Covalent bond:-**

A covalent bond is a chemical bond in which pairs of electrons are shared between two atoms. The covalent bond is also called a molecular bond.

A covalent bond forms between two non-metals by sharing electrons. An example could be Water ( $H_2O$ )

### **Characteristics of covalent compounds :-**

1. Covalent compounds are made up of neutral molecules. ...
2. The melting and the boiling points of covalent compounds are generally low. ...
3. Covalent compounds are insoluble in water but soluble in organic solvents.

4. Covalent compounds do not conduct electricity

**Types of covalent bond:-**

There are two types of covalent bond i.e. sigma and pi bond.

Sigma and pi bonds are chemical covalent bonds.

Sigma and pi bonds are formed by the overlap of atomic orbitals.

Sigma bonds are formed by end-to-end overlapping.

Pi bonds are when the lobe of one atomic orbital overlaps another.

Generally sigma bonds are stronger than pi bonds

**Unit-4-Solution**

A solution is a homogeneous mixture of two or more substances. A solution may exist in any phase. A solution consists of a solute and a solvent. The solute is the substance that is dissolved in the solvent. For example, in a saline solution, salt is the solute dissolved in water as the solvent.

**Solute:-**

A component of a solution present in smaller amount in the solution.

**Solvent:-**

A component of a solution present in large amount in the solution.

**Binary-solution:-**

A binary solution is a kind of homogeneous mixture, in which the mixture of two liquids is completely miscible with each other example salt in water.

**Aqueous solution:-**

An aqueous solution is any solution in which water is the solvent. For example, dissolving salt in water.

**Acid :-** An acid is a substance that gives  $H^+$  ions when dissolved in water. For example:-  
 $HCl, H_2SO_4$  etc.

**Base: -** A base is a substance that Gives  $OH^-$  ions when dissolved in water. For example:-  
 $NaOH, Ca(OH)_2$  etc.

**Salts:-**

A salt results when an acid reacts with a base. Both are neutralized..The  $H^+$  and  $OH^-$  ions combined to form water. The non metallic ions of the acid and the metal ions of the base form salts. Example:- $NaCl, KCl$  etc.

**Acidity:-**

The acidity of bases is the number of hydroxyl ions that the basic molecule can produce in the aqueous solution. Example:- $NaOH$ -1 Acidity

**Basicity:-**

The basicity of the acids is the number of hydronium ions that the compound can produce in the aqueous solution. Example:- $HCl$ -1 Basicity

**Concentration of a solution:-**

The concentration of a solution is a measure of the amount of solute that has been dissolved in a given amount of solvent or solution.

## **Modes of expressing concentration of a solution**

### **Strength:-**

Strength of the solution is defined as the amount of solute in grams that is present in one litre solution.

Strength of solution = Mass of solute in grams/Volume of a solution in litres.

### **Normality:-**

Normality (N) is defined as the number of mole equivalents per liter of solution.

Normality = number of mole equivalents/1 L of solution.

### **Molarity:-**

Molarity is the number of moles of the solute dissolved per liters of the solution

Molarity is also known as the molar concentration of a solution

Molarity=moles of solute/litres of solution

### **PH:-**

The pH of a solution is a measure of hydrogen ion concentration. The range goes from 0 to 14, with 7 being neutral. pHs of less than 7 indicate acidity, whereas a pH of greater than 7 indicates a base.

**Application of PH:** - 1. In the digestion of food: pH plays a very important role in the digestion of food in our stomach.

2. Agriculture, wastewater treatment, industrial processes, environmental monitoring, and research

and development.

3. PH is a measure of the Acidity or Alkalinity of a Solution.
4. PH measurement determines the product quality or monitors chemical reactions.
5. The applications of pH measurements vary widely, from wastewater cleaning to optimizing the texture and flavor of foods and beverages.

### **Unit -5 Electrochemistry**

#### **Electrochemistry:-**

Electrochemistry is the branch of chemistry concerned with the interrelation of electrical and chemical changes that are caused by the passage of current.

#### **Oxidation: -**

Oxidation is a reaction that removes an electron from a substance.

#### **Reduction:-**

Reduction is a reaction that adds electrons to a substance.

#### **Electrolyte:-**

An electrolyte is a substance that conducts electricity when dissolved in water. Example:-  
Acids, Base and salts.

Non electrolyte:- Non electrolytes do not dissociate into ions in solution; nonelectrolyte solutions do not conduct electricity.

Examples include solutions of nonpolar gases ( $H_2$ , noble gases,  $CH_4$ , gaseous hydrocarbons,  $SF_6$ , air), etc.

**Types of Electrolyte: -**There are two types of electrolyte.

**Strong Electrolytes: -**

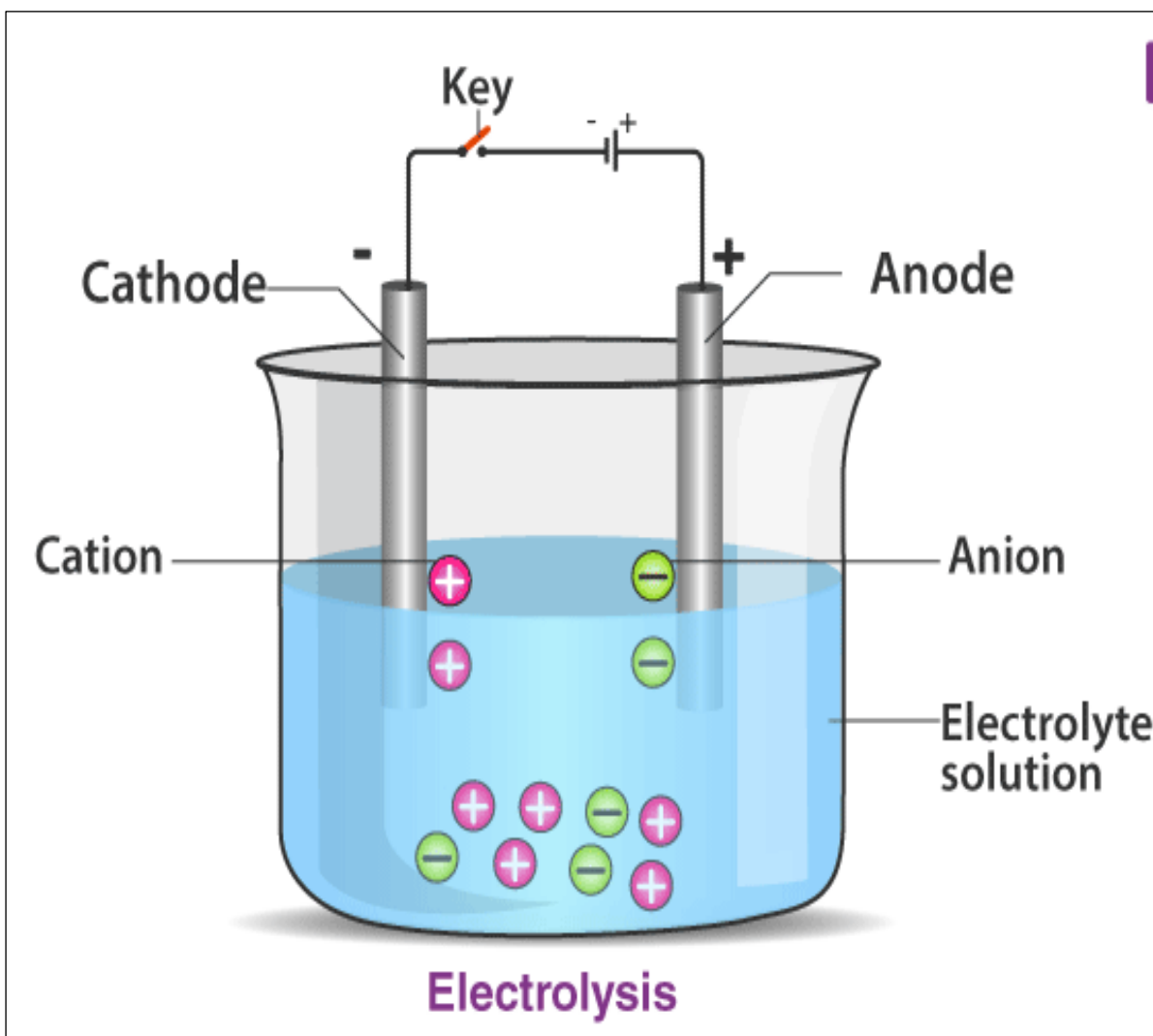
Strong electrolytes ionize completely (100%). Examples: -NaCl, KCl, NaOH etc.

**Weak electrolytes:-**

Weak electrolytes ionize only partially (usually on the order of 1–10%). Examples: -HF, Ammonia, Acetic acid etc.

**Electrolysis: -**

Electrolysis refers to the decomposition of a substance by an electric current. Example: When the current is passed through the molten sodium chloride, sodium and chlorine are deposited at different electrodes.



### **Faraday's First Law of Electrolysis:-**

Faraday's First Law of Electrolysis states that "The mass of a substance deposited at any electrode is directly proportional to the amount of charge passed.

Mass of the ions formed or reacted ( $m$ )  $\propto$  electric current  $\propto Q$ , or

$$m \propto Q \text{ or}$$

$$m = ZQ$$

Where,  $Z$  is a proportionality constant, called the chemical equivalent of the element.

For a flow of, 1 Coulomb of charges for one second,  $m = Z$ .

The proportionality constant is equal to the mass of the substance involved in the reaction.  $Z$  is the electrochemical equivalent mass of one coulomb charge.

### **Faraday's second Law of Electrolysis:-**

Faraday's second law of electrolysis states that "The masses of different ions liberated at the electrodes, when the same amount of electricity is passed through different electrolytes are directly proportional to their chemical equivalents.

#### **For example:**

When the same current is passed through the solutions of sulphuric acid ( $\text{H}_2\text{SO}_4$ ), copper sulphate ( $\text{CuSO}_4$ ), and silver nitrate ( $\text{AgNO}_3$ ) for the same period of time, then:

- Mass of copper deposited/Mass of silver deposited = Equivalent mass of copper/Equivalent mass of silver and,
- Mass of copper deposited/Mass of hydrogen gas liberated =Equivalent mass of copper/Equivalent mass of hydrogen.

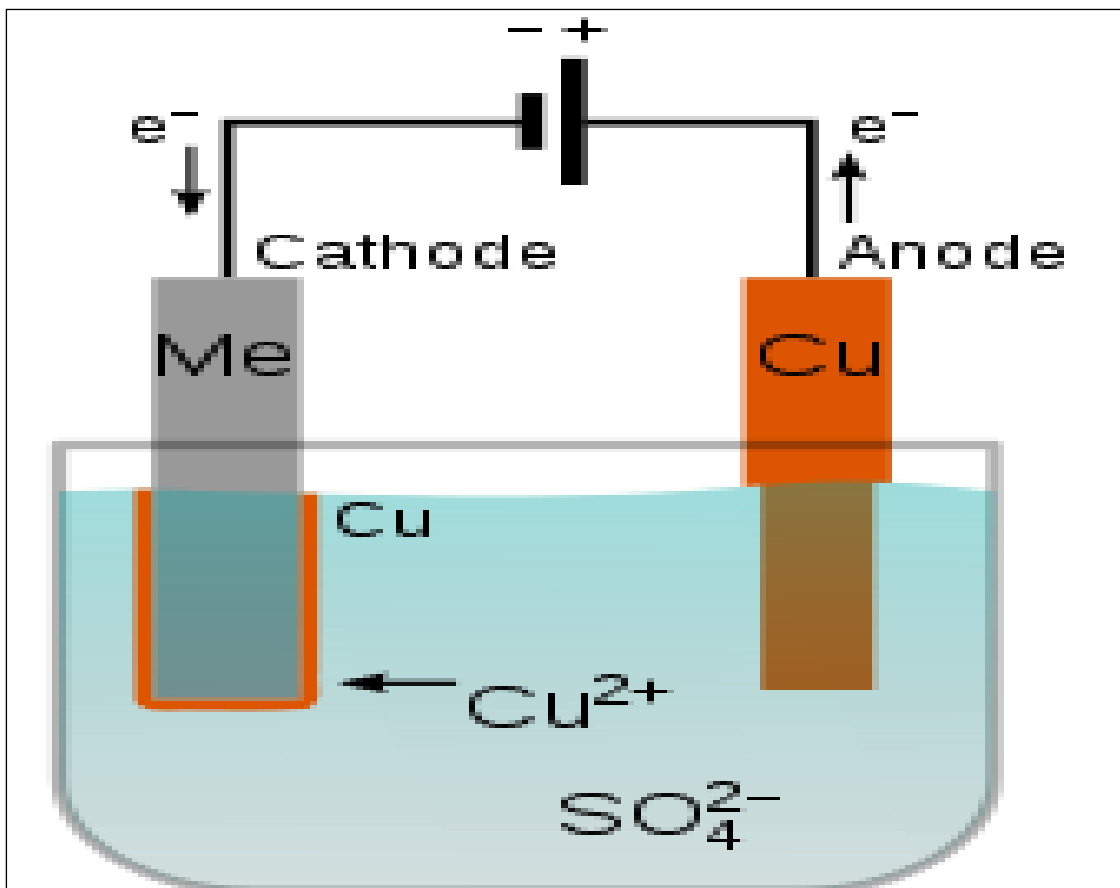
According to the second law of electrolysis, the same quantity of electricity will produce or dissolve chemically equivalent amounts of all the substances. This quantity of electricity is called Faraday (F).

- One Faraday is equal to 96487 coulombs per mole of electronic charges.

### Industrial application of electrolysis:-

1. Electroplating refers to a process that adds a surface layer of metal to another type of metal. It's typically used to prevent corrosion and rust and to extend the useful life of the metal.

Electroplating is used in jewelry making to coat base metals with precious metals to make them more attractive and valuable and sometimes more durable.



2. Electro-refining is the process of refining impure metals by using electricity. In this process impure metal is made as the anode and a strip of pure metal is made the cathode. A solution of a soluble salt of the same metal is taken as the electrolyte. Example- Copper can be purified by this way

3. Electrometallurgy is used for recovering or winning some metals from leaching solutions using an aqueous electrolysis and molten salt electrolysis for recovering aluminum, magnesium and uranium.

### **Unit- 7 Fuels**

Any combustible substance which during combustion gives large amount of heat which can be used economically for domestic and industrial purposes.

#### **Examples of Fuels:-**

1. Wood
2. Diesel Oil
3. Kerosene Oil
4. Natural Gas
5. Liquefied petroleum Gas

#### **Roles Of Fuels In Daily Life:-**

1. The fuels are used in homes for cooking food.
2. The fuels are used in industries.
3. The fuels are used in transporting material from one place to another.
4. The fuels are used for generating electricity.

5. The fuels are used in space propellers like rockets.

### **Classification of Fuels:-**

According to the source from which they are obtained.

#### **A. Natural fuels    B. Artificial fuels**

#### **Natural fuels –**

Fuels which occur in nature as such are called natural fuels.

#### **The type of natural fuels**

1. Natural solid fuels: -                      Wood, Peat, Lignite etc.
2. Natural liquid fuels: -                      Petroleum or Crude oil.
3. Natural gaseous fuels: -                      Natural gas, Marsh gas

#### **B. Artificial fuels**

#### **Artificial fuels–**

Fuels which are prepared artificially are called artificial fuels The type of artificial fuels.

1. Artificial solid fuels:- coke, charcoal etc.
2. Artificial liquid fuels:- petrol, diesel, ethyl alcohol etc.
3. Artificial gaseous fuels:- coal gas, water gas, hydrogen etc.

### **Advantage and disadvantage of various fuels**

#### **Advantage of fuels:-**

Wood

(A) Cleanliness, cheerful fire (B) Quick increase of heat (C) cheap in some localities (D) There is no requirement of any container for burning

### **Disadvantage of fuels**

Wood

(A) Low calorific value (B) large storage space necessary (C) labor in preparation (D) large amount of ash produced after burning

### **Advantage of Oils**

(A) High heat value, (B) immediate increase of heat (C) cleanliness (D) small storage space necessary.

### **Disadvantage of Oils**

(A) High price

(B) Difficulty of safe storage. (C) there is requirement of container for burning (D) Release the poison gases during the burning.

### **Advantage of Gas**

(A) Ease of control

(B) Cleanliness (C) convenience (D) immediate increase of heat.

### **Disadvantage of Gaseous fuels**

(A) High price in many places.

(B) Risky to use

### **Definition of calorific value.**

Calorific value is the amount of energy released or produced when 1 kg of fuel burns or any other substance is burnt in the presence of oxygen and the products of combustion.

### **Characteristic of good fuels**

1. It should be cheap, easily transportable and has highcalorific value. It must have moderate ignition temperature and should leave less ash after combustion. The combustion speed of a good fuel should be moderate. It should not burn spontaneously to avoid fire hazards.
2. Proximate analysis of coal and its importance
3. Proximate analysis is formally determining the percentage of the moisture, volatile matter, fixed carbon, and ash content of a coal sample.
4. It is used to establish the rank of coals, to show the ratio of combustible to incombustible constituents, or to provide the basis for buying/selling, and otherwise evaluating coal for various purposes.

#### **Fuel quality rating:-**

Octane rating is a measure of a fuel's ability to resist 'knock'.

#### **Octane number:-**

The octane number (ON) is a measure of the knock resistance of gasoline. It defines a numerical value from 0 to 100, and describes the behavior of the fuel.

#### **Cetane numbers:-**

The cetane number describes the percentage of cetane found in the mixture that corresponds to the ignition quality of the test fuel.

## **Unit 8 Water**

Water is essential to all form of life.

**Source of Water:-**

Source water refers to sources of water (such as rivers, streams, lakes, reservoirs, springs, and groundwater) that provide water to public drinking water supplies and private wells.

**Hard water:-**

The amount of dissolved calcium and magnesium in the water. Hard water is high in dissolved minerals, largely calcium and magnesium.

When hard water is heated, such as in a home water heater, solid deposits of calcium carbonate can form.

**Soft water:-**

Water that is free from dissolved salts of such metals as calcium, iron, or magnesium.

**Hardness of water:-**

Hardness of water that contains salts of calcium and magnesium principally as bicarbonates, chlorides, and sulfates

**There are two types of water hardness, temporary and permanent****Temporary hardness:-**

Temporary hardness is mainly caused by the carbonates and bicarbonates of calcium and magnesium. It can be easily removed by boiling of water.

**Permanent hardness:-**

Permanent hardness is due to presence of sulfates and chlorides of calcium and magnesium in water. It cannot be easily removed by boiling of water.

**Units of hardness:-**

(1) Parts Per million (ppm): It is defined as the number of parts by weight of  $\text{CaCO}_3$  equivalent present in per million ( $10^6$ ) parts by weight of water.  $1 \text{ mg/L} = 1 \text{ mg of CaCO}_3$  equivalent hardness present per litre of water.

(2) The amount of hardness is expressed in milligrams per litre (mg/L) as calcium carbonate.

### **Disadvantages of hard water in boiler**

Hard water that's filled with minerals like calcium and magnesium can cause damage to the tubes inside water boilers. If these minerals are present in the boiler's water supply, it can lead to limescale forming on the surface of the tubes, which has the potential to cause overheating and tube failure.

When hard water is boiled at home or in industries, it leaves deposits of calcium and magnesium salts in kettles, hot-water pipes, boilers and radiators. These deposits reduce the efficiency of boilers, kettles and pipes and can cause blockages and even bursting of the boilers.

### **Sludge: -**

If the precipitation takes place in the form of loose/slimy precipitate, it is known as sludge.

### **Scale:-**

If the precipitation takes place in the form of a hard, adhering crust/coating on the inner walls of the boiler, it is known as scale.

### **Corrosion:-**

Boiler corrosion is the destruction of boiler metal. It occurs when the oxygen within the boiler dissolves into the water. The dissolved oxygen then causes a reaction with iron-rich (ferrous) boiler metal in a process known as oxidation.

### **Caustic embrittlement:-**

Caustic embrittlement is the phenomenon in which the material of a boiler becomes brittle due to the accumulation of caustic substances.

It also can be described as the cracking of riveted mild steel boiler plates. This occurs at temperatures of 200°-250°C as a result of local deposition of concentrated hydroxide. :

**Characteristics of drinking water:-**

1. Water is free from harmful bacteria, germs, suspended impurities and salts. It is clear, colourless and odourless.
2. Cleaned of Harmful Contaminants. Including chlorine, fluoride, pharmaceutical drugs, metals (mercury, bromide, lead, arsenic), chemicals, bacteria and more.
3. Alkaline pH Balanced.
4. The water is rich in minerals.
5. The pH of most drinking-water lies within the range 6.5–8.5 .
6. The turbidity of drinking water shouldn't be more than 5 NTU.

**Unit-9 Lubricants**

**Lubricant:-**

A lubricant is a substance that helps to reduce friction between surfaces in mutual contact, which ultimately reduces the heat generated when the surfaces move. It may also have the function of transmitting forces, transporting foreign particles, or heating or cooling the surfaces.

**Lubrication:-**

Substances which apply between two moving and sliding surface to reduce friction between them are known as Lubricants and the process by which friction between sliding surface is reduce known as Lubrication.

**Functions of lubrication:-**

1. To lubricate each part of the bearing, and to reduce friction and wear.
2. To carry away heat generated inside bearing due to friction and other causes.
3. To cover rolling contact surface with the proper oil film in order to prolong bearing fatigue life.
4. To prevent corrosion and contamination by dirt.

**Classification of Lubricants**

**Based on its physical states, you can classify lubricants as:**

1. Liquid lubricants, which include
  - A. Vegetable oil and animal oil
  - B. Mineral oil from petroleum
  - C. Blended oil, doped oil, or compound oil
2. Semisolid lubricants
3. Solid lubricants
4. Synthetic Lubricant

**Liquid lubricants:-** Liquid lubricants reduce friction and wear between two moving or sliding metallic surfaces by providing a continuous fluid film in between them. Example:- Vegetable oil, animal oil, Blended oil, doped oil etc.

**Semisolid lubricants:-** The most important semi-solid lubricants are grease, Vaseline, waxes and other compounds of oil and fats. These are called semi-solid because they are neither solids nor liquids at ordinary temperatures.

**Solid lubricants:-** A solid lubricant is a material used as powder or thin film which reduces friction and wear of contacting surfaces in relative motion. Example:- .Graphite and molybdenum disulfide.

### **Types of lubrications:-**

1. Hydrodynamic lubrication.
2. Boundary lubrication.

#### **1. Hydrodynamic lubrication:-**

Hydrodynamic lubrication is a term that defines a situation in which two rubbing surfaces are separated by a thick film of a lubricant. This situation is often beneficial and lubrication is used to reduce friction and/or wear of rubbing solids with the aid of liquid (or semi-solid) lubricant. Hydrodynamic lubrication it depends on the relative speed between the surfaces, oil viscosity, load on the surfaces, and clearance between the moving surfaces. In hydrodynamic lubrication, the viscous friction force increases with increasing speed

**2. Boundary lubrication:-** Boundary lubrication is defined as that in which the sliding surfaces are separated by a very thin molecular film of lubricant.

Boundary lubrication mostly occurs under high-load and low-speed conditions in bearings, gears, piston rings, pumps, transmissions, etc.

In boundary lubrication, friction force is independent of speed.

**A good lubricant generally possesses the following characteristics:**

1. A high boiling point and low freezing point (in order to stay liquid within a wide range of temperature).
2. A high viscosity index.
3. Thermal stability.
4. Hydraulic stability.
5. Demulsibility.
6. Corrosion prevention.
7. A high resistance to oxidation

### **Lubricant Properties:-**

Lubricants have a wide range of properties that impact their physical and chemical properties.

**1. Viscosity:** A lubricant's "internal resistance to flow." Higher viscosity lubricants are thick and don't flow, while lower viscosity lubricants have a closer consistency to water and do flow.

**2. Viscosity Index:** The rate of change in viscosity with changes in temperature. In other words, how much viscosity changes as temperature changes.

**3. Oxidation Stability:** Oxidation is a reaction that occurs when oxygen is combined with lubricating oil. Variables such as high temperatures, water and acids will accelerate the rate of oxidation. The life of a lubricant is reduced as temperatures increase, leading to varnish and sludge.

**4. Pour Point:** The lowest temperature at which a lubricant will flow or pour like a liquid. This can differ depending on test conditions.

**5. Demulsibility:** The ability of a lubricant to separate from water.

**6. Flash Point:** The temperature at which a lubricant will ignite when heated and mixed with air, but a flame is not sustained.

### **Unit-10 polymer and plastic**

**Polymer:-** Polymer is a high molecular mass macro-molecule consisting of repeating structural units derived from monomers.

Polymers are synthesized chemically and are also found naturally. Some of the most common natural polymers are; proteins (polyamides), DNA (polynucleotide), RNA (polynucleotide), Cellulose (polysaccharide) etc. Examples of synthetic polymers include synthetic rubber, nylon, PVC, polyethylene, polypropylene etc

#### **Monomer:-**

Monomer is a single repeating unit that is covalently bound to form polymers.

Monomers are simple molecules with low molecular weights .

They are chemically more reactive than polymers.

**Addition polymerization:-** when the monomer molecules bond to each other without the loss of any other atoms. Examples of addition polymers include polyethylene, polypropylene, polystyrene, polyvinylchloride, polytetrafluoroethylene etc.

**Condensation polymerization:-** The polymers are formed due to the condensation more than one different monomers resulting in the formation of small molecules such as HCl, water, ammonia, etc., as by-products. Common examples of condensation polymerization are nylon, bakelite, silicon, etc .

**Monomer and uses of polyethylene:-** Monomer- ethylene

The primary uses of polyethylene are in packaging film, garbage bags, grocery bags,

insulation for wires and cables, agricultural mulch, bottles, toys, and housewares. Polythene is also used in trays, fruit juice containers, milk containers, crates, and food packaging products.

**Monomer and uses of PVC:-** Vinyl chloride

It is used as vinyl siding, magnetic stripe cards, window profile, pipe, plumbing and conduit fixtures. PVC is commonly used as the insulation on electric wire.

**Monomer and uses of Teflon:-** Monomer:-  $\text{CF}_2 = \text{CF}_2$  tetrafluoroethylene

Teflon is used as a coating in non-stick cookware products such as pots and pans etc.

**Monomer and uses of nylon-66:-** Monomer:- Hexamethylenediamine and adipic acid .

It is used in fibers for textiles and carpets and molded parts.

**Monomer and uses of Bakelite:-** Monomer:- phenol and formaldehyde

Bakelite is a condensation polymer of phenol and formaldehyde. Bakelite is widely used for making molded products. It was the first plastic made from synthetic components.

**Plastic:-**

Plastic is defined as a material that contains as an essential ingredient an organic

Difference between thermoplastics and thermosetting plastics:-

<b>Difference Between Thermoplastic and Thermosetting Plastic</b>	
<b>Thermoplastic</b>	<b>Thermosetting Plastic</b>
Thermoplastic can be synthesized by the process	Thermosetting plastics are synthesized by

called addition polymerization.	condensation polymerization.
Thermoplastic is processed by injection moulding, extrusion process, blow moulding, thermoforming process, and rotational moulding.	Thermosetting Plastic is processed by compression moulding, reaction injection moulding.
Thermoplastics have secondary bonds between molecular chains.	Thermosetting plastics have primary bonds between molecular chains and held together by strong cross-links.
Thermoplastics have low melting points and low tensile strength.	Thermosetting plastics have high melting points and tensile strength.
Thermoplastic is lower in molecular weight, compared to thermosetting plastic.	Thermosetting Plastic is high in molecular weight.
<ul style="list-style-type: none"> <li>• Polystyrene</li> <li>• Teflon</li> <li>• Acrylic</li> <li>• Nylon</li> </ul>	<ul style="list-style-type: none"> <li>• Vulcanized rubber</li> <li>• Bakelite</li> <li>• Polyurethane</li> <li>• Epoxy resin</li> </ul>

**Use of polymer and plastic in daily life and in industries:-**

Product made from polymers are all around us: clothing made from synthetic fibers, polyethylene cups, fiberglass, nylon bearings, plastic bags, polymer-based paints, epoxy glue, polyurethane foam cushion, silicone heart valves, and Teflon-coated cookware.

Grocery bags, soda and water bottles, textile fibers, phones, computers, food packaging, auto parts, and toys all contain polymers.

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