CHAPTER 1

CHEMICAL EQUILIBRIUM

Q 1. What is a chemical reaction? Discus it in brief.

CHEMICAL REACTION

A chemical reaction is a chemical change which involve reactants and products. For Example, formation of water from hydrogen gas and oxygen gas, decomposition reaction of Sodium bicarbonate into sodium carbonate, water, and carbon dioxide etc. A chemical Reaction contains two quantities, reactant and product which are separated by an arrow.

$$2NaHCO_3 \rightleftharpoons Na_2CO_3 + CO_2 + H_20$$

Q 2. Define chemical equilibrium with example.

CHEMICAL EQUILIBRIUM

Chemical equilibrium refers to the state of a system in which the concentration of the reactant and the concentration of the products do not change with time and the system does not display any further change in properties

$$N_2O_4 \rightleftharpoons 2NO_2$$
$$PCl_5 \rightleftharpoons PCl_3 + PCl_2$$
$$N_2 + H_2 \rightleftharpoons 2NH_3$$

Q 3. Describe dynamic equilibrium with two examples.

DYNAMIC EQUILIBRIUM

Any reaction will be in dynamic equilibrium if it's reversible and the rates of the forward and reverse reactions are equal.

Rate of forward reaction = Rate of reverse reaction

EXAMPLE # 1

If you prepare a solution that is saturated with an aqueous solution of NaCl. If you then add solid crystals of NaCl, the NaCl will be simultaneously dissolving and recrystallizing within the solution. The reaction, $NaCl(s) \rightleftharpoons Na^+(aq) + Cl^-(aq)$, will be in dynamic equilibrium when the rate of the dissolution of the NaCl equals the rate of recrystallization.

EXAMPLE # 2

Dynamic equilibrium is $NO_2(g) + CO(g) \rightleftharpoons NO(g) + CO_2(g)$ (again, as long as the two rates are equal). Nitrogen dioxide (NO_2) reacts with carbon monoxide (CO) to form nitrogen oxide (NO) and carbon dioxide (CO_2), and, in the reverse reaction, nitrogen oxide and carbon dioxide react to form nitrogen dioxide and carbon monoxide.

Q 4. Define Reverse reaction and forward reaction.

REVERSE REACTION

A reaction in which product change in to reactant is known as reverse reaction

FORWARD REACTION

A reaction in which reactant change in to product is known as reverse reaction.

Q 5. What are the characteristics of Reversible reaction, forward reaction and dynamic equilibrium?

CHARACTERISTICS OF FORWARD REACTION

1. It is always directed from left to right in a chemical reaction
2. Reactants produce products (Reactants → Products)
3. Initially rate is fast but gradually slow down

CHARACTERISTICS OF REVERSE REACTION

1. It is always directed from right to left in a chemical reaction
2. Product produce reactant (Reactants ← Products)
3. Initially rate is slow but gradually speed up

CHARACTERISTICS OF IN DYNAMIC EQUILIBRIUM

1. A dynamic equilibrium can only exist in a closed system – neither reactants nor Products can enter or leave the system
2. Equilibrium, the concentrations of reactants and products remain constant
3. At equilibrium, the forward and reverse reactions are taking place at equal and opposite rates.
4. Equilibrium can be approached from either side of the reaction equation
5. An Equilibrium state can be disturbed and again achieved under the given Condition of concentration, pressure, and temperature.

Q 6. Distinguished between reversible and irreversible reaction.

REVERSIBLE REACTION	IRREVERSIBLE REACTION
Products are converted back to reactants.	Products are not converted back to reactants.
The reaction appears to have stopped but does not undergo completion.	The reaction stops completely and almost goes to completion.
It is generally carried out in a closed vessel.	It can be carried out in an open or closed vessel
It takes place in both directions. It is represented by e.g. $N_2 + O_2 \rightleftharpoons 2NO$	It takes place only in one direction. It is represented by e.g. $C + O_2 \rightarrow CO_2$

Q 7. State law of mass action How is the active mass is represented?

LAW OF MASS ACTION:

The rate at which a substance reacts is directly proportional to its active mass and the rate of a reaction is directly proportional to the product of the active masses of the reacting substances.

REPRESENTATION

The unit of active mass Mol/dm^3 and its value is expressed in square brackets.

Q 8. Derive an expression for equilibrium constant.

DERIVATION

Let us apply law of mass action on a hypothetical reversible reaction.

$$aA + bB \rightleftharpoons cC + dD$$

First let us discuss forward reaction, where A and B are reactants whereas "a" and "b" are the number of moles needed to balance a chemical equation. The rate of forward reaction according to law of mass action is

$$Rf \alpha [A]^a [B]^b$$

$$Rf = kf [A]^a [B]^b$$

Where Kf is the rate constant for forward reaction.

Likewise, rate of reverse reaction is directly proportional to product of molar concentration Of C and D whereas "c" and "d" are number of moles needed to balance a chemical reaction

$$Rr \alpha [C]^c [D]^d$$

$$Rr = kr [C]^c [D]^d$$

Where Kr is the rate constant for reverse reaction. You know at equilibrium rate of forward and reverse reaction becomes equal. So

$$Rf = Rr$$

Putting the values of Rt ana Rr, we have

$$kf [A]^a [B]^b = kr [C]^c [D]^d$$

By taking constants on L.H.S and variables on R.H.S, we have

$$\frac{Kf}{Kr} = \frac{[C]^c[D]^d}{[A]^a[B]^b}$$

$$Kc = \frac{[C]^c[D]^d}{[A]^a[B]^b}$$

$$OR \quad Kc = \frac{Kf}{Kr}$$

Hence

$$Kc = \frac{[Product]}{[Reactant]}$$

Q 9. Why equilibrium constant may or may not have unit? Justify with example

Since the kc is the ratio of product and reactant, therefore when the number of moles of an equation are equal the kc will have no unit. When the number of moles is unequal then it will have the unit

EXAMPLE # 1 **$2HI \rightleftharpoons H_2 + I_2$**

Since, $Kc = \frac{[Product]}{[Reactant]}$

$$Kc = \frac{[H_2]\,[I_2]}{[HI]^2}$$

$$unit = \frac{[mole/dm^3]\,[mole/dm^3]}{[mole/dm^3]^2}$$

$$unit = \frac{\frac{mole}{dm^3} \times \frac{mole}{dm^3}}{\frac{mole^2}{dm^6}}$$

Unit = 1

EXAMPLE # 1 **$PCl_5 \rightleftharpoons PCl_3 + Cl_2$**

Since, $Kc = \frac{[Product]}{[Reactant]}$

$$Kc = \frac{[PCl_3]\,[Cl_2]}{[PCl_5]}$$

$$unit = \frac{\frac{mole}{dm^3} \times \frac{mole}{dm^3}}{\frac{mole}{dm^3}}$$

Unit = $mole/dm^3$

Q 10. How direction of a reaction can be predicted if Kc is known to you.

DIRECTION OF REACTION

1. If Qc = Kc, the actual product and reactant concentrations are equal to equilibrium concentrations, and the system is stable.
2. If Qc <Kc increase in product concentration for equilibrium. So, the Reaction occurs, forming additional products.
3. If Qc > Kc, there is decrease in product concentration. As, the process Reverses, forming more reactants.

Q 11. Discus the extent of chemical reaction on the basis of Kc

Kc IS VERY SMALL

Reactions with low Kc never finish. That is, maximum reactant concentration and minimum product concentration. These are called 'reverse or backward responses.

$F_2 \rightleftharpoons 2F$ $Kc = 7.4 \times 10^{-13}$ at 227°C

Kc IS VERY LARGE

Reactions with high Kc values are virtually complete. That is, maximum product Concentration and minimum reactant concentration. This type of reaction is known as "Forward reaction"

$2H_2 + O_2 \rightleftharpoons 2H_2O$ $Kc = 2.4 \times 10^{47}$ at 227°C

Kc IS NEITHER VERY SMALL NOR VERY LARGE

Reactions which have moderate value of Kc are considered to be at equilibrium. The Concentration of reactants and products is almost same.

FOR EXAMPLE:

$N_2O_4 \rightleftharpoons 2NO$ $Kc = 0.36$ at 25°C

Q 12. How con you predict the following stages of a reaction by comparing the values Of Kc and Qc.

1) Net reaction proceeds in forward direction.
2) Net reaction proceeds in reverse direction

1. Net reaction proceeds in forward direction.

The value of Kc will be very large

2. Net reaction proceeds in reverse direction

The value of Kc will be very small

Numerical 01

Equilibrium occurs when nitrogen monoxide gas reacts with oxygen gas to form nitrogen dioxide gas.

$2NO+0_2 \rightleftharpoons 2NO_2$

At equilibrium at 230 °C, the concentrations are measured to be : [NO] =0.0542 mol.dm^{-3} , [O_2] = O.127 mol.dm^{-3}, and [NO_2] = 15.5 mol.dm^{-3} Calculate the equilibrium constant at this temperature.

Numerical 02

A reaction takes place between iron ion and chloride ion as:

$$Fe^{+3} + 4Cl^- \rightleftharpoons FeCl_4^-$$

At equilibrium, the concentrations are measured to be (Fe^{+3}) is 0.2 mol.dm^{-3}, Cl^- is 0.28mol.dm^{-3} and $FeCl_4^-$ is 0.95x 10^{-4} mol.dm^{-3}. Calculate equilibrium constant Kc for given reaction.

Numerical 03

Nitrogen oxides are air pollutants produced by the reaction of nitrogen and oxygen at high temperature. At 2000 °C, the value of the equilibrium constant for the given reaction is 4.1 x 10^{-4}

$$N_2 + 0_2 \rightleftharpoons 2NO$$

Find the concentration of NO in an equilibrium mixture at 1 atm pressure at 2000°C. In air, [N_2] = 0.036 mol/L and [0_2) = 0.0089 mol/L.

Book Numerical

1. Dinitrogen tetra oxide N_2O_4 decomposed into nitrogen dioxide NO_2 in a reversible reaction. Derive equilibrium constant expression for the reaction of decomposition. Also interpret unit of Kc for balanced chemical reversible reaction.

2. PCl_5, PCl_3, and Cl_2 are at equilibrium at 500K in a closed container and their concentrations are 0.8 x 10^{-3} mol dm^{-3}, 1.2 x 10^{-3} mol dm^{-3} and 1.2 x 10^{-3} mol dm^{-3} respectively. Calculate the value of Kc for the reaction along with unit.

3. The value of Kc for the reaction is 1x10^{-4} $2HI \rightleftharpoons H_2 + I_2$

At a given temperature, the molar concentration of reaction mixture is HI = 2x10^{-5} mol dm^{-3}, H_2=1x10^{-5} mol dm^{-3} and I_2 = 1 x10^{-5}mol dm^{-3}. Predict the direction of the reaction.

CHAPTER 2

ACID, BASE, SALT

Q 1. Discus the properties of acid and base

PROPERTIES OF ACID

1. Acids have sour taste.
2. They change the colour of blue litmus to red.
3. Aqueous solution of acids conducts electricity.
4. When react with base, they from salt and water.

PROPERTIES OF BASE

1. Bases have bitter taste.
2. Bases are slippery to touch.
3. They changed the colures of red litmus to blue.
4. Aqueous solution of bases, conduct electricity.
5. They react with acids to form salt and water.

Q 2. Elaborate the Arrhenius concept of acid and base with suitable example

ARRHENIUS THEORY OF ACIDS

The acids are those substances that produce Hydrogen (H^+) ions when dissolved in water are called acids

EXAMPLE:

HCl, HNO_3, CH_3COOH, HCN)

ARRHENIUS THEORY OF BASE

Bases are those substances that produce hydroxide ion (OH^-) when dissolved in water

EXAMPLE:

NaOH, KOH, NH_4OH, $Ca(OH)_2$).

Q 3. What is the limitation of Arrhenius theory?

LIMITATIONS OF ARRHENIUS THEORY

1. Hydrogen ions do not exist in water solution and they react with water to form Hydronium Ions (H_30^+).
2. The Arrhenius theory does not explain the basicity of ammonia (NH_3), acidity of Carbon dioxide (CO_2) and other similar compounds.
3. It is only applicable in aqueous solutions.

Q 4. What is Bronsted-Lowry acid- base theory?

BRONSTED-LOWRY THEORY OF ACID AND BASES

According to this theory any substance behaves as an acid when it donates a proton (H^+) to a base and any substance which accepts a proton, it behaves like a base, so acids are proton donor and bases are proton acceptors they both react with water to produce hydronium ions (H_3O^+). Let us consider the dissolution of hydrogen chloride in water. In this reaction HCl donates its one proton to water (H_2O), and water (H_2O) accepts one proton to become H_3O.

$$HCl + H_2O \rightleftharpoons H_3O^+ + Cl^-$$

Thus, HCl is a Bronsted acid and H_2O is Bronsted base. H_3O^+ is Conjugated acid and Cl^- is a Conjugated base.

Q 5. What is the limitation of Bronsted-Lowry theory?

LIMITATIONS OF BRONSTED-LOWRY CONCEPT

1. It could not explant the acidic nature of compounds having no tendency to lose H^+ ions. Examples CO_2, $AlCl_3$, SO_3.
2. It could not explain the basic nature of compounds having OH^- ions, **Examples** NaOH, $Co(OH)_2$, KOH.

Q 6. Discus the Lewis concept of acid and base.

LEWIS'S THEORY OF ACID

An acid is a substance that is capable of accepting an electron pair. a Lewis acid is an electron pair acceptor

LEWIS'S THEORY OF BASE

Base is a substance that is capable of donating an electron pair. Thus, and a Lewis base is an electron pair donor

Q 7. What is the limitation of Lewis theory?

LIMITATIONS OF LEWIS ACID AND BASE CONCEPT

1. It could not explicate the release of energy during the formation of a covalent bond.
2. It could not clarify the shapes of molecules and amount of energy released during covalent bond formation.
3. It could not explain the nature of attractive forces between the constituent atoms of a molecule.

Q 8. What is P_H and P_{OH}?

pH:

A measurement of the concentration of Hydrogen ions (H^+) in a solution. It may also be defined as "the negative logarithm of Hydrogen ion concentration".

Mathematically

$pH = -\log [H^+]$

pOH:

A measurement of the concentration of Hydroxyl ions (OH) in a solution. It may also be defined as "the negative logarithm of Hydroxyl ion concentration".

Mathematically

$pOH = -\log [OH^-]$

Q 9. What is salt? Give some examples of salt

SALTS

Salt is an ionic compound that contains a cation (from base) and an anion (from acid).

Examples: NaCl, $CuCl_2$, etc.

Q 10. Write chemical preparation of salts

$$CaO + H_2SO_4 \rightarrow CaSO_4 + H_2O$$

(Calcium oxide) (Calcium sulphate)

$KOH + HNO_3 \rightarrow KNO_3 + H_2O$

(Potassium hydroxide) (Potassium nitrate)

$BaCO_3 + 2HCl \rightarrow BaCl_2 + CO_2 + H_2O$

(Barium carbonate) (Barium chloride)

$H_2SO_4 + 2NaOH \rightarrow Na_2SO_4 + 2H_20$

(Sodium sulphate)

Q 11. Discus the types of salts

TYPES OF SALTS

ACIDIC SALT:

Acidic salts are those salts which are distinctly acidic in nature they produce acidic solution when dissolved in water.

FOR EXAMPLE

NH_4Cl, $Ca(NO_3)$, $NaHSO_4$, NaH_2PO_4, Such salts solution have pH less than 7.

BASIC SALT:

Basic salts are those salts which are distinctly basic in nature they produce alkaline solution when dissolved in water

FOR EXAMPLE

CH_3COONo, K_2CO_3, Na_2CO_3, KCN.

Such salts solution has pH more than 7.

NEUTRAL SALT:

Neutral salts are those salts which are formed by the complete neutralization of a strong base and strong acid. The aqueous solutions of these salts are neutral to litmus paper.

FOR EXAMPLE

NaCl, KCl, K_2SO_4, $NaNO_3$.

Such salts are neutral with pH 7.

Q 12. Give uses of salt

USES OF SOME SALTS

1. Salts play an important role in our daily life.
2. Most of the chemical fertilizers used in agriculture by farmers are salts.

3. Certain salts are used as pesticides to kill or destroy insects, pests, weeds and fungi.
4. In medical field hydrated calcium sulphate, is found in plaster of Paris. It is used to make plaster casts for supporting broken bones.
5. Patients suffering from anemia use iron (11) sulphate heptahydrate is an ingredient in 'iron Pills as food supplement.
6. Sodium hydrogen carbonate is ap ingredient in anti-acids. This salt can neutralize the excess acid secreted by the stomach.
7. Barium sulphate is used to make barium meals for patients who need to take an X-ray of their stomach. The salt helps to make internal soft organs like intestines appear on X-ray films
8. Potassium permanganate (VII) can kill bacteria and hence is suitable for use as a disinfectant

Q 13. Discus the P_H in our food.

- The pH of acidic food is 0 to7
- The neutral food has exact pH 7
- The alkaline food is from pH 7 to 14.

A healthy human body required a controlled pH level in the serum up to 7.4, which is slightly alkaline.

Q 14. What are the effect of acid rain

HARMFUL EFFECTS OF ACID RAIN

1. It affects both animals and humans' respiratory systems.
2. Acid rain has an impact on the aquatic ecology when it falls and runs into rivers and ponds.
3. It creates water pollution by changing the chemical composition of the water to a state that is damaging to the aquatic ecosystem's ability to exist.
4. Acid rain also causes water pipelines to corrode, resulting in heavy metals such as iron, lead, and copper seeping into drinking water.
5. It causes damage to stone and metal structures and monuments.

Q 15. Write short note on stomach acidity

STOMACH ACIDITY

Stomach acid, also known as gastric acid, is a colorless, watery fluid generated by the lining of the stomach. It's very acidic and aids digestion by breaking down meals. This makes it easier for your body to absorb nutrients when food passes through your digestive tract. Laying on your back or bending down at the waist after eating a large meal. Snacking right before night. Consuming citrus, tomato, chocolate, mint, garlic, onions, or spicy or fatty meals. Consuming alcoholic beverages, carbonated beverages, coffee, or tea etc.

Q 16. Define the following terms;

(a) Indicator (b) Neutralization (c) Titration

(a) Indicator

Indicators are weak organic acid or base which change their color over small range of pH.

(b) Neutralization

Neutralization is a reaction between acid and base to produce salt and water

(c) Titration

A titration is a technique where a solution of known concentration is used to determine the concentration of an unknown solution. Typically, the titrant (the known solution) is added from a burette toa known quantity of the analyte (the unknown solution) until the reaction is complete.

Q 17. Define buffers. What is the composition of buffers? Discuss its importance in our daily life.

BUFFER SOLUTION

A buffer is a solution that can resist pH change upon the addition of acidic or basic components. It is able to neutralize small amounts of added acid or base, thus maintaining the pH of the solution relatively stable

COMPOSITION OF BUFFERS

A buffer is an aqueous solution that has a highly stable pH. A buffering agent is a weak acid and its conjugated base or weak base and its conjugated acid. That helps to maintain the pH of an aqueous solution after adding another acid or base. If you add an acid or a base to a buffered solution, its pH will not change significantly. Similarly, adding water toa buffer or allowing water to evaporate will not change the pH of a buffer.

IMPORTANT

1. Bicarbonate buffer maintains the pH of the blood.
2. Phosphate buffer maintains the internal environment of cells.
3. Hemoglobin has buffering capacity.
4. Proteins have a zwitterionic structure that enables them to resist pH change.

Q 18. Classify the following solutions as acidic, basic or neutral.

A solution that has $[H^+]=1x10^{-4}$ mol. dm^3

A solution that has $[H^+]=1x10^{-11}$ mol. dm^3

A solution that has $[OH^-]=lx10^{-9}$ mol. dm^3

A solution that has $[OH^-]= 1x10^{-3}$ mol. dm^3

NUMERICAL

Book Example. 1

A solution of HCl has pH of 2.3: calculate its pOH and $[H^+]$

Book Example.2

Find pH, pOH, $[OH^-]$ and $[H^+]$ of 2.46 x 10^{-9} M KOH solution

Book Numerical

1. Calculate pH of 5M solution of NaOH.
1. A solution of H_2SO_4 has pH of 1.05 calculate its pOH and $[H^+]$
2. The hydrogen ion concentration of a solution is $1x10^{-8}$ mol. dm'. what is pH of the solution?

CHAPTER 3

ORGANIC CHEMISTRY

Q1. Define organic compounds

ORGANIC COMPOUND

Organic compounds are those that include one or more carbon atoms that are covalently linked to atoms of other elements, such as hydrogen, oxygen, nitrogen e.t.c

FOR EXAMPLE

Ethane, Alcohol, Amine, Polystyrene, Chloroform, e.t.c

Q2. Give general characteristics of organic compounds

GENERAL CHARACTERISTICS OF ORGANIC COMPOUNDS

1. Organic compounds are obtained from Irving things (animals and plants) and minerals
2. Carbon is the key element in all organic compounds. After carbon, most frequently used element is hydrogen. Organic compounds may also contain halogens, oxygen, sulphur, nitrogen and phosphorus elements.
3. Organic compounds contain both types of covalent bonds-polar and non polar bonds.
4. According to like dissolve like rule, organic compounds are insoluble in water but soluble in organic solvents. Non-polar organic compounds are soluble in benzene, carbon disulphide, ether etc and polar compounds are soluble in alcohols.
5. As covalent bond is weaker than ionic bond, so organic compounds have lower melting and boiling points.
6. The rate of reactivity of organic compound is very slow and need specific conditions.
7. Generally, organic compounds are non-conductors of electricity because they consist of covalent molecules.

8. All organic compounds are more combustible and burn in air due to high percentage of carbon. The common product produced in all cases is carbon dioxide.

9. Organic compounds are less stable on a high temperature as compare to inorganic compounds.

Q3. What is the representation of organic compounds? Also give two example of each.

REPRESENTATION OF ORGANIC COMPOUND

Organic compounds have four different sorts of formulae:

1. Molecular formula
2. Structural formula
3. Condensed formula
4. Dot and cross formula

Molecular Formula

The molecular formula is the formula that indicates the exact number of atoms in one molecule of an organic compound.

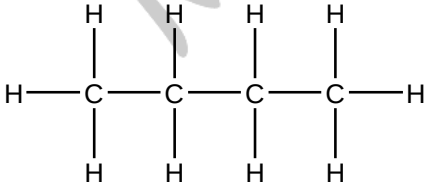
FOR EXAMPLE,

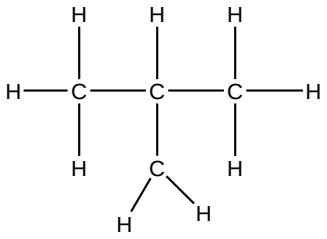
Molecular formula of butane is C_4H_{10}

Structural Formula

The exact arrangement of the individual atoms of various elements contained in a molecule of a substance is represented by the structural formula of a compound. Between the bonded atoms, a single bond is represented by a single line (–), a double bond by two lines (=), and a triple bond by three lines (≡). Organic compounds can have the same molecular formula but various structural formulas, such as butane C_4H_{10},which has two the structural formulae.

EXAMPLE





n- butane iso butane

CONDENSED FORMULA

Condensed formula is the formula in which bond line to each carbon are omitted and each distinct structural unit is written with subscript numbers for multiple substituents including hydrogen.

EXAMPLE

$CH_3\ CH_2\ CH_2\ CH_3$ $CH_3\ CH\ (CH_2)\ CH_3$

n- Butane isobutane

DOT AND CROSS FORMULA (ELECTRONIC)

The dot and cross formula, also known as the electronic formula, depicts the sharing of electrons between distinct atoms in a single molecule of an organic compound.

Butane

Propane

Q4. Discus the classification of organic compounds

CLASSIFICATION OF ORGANIC COMPOUNDS ORGANIC COMPOUND

OPEN CHAIN COMPOUNDS

The compound which contains atoms linked in open chain are known as open chain compound

FOR EXAMPLE n-pentane, isopentane

STRAIGHT CHAIN

The open chain compound with substituents linked in the straight chain are known as straight chain compound

FOR EXAMPLE n–butane

BRANCHED CHAIN

The open chain compound contains branches are termed as branched chain

FOR EXAMPLE isobutane

CYCLIC COMPOUNDS

The organic compound having a basic nonlinear structure are cyclic compounds

FOR EXAMPLE benzene and phenol cyclobutene

HETEROCYCLIC COMPOUNDS

Those compounds a carbon ring structure that contains at least one other electronegative element

FOR EXAMPLE C_6H_5N, C_6H_5OH,

HOMOCYCLIC COMPOUNDS

Cyclic compounds having atoms of the same elements in ring are Homocyclic compounds

FOR EXAMPLE benzene, cyclobutene.

ALICYCLIC COMPOUNDS

The compounds which have no benzene ring

FOR EXAMPLE cyclobutene.

AROMATIC COMPOUND

The compound which has benzene ring with six carbon atoms are known as aromatic compound

FOR EXAMPLE benzene naphthalene

Q5. Define catenation, isomerism, homologous series, functional group

1. **CATENATION**

The ability of carbon atoms to join with another via covalent bonds to create long chains or rings of carbon atoms is the primary cause for the formation of a vast number of organic compounds.

2. **HOMOLOGOUS SERIES**

A Homologous Series is a group of organic chemical compounds, usually listed in order of increasing size, that have a similar structure (and hence also similar properties).

3. ISOMERISM

The existence of two or more compounds having the same molecular formula but a different arrangement of atoms within the molecule is known as isomerism.

4. FUNCTION GROUP

Functional group can be defined as the atom (or group of atoms) present in a molecule which determines the characteristic properties of that molecule.

Q6. Write short note of sources of organic compounds

COAL:

Coal is made up of a variety of hydrocarbons. It is an important source of solid fossil fuels for us. It can be found at various depths beneath the earth surface. Coal is formed in a variety of ways. Coal is said to have developed in ngtue500 million years ago from the remnants of trees buried deep inside the soil. It was turned to peat as a result of bacterial and chemical processes on the wood. Peat was then converted into coal as a result of high temperature and pressure within the Earth's crust Natural carbonization is the process of converting wood into coal. Wood has a carbon content of 40%.Four varieties of coal are created depending on the degree of carbonization.

China, the United States of America, Russia, the United Kingdom, Germany, Poland, Australia, and Pakistan are the world's top coal producers.

PETROLEUM:

Petroleum is a thick dark brownish or greenish black liquid. It's a complicated combination of solid, liquid, and gaseous hydrocarbons, together with water, salts and earth particles. Organic compounds are mostly derived from petroleum. It is made up of a variety of substances, the majority of which are hydrocarbons. Fractional distillation is used to separate these chemicals (separation of fractions or components from a liquid mixture depending upon their boiling point ranges is called fractional distillation). Each fraction contains single chemical compound, rather than multiple components.

NATURAL GAS

It's a mixture of hydrocarbons with low molecular weight. Methane, together with other gases such as ethane, propane, and butane, makes up around 85% of the mixture. It has a similar origin to coal and

petroleum. As a result, it is discovered with their deposits. Natural gas is utilized as a fuel in both households and industries. Compressed natural gas (CNG) is utilized as a fuel in cars. Carbon black and fertilizers are also made from natural gas.

PLANTS

Macromolecules, such as carbohydrates, proteins, lipids, and vitamins, are synthesized by living plants. Glucose is the fundamental unit of all carbohydrates, and it is produced by plants through photosynthesis. Starch, and cellulose are formed as glucose polymerizes further. Pulses and beans are high in protein. Proteins are made by nitrogen fixing bacteria that live on the roots of plants. Seeds from plants including sunflower, rapeseed, palm, coconut, and groundnut contain oils. Apples and citrus fruits are high in vitamins. Plants provide us with gums, rubber, medications, and other products in addition to these primary food staples.

SYNTHESIS IN LABORATORY

Only plants and animals, it was thought just over two centuries ago, could synthesize organic compounds because they possessed Vital Force,' which is required for organic compound synthesis. However, FM. Wohler's laboratory synthesis of urea (NH_2CONH_2) in 1828 established the area of laboratory synthesis of organic molecules. More than 10 million organic molecules have been synthesized in laboratories till today. They range in complexity from simple to complicated. Drugs and medications, flavourings and scents, plastics and paints, synthetic fibbers and rubber, cosmetics and toiletries, detergents, insecticides and pesticides, and other products include them.

Q7.Give uses of organic compounds

USES OF ORGANIC COMPOUNDS

USES AS FOOD: The foods we eat on a daily basis, such as milk, eggs, meat, vegetables, and so on, are all organic and contain carbohydrates, proteins, lipids, vitamins, and so on.

USES AS CLOTHING: Natural (cotton ilk, wool, etc.) and synthetic (polyester, nylon, etc.) fibers are used in all form of clothing (we wear, we use as bed sheets, etc). (nylon Dacron and acrylic, etc) All these substances are made up of organic components.

USES AS A HOUSE: Wood is made mostly of cellulose (naturally synthesized organic compound). Its used to build anything from buildings to furnishings.

USES AS FUEL: Coal petroleum, and natural gas are the fuels we use in our cars. and in our homes, These are referred to as fossil fuels. These are all organic compounds Medical Applications: We employ a significant variety of organic compounds (naturally generated by plants) as medications. Antibiotics (which suppress or kill bacteria that cause infectious illnesses) and other life-saving medications and treatments are manufactured in laboratories.

Q8.What are Alkane, Alkene and Alkynes

ALKANES

Alkanes are hydrocarbons with only single bonds between the atoms.

They have general formula $C_nH_{2n+2.}$

The number of carbons in each chain determine the name.

ALKENES

Alkenes are hydrocarbons with at least one double bond.

They have general formula C_nH_{2n}

The number of carbons in each chain determine the name.

ALKYNES

Alkynes are hydrocarbons with at least one triple bond.

They have general formula C_nH_{2n-2}

The number of carbons in each chain determine the name.

Q9.What are alkyl radicals

FORMATION OF ALKYL RADICAL

Alkyl radicals are alkane derivatives. They are created by removing one of an alkane's hydrogen atoms and are symbolized by the letter R. Their name is formed by substituting the letter "ane" in alkane with the letter "yl." Therst10 alkanes and their alkyl radicals are shown in Table. C_nH_{2n+1} is their general formula.

Q10. What are alcoholic group, ether linkage. Aldehydic group, ketonic group, carboxyl group, ester linkage

(I) ALCOHOLIC GROUP

The functional group of alcohol is -OH. Their general formula is ROR Where R is any alkyl group.

EXAMPLES

CH_3— OH CH_3— CH_2— OH CH_3— CH_2— CH_2 — OH

Methyl alcohol Ethyl alcohol n-Propyl alcohol

(II) ETHER LINKAGE

The functional group of ether is C — 0 — C. Their general formula is R — 0 — R' where R and R' are alkyl groups.

R and R' may be same or different, such as:

EXAMPLES

H_3C —O — CH_3 C_2H_5 — O — C_2H_5 H_3C — O — C_2H_5

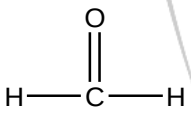
Dimethyl ether Diethyl ether ethyl methyl ether

(II) ALDEHYDIC GROUP

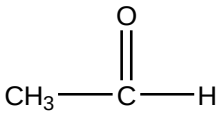
Aldehyde family consists of carbonyl functional group. Their general formula is RCHO

Where R stands for H or some alkyl groups, such as:

EXAMPLES



Formaldehyde



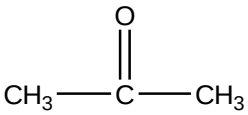
Acetaldehyde

(IV) KETONIC GROUP

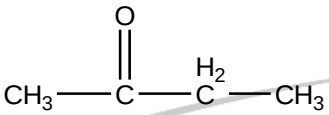
Compounds containing the functional group — CO — are called ketones.

They have the general formula R— CO — R' where R and R' are alkyl groups.

EXAMPLES



Acetone(dimethyl ketone)



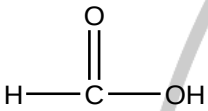
Ethyl methyl ketone

(V) CARBOXYL GROUP

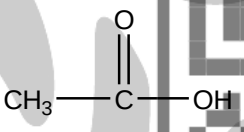
Compounds containing — CO — OH functional group are called carboxylic acids.

Their general formula R — CO — OH is where R and — OH stands for some alkyl groups.

EXAMPLES



Formic acid



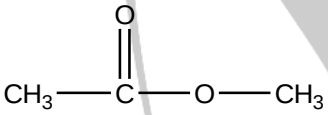
Acetic acid

(VI) ESTER LINKAGE

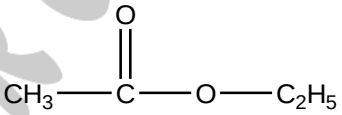
Organic compounds consisting of RCOOR' functional group are called esters

Their general formula is R — CO — O — H

EXAMPLES



Methyl acetate



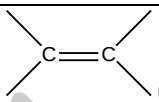
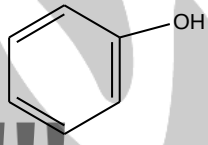
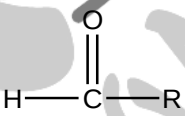
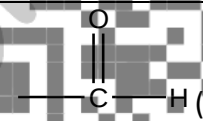
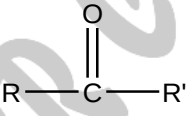
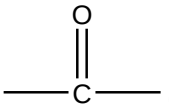
Ethyl acetate

Q11. Differentiate between saturated and unsaturated hydro carbons

SATURATED HYDROCARBON	UNSATURATED HYDRO CARBON
Saturated hydrocarbons contain carbon single bond.	Unsaturated hydrocarbons contain carbon double and triple bonds.
Saturated hydrocarbons are less reactive.	Unsaturated hydrocarbons are more reactive.

The valances of all carbon atoms are fully satisfied through single bond.	The valances of all carbon atoms are fully satisfied through double and triple bond.
Saturated hydro carbon have a less amount of carbon and high amount of hydrogen.	Unsaturated hydrocarbon have a less amount of hydrogen and high amount of carbon as compared to sutured hydrocarbons.
They burns with blue and non-sooty flame in air	They burn with yellow and sooty flame in air.
The compounds of saturated hydrocarbon are alkanes Alkanes are represented by general formula C_nH_{2n+2}	The compounds of unsaturated hydrocarbon are alkenes and alkynes. The general Formula of alkenes (C_nH_{2n}) and alkynes (C_nH_{2n-2})
Examples of alkanes are Ethane (CH_3—CH_3), Propane (CH_3 — CH_2 — CH_3).	Examples of alkenes are Ethene ($CH_2 = CH_2$), Propene ($CH_2 = CH$ — CH_3) and Example of alkynes, Ethyne ($CH \equiv CH$), Propyne(CH_3 — $C \equiv CH$)

Q12. Give molecular formula and functional group of following

HOMOLOGUES SERIES	GENERAL FORMULA	FUNCTIONAL GROUP
Alkane	R — H or C_nH_{2n+2}	—
Alkene	R = H or C_nH_{2n}	 (double bond)
Alkyne	R ≡ H or C_nH_{2n-2}	 (triple bond)
Haloalkane	R — X (where X = F, Cl, Br, I Or $C_nH_{2n+1}X$	—X (halide group)
Alcohol	R — OH or $C_nH_{2n+1}OH$	— OH (hydroxyl group)
Phenol	 Or R — O —R' or C_6H_5OH	— OH (hydroxyl group)
Ether	R — O —R' or $C_nH_{2n+2}O$	— OR' (alkoxyl group)
Aldehydes		 (carbonyl group or —CHO) aldehyde group
ketone		 (carbonyl group) (Ketonic group)

Chapter # 4

BIOCHEMISTRY

Q1. What are carbohydrates. Discus the classification of carbohydrates

CARBOHYDRATES

Carbohydrates are naturally occurring organic compounds and are important component of our food Generally they contain elements like carbon, hydrogen and oxygen. Mostly carbohydrates are represented by general formula Cx (H_2O)y because in these compounds hydrogen and oxygen are in the ratio as in H_20. Actually, these compounds do not contain water molecules.

CLASSIFICATION OF CARBOHYDRATES

MONOSACCHARIDES (GREEK MONO = ONE)

These are also called simple sugars. These carbohydrates cannot be further simplified on hydrolysis. Monosaccharides contain 3 to 10 carbon atoms and may be subdivided into trioses, tetrodes, pentoses, hexoses etc depending upon the number of carbon atoms they possess. Glucose (grape sugar) belongs to aldoses and fructose (honey) to ketoses are examples of monosaccharides.

$$\text{Monosaccharide + water} \xrightarrow{\text{Hydrolysis}} \text{No reaction}$$

$$C_6H_{12}O_6\text{,+ water} \xrightarrow{\text{Hydrolysis}} \text{No reaction}$$

OLIGOSACCHARIDES (GREEK OLIGO= FEW)

These carbohydrates produce 2 to 10 Monosaccharides on hydrolysis. The oligosaccharides which contain two monosaccharides are called disaccharides and those which contain three are known as trisaccharide's and so on.

$$\text{Oligosaccharides + water} \xrightarrow{\text{Hydrolysis}} \text{2-10 monosacchrides}$$

$$C_{12}H_{22}O_{12} + H_20 \xrightarrow{\text{Hydrolysis}} C_6H_{12}H_6 + C_6H_{12}0_6$$

Sucrose Water Glucose Fructose

POLYSACCHARIDES (GREEK POLY = MANY)

These carbohydrates produce more than ten monosaccharides on hydrolysis. These are also called polymeric carbohydrates. In these Carbohydrates, monosaccharides are connected by glycosidic linkage.

Polysaccharides + water → More than 10 monosacchrides

$(C_6H_{10}O_5)n + H_2O \rightarrow n(C_6H_{12}O_6)$

Cellulose or starch Water Glucose

Q2. Give sources of carbohydrates.

SOURCES OF CARBOHYDRATES

Carbohydrates are important food factor and obtained from various sources like

1. Fruits
2. Vegetables
3. Dairy products

Q3. Give uses of carbohydrates.

USES OF CARBOHYDRATES

1. They are required as energy source for the survival of both plants and animals.
2. They sustain structure of plants.
3. Carbohydrates, in the form of starch in plants and glucose in mammas, serve as energy storage.
4. They keep our blood sugar levels in check.
5. Sucrose is a food additive. It's found in confectioneries, condensed milk, canned fruits, jams, and jellies, among other things.
6. Carbohydrate fiber helps in cholesterol reduction and blood pressure regulation.
7. Carbohydrates coexist with a variety of proteins and lipids in biosystems.
8. Celluloses provide food its bulk and fiber. It promotes peristalsis in the intestine.

Q4. What are proteins?

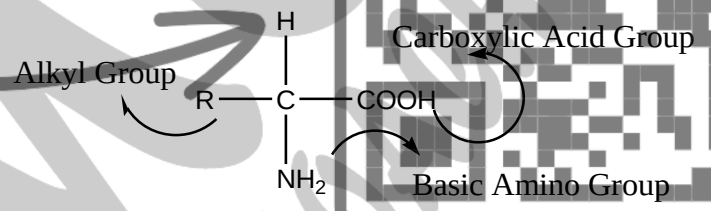
PROTEINS

The word protein is taken from Greek Proteios means first. These are nitrogenous macro-molecules found in all the cells of living organisms. Proteins have central position in architecture and functioning of living matter. They are composed of carbon, hydrogen, nitrogen, oxygen and very rarely sulphur and phosphorus. Proteins are defined as: The polymers (macro-molecules formed of simple units called monomers) of amino acids are called proteins.

Q5. What do you know about Amino acid?

AMINO ACIDS

Amino acids are building blocks of proteins. They are bi functional compounds and contain basic amino (-NH,) and acidic carboxyl group (— COOH) groups. Up to twenty amino acids have been found in nature, ten re essential and remaining ten non- essential. Body can only synthesize non-essential ten amino acids. The general formula for amino acids is:



Q6. Give sources of protein

SOURCES OF PROTEIN

The important sources of proteins are

1. Eggs
2. Meat
3. Pulses
4. Nuts
5. edible seeds
6. beans
7. peas
8. cheese etc.

Q7.Give uses of protein

USES OF PROTEINS:

Animal proteins can be found in meat, mutton, poultry, fish, and eggs. Humans consume them as food since they are required for protoplasm production.

Enzymes are proteins generated by living organisms. They help to stimulate chemical processes in our body. They are highly specialized and extremely efficient. Many enzymes are utilized in pharmaceuticals. They cure blood cancer as well as decrease bleeding.

Proteins are hides. These are used in the tanning process to create leather. Leather is used to produce shoes, coats, and sports equipment, among other things.

Bones are rich in proteins. When bones are cooked, gelatin is produced. Bakery goods are made with gelatin.

Plants, such as pulses, beans, and other legumes manufacture proteins as well. These are utilized as a source of food.

Q8.What are lipids?

LIPIDS

A group of naturally occurring heterogeneous organic compounds which includes fats, oils, waxes and are insoluble in water means hydrophobic (water repellent) but easily soluble in Bloor's reagent (mixture of diethyl ether and ethyl alcohol in the ratio of 2:1) and organic solvents like ether, benzene, acetone, carbon tetra chloride and chloroform.

Generally, lipids are composed of elements like carbon, hydrogen and oxygen, but there are some lipids which contain nitrogen and phosphorous too.

Lipids are the building blocks of cells.

Q9.Define fatty acid. also give its example

FATTY ACIDS

Fatty acids are lipids building components. They're carboxylic acids with a lengthy chain, either saturated or unsaturated

FOR EXAMPLE:

$C_{15}H_{31}COOH$ Palmitic acid

$C_{17}H_{35}COOH$ Stearic acid

In the presence of mineral acids, these acids produce esters (oils or fats) with glycerol.

Q10. Differentiate between fat and oil

FATS	OILS
These are solids at ordinary room temperature	These are liquids at ordinary room temperature
They are obtained mainly from animals.	They are obtained mainly from plants.
These are saturated compounds.	These are unsaturated compounds.
They have high melting points.	They have low melting points.
They increase cholesterol level in body.	They maintain cholesterol level in body.

Q11. Give sources of lipids

ANIMALS:

Marine animals like salmon and whales are rich sources of lipids. Butter, ghee, cheese are obtained from animals.

PLANTS:

Sunflower, coconut, ground nuts, corn, cotton seed, olive etc. are important plant sources of lipids.

Q12. Give uses of lipids.

USES OF LIPIDS:

1. They act as transporter of fatty acids and fat soluble vitamins (vitamin A, D, E &K) in body.
2. Some lipids reduce cholesterol level in body.
3. Fats and oils are used for cooking and frying of food.
4. Fats and oils are used in detergents, soaps, cosmetic polishes and paints.

5. They activate the enzymes.
6. Animal fats are found in adipose tissue cells. Animals secrete milk from which butter and ghee is obtained. Butter and ghee are used for cooking and frying of food, for preparing bakery products and sweets.

Q13. Write short note on nucleic acid

NUCLEIC ACIDS

The name nucleic acid implies that they generally occur in nuclei of the cells. But some nucleic acids are also present in cytoplasm. Like proteins, nucleic acids are biopolymers. They are most important of all biomolecules because they store and transmit hereditary information from parents to children. In living organisms, even single fertilized egg carries the information for making the different organs like heart, liver, eyes, kidneys, hands, legs, heads etc.

Each nucleotide is composed of:

1. Pentose sugar
2. Phosphate group
3. Nitrogenous base (purines and pyrimidines)

Q14. Discus the types of nucleic acid

TYPES OF NUCLEIC ACIDS

There are two types of nucleic acids. These both types of nucleic acids are present in all animals and plants.

DEOXYRIBONUCLEIC ACID (DNA)

Deoxyribose sugar is found in DNA. J. Watson and F Crick identified its structure in 1953. It's a two-chained double-stranded molecule with a considerable length. Sugar, phosphate, and a base make up each chain. The backbone of the chains is made up of sugar and phosphate groups, and two chains are joined by bases. Chains are wrapped around each other in a double helix shape

In the nucleus of a cell, DNA is the permanent storage for genetic information. It transports and stores all of the cell's genetic information conveys these instructions on how to build certain proteins from amino acids from generation to generation. These instructions are referred to as the "genetic/code of

life." They decide whether a cell is nerve cell or a muscle cell, and if an organism Is a man, a tree, or a buffalo.

RIBONUCLEIC ACID (RNA)

It is made up of ribose sugar. It's a molecule with only one strand. It is in charge of putting genetic information to work in the cell in order to produce proteins. Its function is similar to that of a messenger.

DNA produces RNA in order to convey genetic information. The information sent to RNA is received, read, decoded, and used to build new proteins. As a result, RNA is in charge of guiding the production of new proteins.

Q15. Give some importance of nucleic acid?

IMPORTANCE OF NUCLEIC ACID

1. Nucleic acid are the most vital, material for cell functioning.
2. Nucleic acids are the storage of genetic information
3. Nucleic acid work for mutation to save the cells and body from threatening diseases.
4. Nucleic acids transfer heredity characters from one generation to another generation.
5. Nucleic acids serve as source of energy in the form of ATP

Q16. What do you know about Vitamins?

1) TYPES OF VITAMINS

On the basis of solubility, there are two types of Vitamins

(a) Water soluble vitamins

(a) Fat soluble vitamins

Q17. Discus the type of vitamins

TYPES OF VITAMINS

(a) WATER SOLUBLE VITAMINS

Those vitamins which are soluble in water are called water soluble vitamins. These vitamins are obtained from cereals and nuts. Generally, vitamin B (complex) and vitamin C are water soluble vitamins. These vitamins are not stored in body. If we take these vitamins in excess, they cannot harm. Further, these vitamins are easily excreted from our body.

(b) FAT SOLUBLE VITAMINS

Those vitamins which are soluble in fats and organic solvents are called fat soluble vitamins. Vitamins A, D (sunshine vitamin), E and K are fat soluble vitamins and are stored in the body for long period of time. These vitamins are obtained from lipids. If we take overdoses of vitamins, they may harm us and cause diseases. For example, excess of vitamin, A causes irritation and headache, vitamin D calcification and pain in bones, vitamin E fatigue and headache and vitamin K liver and kidney diseases.

Q18. Give uses of enzymes.

USES OF ENZYMES

1. Commercially, yeast enzymes are utilized in the fermentation of molasses and starch to make alcohol (Ethanol).
2. Detergents include microbial enzymes (powder or liquid). Lipases are enzymes that break down fats into more water-soluble molecules.
3. Fruit juices are purified with the help of retimes.
4. Amylase enzymes are utilized in the Production of bread because they can increase the amount of starch in the flour Even they are capable of converting starch to sugary glucose syrup.
5. This may be used as sweetener in cuisine as well as in the baking of bread.
6. The lactase enzyme is used to make ice cream sweeter. Lactose is broken down in milk to galactose and glucose, both of which are sweeter than lactose.
7. Enzymes ore used in the dairy sector to make cheeses, yogurt, and other dairy products, while others are employed to improve the texture or flavor of the product.

Q19. Write sources, importance, deficiency disease of following vitamins A, B, C, D, E, k

VITAMINS	SOURCES	IMPORTANCE	DEFICIENCY DISEASES
A	Butter, fish, eggs, milk, cheese, carrots etc. It may	Eyes (form visual pigments), skin	Night blindness (an inability to see in dim

	be obtained from the coloring matter of green and yellow vegetables.		light), Xerophthalmia tear glands cease to unction), dryness of skin etc.
B (Complex)	Wheat, rice, eggs, milk, meat, live, nuts, yeast etc.	Nerves, skin	Beriberi (causes inflammation of nerves and heart failure), Dermatitis (red and swollen skin), loss of hairs, tongue inflammation, inflammation of lips, burning of eyes, thickening of skin etc.
C (ascorbic acid)	Oranges, lemon, tomatoes, green peepers etc.	Heal wounds, prevent gum beading and cold.	Scurvy (swelling gums and opening of healed Wounds).
D (Anthracitic vitamin)	Fish, Milk, butter mushroomed sunshine etc.	Bones, teeth (controls the metabolism of calcium and phosphorus in body).	Rickets (softening and weakening of bones in children).
E (some time it is called fertility factor)	Plant oils like wheat germ oil, cotton seed oil, corn germ oil, Soybean oil, peanut oil etc. It also occurs in green leafy Vegetables.	Maintain cell membrane and proper functioning of reproductive system.	Sterility, hemolysis (fragility of R.B.C) etc.
K	Green vegetables like spinach, alfalfa, cabbage, cereals etc..	Form blood clotting factor.	Hemorrhage (increase blood clotting time)

Chapter 5

Environmental Chemistry-1 The Atmosphere

Q1. Define Environmental chemistry.

Environmental chemistry

It is the study of chemical species' origins, interactions, movement, impacts, and destinies in the air, soil, and water environments, as well as the impact of human and biological activities on these.

Q2. Define Atmosphere. Give its importance.

Atmosphere

Definition

The earth is surrounded by a layer of gases called the atmosphere.

Importance of atmosphere:

1. The atmosphere protects Earth like a big blanket of insulation.
2. It absorbs the heat from the Sun and keeps the heat inside the atmosphere helping the Earth to stay warm.
3. The big blanket also helps to form our weather patterns and climate.

Q3. Describe the Composition of atmosphere?

Composition of atmosphere

It is made up of nitrogen (78.09%) and oxygen (20.95%), with small amounts of argon (0.93%), carbon dioxide (0.03%), water vapour, and other gases. There are lots of other gases like neon, helium, hydrogen that are part of the atmosphere, but in much smaller amounts. Solid particulates including ash, dust, volcanic ash, etc. are also small parts of the atmosphere.

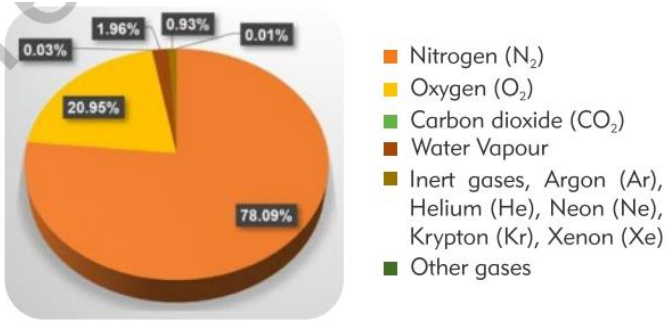
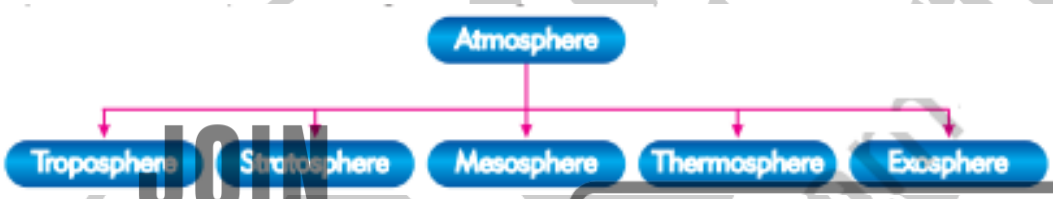


Figure 5.1 Composition of atmosphere

Q4. What do you know about the Layers of atmosphere

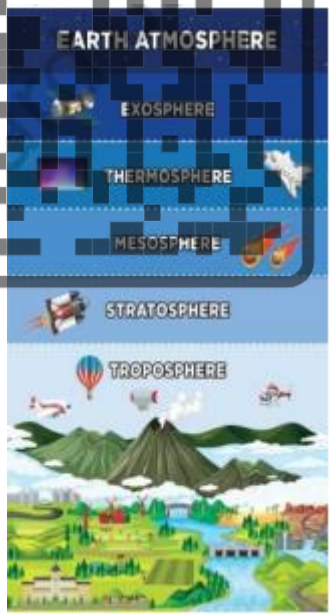
Layers of atmosphere

The Earth's atmosphere is divided up into 5 major layers. These layers are classified on the basis of temperature and density with respect to earth surface; following are the layers of the atmosphere, starting from the ground to upward:



Troposphere:

- The troposphere is the lowest layer of Earth's atmosphere.
- It extends from earth surface to an average height of about 12 km, although this altitude varies from about 9 to 17 km (9 km at the poles, 17 km at the Equator) above earth's surface.
- This is where we live and even where planes fly mostly.
- Around 80% of the mass of the atmosphere is in the troposphere.



Stratosphere:

- The stratosphere is the second lowest layer of Earth's atmosphere.
- It lies above the troposphere and is separated from it by the tropopause.
- This layer extends from the top of the troposphere at roughly 12 km above Earth's surface to the stratosphere at an altitude of about 50 to 55 km.

- The higher the altitude the hotter is the atmosphere. Unlike the troposphere the stratosphere gets its heat by the ozone layer absorbing radiation from the sun. As a result, it gets warmer the further away you get from the Earth.
- There are less water vapours and other substances in this layer. Weather balloons go as high as the stratosphere.

Q5. Distinguish between troposphere and stratosphere.

S.No.	Troposphere	Stratosphere
1.	It is the lowest point on the earth's surface.	It is the uppermost layer of the atmosphere after the troposphere.
2.	It stands at a height of around 11 km above sea level.	It rises up to 50 km above sea level.
3.	The troposphere makes up around 75% of the mass of the atmosphere.	The stratosphere has a far less amount of atmosphere then the troposphere.
4.	As you climb higher in this sphere the temperature drops steadily. It ranges in temperature from 15 °C to -56 °C.	The temperature fluctuates somewhat with height and usually the higher the altitude the hotter it gets.
5.	Ozone, which is found here, is a polluting gas.	The presence of ozone hair shields the planet from ultraviolet radiation.
6.	There is a lot of movement of the air, and this area is part of an active weather system.	There is a lack of air movement in this area.
7.	Almost all planes pass through this layer.	Airplanes are not permitted in this layer.
8.	N_2,O_2,CO_2 and water vapours are the most essential gases in this sphere.	In this layer water vapours and gases are quite low in quantity.

Q6. What is Pollutants? Give its causes and effects.

Pollutants

Definition:

A material or energy which is present in excess of the natural concentration and produces an adverse effect upon the environment is known as pollutant and the phenomenon is known as pollution.

Causes: Human activities produce and release these contaminants into the environment.

Effects:

1. They endanger human life by polluting the environment (air, water, and soil).
2. Pollutants in the air alter the weather, have a negative impact on human health, harm vegetation, and cause the destruction of structures.

Q7. Name the different types of air pollutant.

Types of pollutants: There are seven types of pollutants.

- Air pollutants
- Water pollutants
- Soil pollutants
- Thermal pollutants
- Radioactive pollutants
- Noise pollutants
- Light pollutants

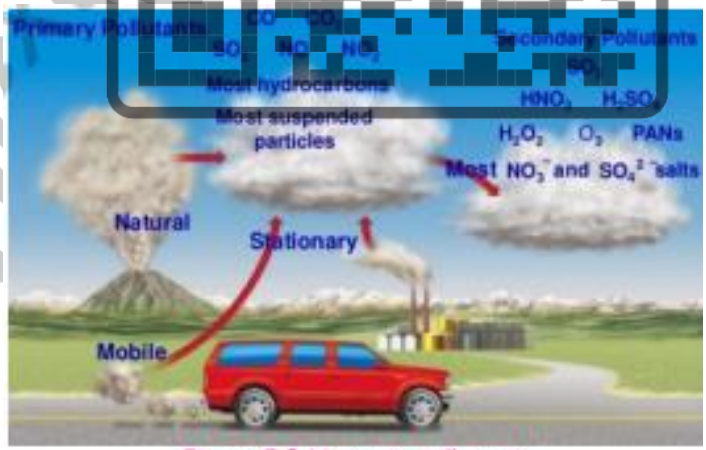


Figure 5.3 Major air pollutants

Q8. Name and discus the different Major air pollutants

Major air pollutants

Types of major air pollutants: There are two types of major air pollutants, which are following.

1. Primary air pollutants
2. Secondary air pollutants

Primary air pollutants:

The waste or exhaust products produced by the burning of fossil fuels and organic materials are referred to as primary pollutants. Sulphur oxides (SO_2), carbon oxide (CO_2 and CO), nitrogen oxides (especially nitric oxide NO), hydrocarbons (CH4), ammonia, and fluorine compounds are among them.

Secondary air pollutants: Primary pollutants create secondary pollutants through a variety of processes. Sulphruic acid, carbonic acid, nitric acid, hydrofluoric acid, ozone, and peroxyl acetyl nitrate (PAN) are secondary pollutants.

Q9. Give the sources of different pollutant their risk on our environment an effect on human?

Pollutant	Source	Environmental Risks	Human Health risks
Carbon Monooxide (CO)	Emissions from automobiles, fires, and industrial operations	causes the production of smog	In healthy persons, it can increase symptoms of cardiac disease, such as chest discomfort it can also Course visual difficulties and diminish physical and mental skills.
Nitrogen Oxide (NO and NO_2)	Emissions from automobiles, electrical generation, and industrial operations	It causes harm to the plats and helps to the creation of Pollution.	Inflammation and irritation of the respiratory tract.
Sulfur dioxide (SO_2)	Electricity generation, fossil-fuel burning. industrial activities and automotive emissions are all examples of Pollution sources.	Key contributor to the creation of acid rain, which destroys flora, buildings, and monuments; interacts to generate patricide matter	Having trouble breathing, especially if you have asthma or heart problems
Oxone (O_3)	NOx and VOCs from industrial and car emissions, gasoline vapours, chemical solvents, and electrical utilities are all sources of 0zone.	Interferes with certain plants capacity to breathe, making them more vulnerable to other environmental stresses (e.g. disease, harsh, weather)	Lung function is impaired, and breathing passage ways are irritated and inflamed.
Particular Matter	Fires, smokestacks, building sites, and unpaved roads are examples of primary particle sources; interactions between gaseous compounds released by power plants and	Contributes to the creation of haze and acid rain, which alters the pH balance of streams and harms vegetation, buildings, and monuments	breathing passage discomfort, asthma exacerbation, irregular heartbeat

	cars are examples of secondary particle sources.		
Lead (Pb)	Metal processing, garbage Incineration, and fossil-fuel burning are all examples of industrial processes.	Biodiversity loss, reduced reproduction and neurological difficulties in vertebrates are all issues that need to be addressed.	When young children are exposed, it can have negative effects on numerous body systems and can lead to learning problems. Adults cardiovascular consequences

Q10. What is acid rain? What are the Effects of acid rain?

Acid rain

Rainwater is somewhat acidic because it contains dissolved CO_2 from the atmosphere. It has a pH of 5.6 to 6. Rainwater, on the other hand, becomes increasingly acidic as a result of dissolving air pollutants (acids) and its drops pH to 4. Acid rain is created when rainwater dissolves acidic air pollutants like sulphur dioxide and nitrogen dioxide.

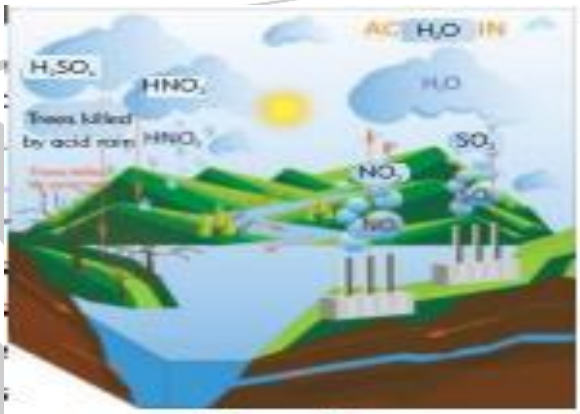


Figure 5.4
Acid rain

Effects of acid rain:

1. Acid rain leaches heavy metals (Al, Hg, Pb, Cr, etc.) from soil and rocks and discharges them into rivers and lakes.
2. The aquatic life in lakes, on the other hand, suffers as a result of the high concentration of these metals. It causes fish to suffocate and die as a result.
3. Acid rain eats away the calcium carbonate in marble and limestone, which is found in many structures and monuments. As a result, these structures are becoming increasingly drab and degraded.
4. Acid rain makes the soil more acidic. Many crops and plants are unable to thrive in such conditions. It also raises the levels of hazardous metals in the soil, which damage the plants.
5. Because of the acidity of the soil, even elderly trees are impacted. Their development is slowed. They wilt and perish as a result of the dryness.
6. Acid rain causes direct harm to tree and plant leaves, restricting their development. Plant development may be impeded depending on the severity of the injury.

Q11. What is Ozone? Discus its formation.

Ozone

Three oxygen atoms make up ozone (O_3), a highly reactive gas. It is a natural and man-made substance.

Formation of stratospheric ozone(O_3): The interaction of solar ultraviolet (UV) light with molecular oxygen produces stratospheric ozone (O_3).

Formation of tropospheric or ground level ozone(O_3): Photochemical interactions between two primary groups of air pollutants, volatile organic compounds (VOC) and nitrogen oxides, produce tropospheric or ground level ozone, in which humans breathe.

Q12. What do you know Ozone depletion? What are the effect of Ozone depletion?

Ozone depletion

Ozone concentration in the atmosphere is essentially constant under normal conditions due to a series of complicated atmospheric interactions.

However, different chemical interactions are depleting the ozone layer. Such as, chlorofluorocarbons (CFCs), which are utilized as refrigerants in air conditioners and refrigerators, are a major contribution to ozone depletion. These substances leak in some way and disperse into the stratosphere. The C-CL bond in $CFCl_3$ is broken by ultraviolet light, resulting in chlorine free radicals.

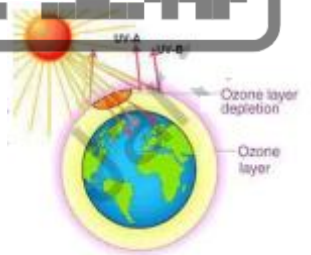


Figure 5.5
Ozone depletion

These free radicals have a high level of reactivity. They react with ozone to produce oxygen in the following way

$O^3 + Cl^o \rightarrow O^2 + OCl^o$

$OCl^o \rightarrow O^o + Cl^o$

$O^o + O^o \rightarrow O_2$

A single chlorine free radical produced by the breakdown of CFCs has the potential to damage millions of ozone molecules. The ozone hole is a location where the ozone layer is depleted.

Effect of ozone depletion:

1. Ozone depletion allows UV light from the Sun to reach the Earth, which can cause skin cancer in humans and other animals.
2. As the Ozone layer gets thinner, infectious illnesses such as malaria become more prevalent.
3. It has the potential to disrupt the food chain by altering plant life cycles.
4. It has the ability to alter wind patterns, resulting in global climate shifts. Asia and the Pacific, in particular, would be the most impacted regions, as a result of the human migration issue caused by climate change.

Q13. Give advantages and disadvantages of ozone layer

Advantages

This layer surrounds the Earth and acts as a screen against damaging UV radiation. UV rays would induce skin cancer if the Ozone layer were not present.

Disadvantages

The ozone layer, which is located about 6 to 30 miles above the earth's surface, decreases the quantity of dangerous UV light that reaches the Earth surface.

Q14. What is Green House Effect?

Green House Effect (Global Warming):

Despite the fact that CO_2 is a harmful gas, its rising concentration as a result of the combustion of fossil fuels in various human activities is concerning. CO_2 in the atmosphere works as a greenhouse's glass wall. It permits UV and IR radiations to pass through, but not the other way around. Some of the infrared light released by the Earth is trapped by it.

As a result, higher CO_2 concentration absorbs infrared radiation generated by the Earth's surface, preventing heat energy from existing the atmosphere. It aids in preventing the surface from cooling down at night. As CO_2 concentrations in the

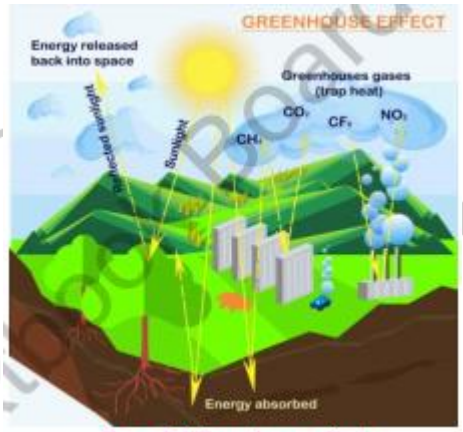


Figure 5.6 Green house effect

atmosphere rises, less thermal energy is lost from the Earth's surface. As a result, the surface's average temperature progressively rises. This is known as greenhouse effect. The quantity of CO_2 in the air has a direct relation with this impact. The greater the amount of CO_2, the greater the heat trapping or warming. This phenomenon is also known as global warming because of the increased temperature. Primary greenhouse gases in the earth atmosphere are water vapours, CO_2, CH_4, N_2O and ozone.

Q15. List some Effect of Global Warming.

Effect of Global Warming

1. The accumulation of carbon dioxide in the atmosphere causes an annual increase in atmospheric temperature of roughly 0.05 degree Celsius.
2. It's producing significant shifts in weather patterns. Extreme weather events are occurring more frequently and with more intensity than in the past.
3. It melts glaciers and snow caps, increasing the danger of flooding and intensifying tropical cyclones.
4. As the sea level rises, low-lying regions are more likely to be submerged, rendering previously populous places uninhabitable.

MULTIPLE CHOICE QUESTIONS

1. Second highest layer of Earth's atmosphere is

(a) stratosphere (b) mesosphere (c) troposphere (d) thermosphere

2. Aero planes fly in:

(a) Troposphere (b) Stratosphere (c) Mesosphere (d) Thermosphere

3. Atmospheric pressure decreases with the

(a) increase in altitude (b) decrease in altitude

(c) increase in altitude (d) increase in latitude

4. Layer of atmosphere which separates stratosphere and troposphere is known as

(a) tropo-pause (b) mesopause (c) tropopause (d) stratopause

5. Ozone layer is part of

(a) mesosphere (b) stratosphere (c) thermosphere (d) troposphere

6. Which is not part of greenhouse gases

(a) carbon dioxide (b) methane (c) nitrous oxide (d) oxygen

7. Second most abundant constituent of dry air in terms of volume after nitrogen is

(a) nitrogen (b) oxygen (c) carbon dioxide (d) helium

8. Which of the following is the reason of global warming

(a) Presence of sulphide (b) Rise in CO_2 concentration

(c) Oxides of nitrogen (d) Formation of ozone

9. The altitude on stratosphere is global warming

(a) 40 to 45 km (b) 50 to 55 km (c) 60 to 65 km (d) 70 to 75 km

10. Ozone is a gas found in the _____ layer:

(a) Troposphere (b) Mesosphere (c) Stratosphere (d) none

Ans:

1.thermospher e	2.Stratosphere	3.increase in altitude	4.tropo-pause	5.stratosphere
6.oxygen	7.oxygen	8.Rise in CO_2 concentration	9.50 to 55 km	10.Stratosphere

Chapter 6

Environmental Chemistry II: Water

Chemical formula H_2O

Properties

It doesn't have Odour, colour, and smell.

Q1. Describe the Occurrence of water.

Occurrence of water

Water makes up around one third of the Earth's surface. Oceans, rivers, glaciers, lakes, wells, and groundwater are the primary sources of water. Water covers around 70% of the Earth's surface, while land covers the remaining 30%. The majority of the water on Earth (about 97%) is salt water, largely found in the seas, with only 3% being fresh water. Fresh water accessible for human needs accounts for less than 1% of the total quantity on the planet. The issue is that fresh water is not distributed equitably across the globe.

Figure 6.1 Occurrence of water

Q2. List some of the importance of water

Importance of water:

1. Our organs need water to work properly and toxins are removed from our body through urine.
2. Fatigue is also caused by dehydration; therefore, water prevents fatigue.
3. It is necessary for washing and sanitation.

4. It is used in cooking.
5. It is used for growing food (Agriculture).
6. Thermal power plants use water for the production of energy (electricity).
7. In many medical procedures water act as an important component in e.g: In dialysis, water containing fluid is used to remove waste from blood.
8. Fatal diseases are prevented by clean water e.g cholera, typhoid etc.

Q3. **What are the properties of water?**

Properties of water:

Pure water is a transparent, colorless, odorless, and tasteless liquid possessing the attributes listed below:

1. It is litmus-neutral.
2. At sea level, it has a freezing point of 0°C and a boiling point of 100°C.
3. At 4°C, its maximum density is 1 $g.cm^{-3}$.
4. It's a great solvent for both ionic and molecular substances.
5. It has a very high heat capacity of 4.2 $J.Kg^{-1}K^{-1}$,which is almost six times that of rocks.
6. This feature of water is responsible for maintaining the Earth's temperature within responsible bounds. Otherwise, the temperature during the day would have been too hot to handle, and the temperature during the night would have been too cold to freeze everything.
7. It has a lot of surface tension. Water's remarkable capillary strength is due to its one-of-a-kind action. The mechanism by which the water rises from the roots of plants to the leaves is known as capillary action. The survival of terrestrial plants depends on this mechanism.

Q4. What do you know about the Composition of water?

Composition of water:

Water molecule is made up of one atom of oxygen and two atoms of hydrogen connected by covalent bond. Rainwater is considered the purest form of water drinking. Drinking water contains ions necessary for our body i.e. Na^+, Cl^-,K^+,Mg^{2+} etc. Water is a polar molecule due to difference in electronegativity between H and O.

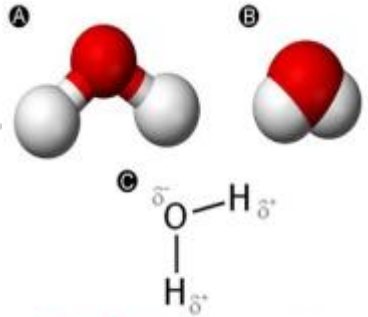


Figure 6.3 Molecular structure of water

Structure of water:

Water is a simple molecule consisting of one oxygen atom bonded to two different hydrogen atoms. Because of the higher electronegativity of the oxygen atom, the bonds are polar covalent (polar bonds). The oxygen atom attracts the shared electrons of the covalent bonds to a significantly greater extent than the hydrogen atoms. As a result, the oxygen atom requires a partial negative charge (δ^-),while the hydrogen atoms each acquire a partial positive charge (δ^+)

Q5. Discus the qualities of water

Water as a solvent:

Water can dissolve practically all minerals; water is known as the universal solvent. Water's capacity to dissolve compounds is due to two distinct qualities of the molecule:

1. Polar nature of water.
2. Extensive hydrogen bonding ability.

Polar nature of water:

The water molecule has a polar structure because of the electronegativity difference between oxygen and hydrogen atoms, which means one end of the molecule is partially positive and the other is partially negative.

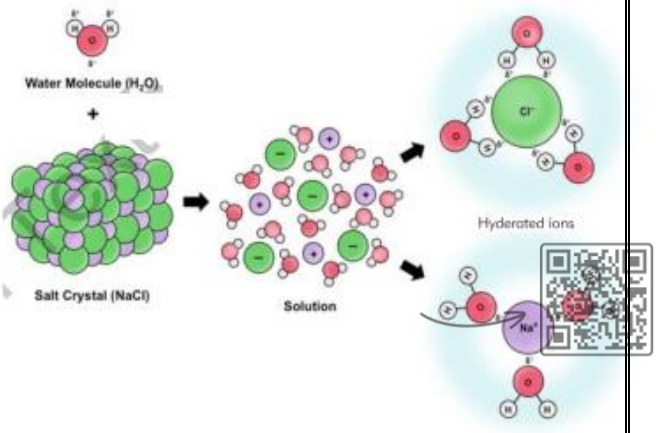


Figure 6.4 Polar structure of water

Water dissolves all other polar compounds because the positive end of the substance is drawn to the water's negative end ($O^{\delta-}$) and the negative end is

attracted to the water's positive end ($H^{\delta+}$). The ion-dipole forces of attraction between ions and water molecules overcome the electrostatic interactions among the ions. The positive and negative ions of the compounds are separated in this manner. These oppositely charged ions are eventually enveloped by water molecules, which keeps them separated in solution.

Most salts, such as NaC, KCl, Na_2SO_4, and others, are soluble in water. Water molecules, on the other hand, are not attracted to numerous covalent compounds that lack polar ends or links, such as benzene, ether, oil and petrol. Non-polar chemicals do not dissolve in water as a result.

Extensive hydrogen bonding ability:

The oxygen and hydrogen atoms make up the water molecule. One H_2O molecule can create hydrogen bonds with maximum 4 additional H_2O molecules stacked tetrahedrally around the H_2O molecule due to two O-H bonds and two lone pairs. By establishing hydrogen bonds with various polar non-ionic molecules containing hydrogen groups (-OH), such as alcohols, organic acids, glucose, sugar, and so on, water is able to dissolve them.

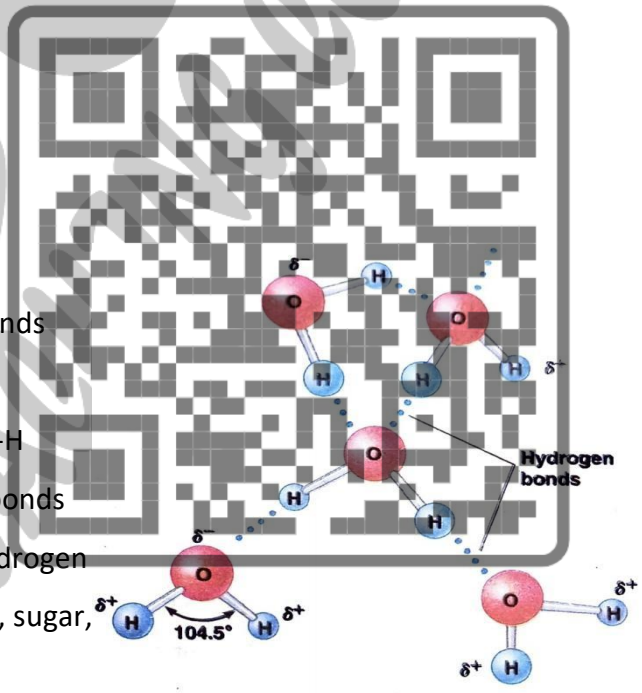


Figure 6.5 Hydrogen bonding

Q6. What is soft water and hard water?

Soft water

Soft water is water that generates an excellent leather when used with soap. It contains dissolved impurities but in small quantity.

Hard water: Hard water is defined as water that does not leather with soap. Hardness in water is caused by a variety of factors.

Q7. Discus the Types of Hardness

Types of Hardness There are two types of hardness in water:

(I)TEMPORARY HARDNESS

Temporary hardness is due to the presence of dissolved hydrogen carbonates of calcium and magnesium. These salts are water soluble and ionize into water

(II) PERMANENT HARDNESS:

Permanent hardness is due to dissolved chlorides and sulphates of Ca and Mg, for example, $MgCl_2$, $MgSO_4$ and $CaCl_2$. They are also soluble in water and ionize in water.

Q8. List the Degree of hardness of water

Degree of hardness of water on the basis of dissolved calcium (Ca^{+2}) ion and (Mg^{+2}) ion	
Soft water	0 – 16.1 mg /liter
Slightly hard water	16.1 – 60 mg /liter
Moderate hard water	61 – 120 mg /liter
Hard water	121 – 180 mg /liter
Very hard water	More than 180 mg /liter

Q9. What are the Methods of removing Hardness?

Methods of removing Hardness

1. **Removal of temporary hardness:**

(a) Boiling water:

A temporary hardness can be readily eliminated by boiling it. When calcium bicarbonate, $(HCO_3)_2$, is heated, it decomposes into insoluble calcium carbonate, which precipitates out of the solution.

$$Ca(HCO_3)_2 \xrightarrow{\Delta} CaCO_3 + H_2O + CO_2$$

(b) Clark's method:

The addition of slaked lime $Ca(OH)_2$ is a chemical approach for removing temporary hardness. Temporary hard water is treated using a determined amount of lime water. As a result of the precipitation of magnesium and calcium ions, water becomes soft.

$$Ca(HCO_3)_2 + Ca(OH)_2 \rightarrow 2CaCO_3 + 2H_20$$

$$Mg(HCO_3)_2 + Ca(OH)_2 \rightarrow MgCO_3 + CaCO_3 + 2H_20$$

2. Removal of permanent hardness:

Using washing soda: Adding washing soda to the calcium and magnesium ions results in the formation of insoluble calcium and magnesium carbonates.

$$Na_2Co_3 + CaSO_4 \rightarrow CaCO_3 + Na_2SO_4$$

$$Na_2Co_3 + MgSO_4 \rightarrow MgCO_3 + Na_2SO_4$$

Q10. What are the Disadvantages of water hardness?

Disadvantages of water hardness

1. **Leather formation:** When you wash your clothing in hard water, the soap generates a white precipitate instead of leather. The scum is the white precipitate. Without the development of leather, your garments will not be cleansed.
2. **Stains:** Hard water leaves stains on your clothes. They fade the colours of your garments. calcium scum also causes your garments to become rough.
3. **Effects on hair:** If you continue to wash your hair with hard water, you will continue to have awful hair days. Your hair becomes dry and scratchy when you wash it with hard water.
4. **Effects on skin:** Bathing with hard water causes your skin to become dry and irritated. It's because the soap residue left behind adheres to your skin. Eczema-like symptoms are caused by the remaining residue. Children are more likely to have such a problem.

5. **Reduces the life of Appliances**: If you continue to use hard water with your household equipment, the lifespan of the appliances will be dramatically reduced. The appliances steadily deteriorate due to the hard water, and they finally fail.

6. **Corrosion of pipes:** Hard water deposits may corrode pipes as well as obstruct them. As a result, the amount of water that can flow through the pipe is limited. And all that this does is slow down the flow of water. Pipe corrosion can also cause metals to leak into the water, making it unsafe to drink.

Q11. What is Water Pollutants? Also discus them in with fields

Water Pollutants

Pollutants are dumped directly or indirectly into water bodies without proper treatment to eliminate dangerous substances, resulting in water pollution.

Industrial waste: Industrial units are erected to create the needed substances. However, all industrial units, sadly, release their waste (chemicals and solid materials) into the open land or into waterways. The term for this is industrial wastewater. Organic compounds, inorganic salts, heavy metals, mineral acids, oil and greases, and other very poisonous substances may be found in industrial waste.

The effects of industrial waste:

1. They degrade the quality of water.
2. They lower the amount of dissolved oxygen in the water, which has an impact on aquatic life and ecosystems.
3. They can also leak into the groundwater and influence the deposits. They pollute the water reserves. When this water is used by humans, it causes significant illnesses such as cancer and gastroenteritis. Soil, crops, plants and animals are all harmed by this filthy water.
4. Heavy metals such as cadmium, lead, and mercury are harmful to humans and pose a health risk. Acute cadmium poisoning results in elevated blood pressure, renal damage, and red blood cell disintegration.

Household waste:

The usage of detergents for cleaning purposes in homes and businesses is growing by the day. It's because detergents, even in hard water, have a stronger cleaning activity than soap. However, they have a significant disadvantage over soaps in that certain detergents are non-biodegradable. Water contamination occurs when domestic water containing these detergents is dumped into streams, ponds, lakes, and rivers.

The detergent lingers in the water for an extended period of time, rendering it unsuitable for aquatic life. Detergents include phosphate salts, which allow algae to develop quickly in water bodies and float on the surface. It is known as Eutrophication.

A wide range of dissolved and suspended pollutants can be found in domestic sewage. Food and vegetable waste, rubbish, cans, bottles, chemical soaps, washing powder, and other items are among them. It also has disease-causing bacteria in it. All of these things pollute the water.

Agricultural waste: Effects of water pollutants on life: the usage of fertilizers and pesticides causes water contamination on two agriculture waste.

The effects of agriculture waste:

1. Chemicals from fertilizers and pesticides leak into groundwater as a result of rain and intensive crop production, a process known as leaching. Irrigation run-off from agricultural fields is the primary source of excessive nitrate levels in groundwater.
2. Runoff from agricultural land (which has been treated with fertilizers and pesticides) reaches ponds, streams, and rivers. Nitrate NO_3^- and phosphate (PO_4^{3-}) salts are present in this water. These compounds cause algae to develop quickly and float on the water's surface. They block the passage of sunshine and oxygen to aquatic life. When algae dies, microorganisms eat oxygen from the water to help the algae decompose. As a result, the water loses oxygen. Due to a lake of oxygen, aquatic creatures experience asphyxia and eventually perish.

Q12. What are the Effects of water pollutants on life?

Effects of water pollutants on life:

Following are the effects of water pollutants.

1. It is helpful to people's health. Chris, typhoid, and diarrhea can all be caused by drinking contaminated water.
2. The use of dirty water is harmful not only to humans, but also to animals and birds.
3. It promotes algae to develop quickly. The death and breakdown of algae results in a lack of oxygen in the water, which impacts aquatic organisms.
4. It harms aquatic life, causing a food chain link to be broken.
5. It degraded the appearance of lakes and rivers.
6. It is not suitable for cleaning or washing.

Q13. What is Water Borne diseases?

Waterborne infectious illnesses are diseases that spread by drinking dirty water or eating food prepared with polluted water. Toxins or bacteria can cause water contamination. Arsenic, mercury, calcium, lead, and a variety of organic substances are examples of toxins. Viruses, bacteria protozoa, and warms are examples of microorganisms.

The major reason of quickly spreading waterborne illnesses is a lack of sufficient sanitary facilities.

Q14. List some common Water Borne diseases.

Following are of the most frequent illnesses:

1. **Diarrheal diseases:** Intestinal illnesses that can lead to serious dehydration, such as cholera. Viruses, bacteria, and parasites all can cause diarrhea.
2. **Dysentery:** Dysentery is a kind of gastrointestinal infection caused by bacteria or parasites. It's characterized by severe diarrhea, which may include blood or mucus.
3. **Cholera:** The bacteria Vibrio cholerae, which may be found in water tainted by human feces, causes cholera. Cholera is a disease that produces severe diarrhea and is potential lethal.
4. **Cryptosporidium:** Cryptosporidiosis is a gastrointestinal ailment caused by a waterborne microbe (protozoa) that causes diarrhea and vomiting. Surface water sources such as reservoirs, lakes, and rivers contain these microscopic germs.

5. **Fluorosis:** Fluorosis is a condition caused by too much fluoride in the body. Fluorosis can harm your bones and teeth.

6. **Hepatitis:** Hepatitis A,B,C,D, and E are the five viruses that often cause liver inflammation. Viruses like hepatitis A and E can be spread through polluted water.

7. **Hook warm:** Hookworm is a parasitic warm that lives in the small intestine and causes disease. Anemia and slowed development in children can occur in severe situations. Hookwarm larvae enter the body via the skin, most commonly through the feet. Hookwarms which are spread by unsanitary settings, infect nearly one billion individuals each year throughout the world.

8. **Jaundice:** An excess of bile pigments in the blood causes jaundice. The liver stops working, and the eyes turn yellow. The patient is weak and tied.

9. **Typhoid:** A severe bacterial illness spreads often through polluted water or food cooked with contaminated water.

Multiple choice Question

1. Which of the following water borne diseases is of viral origin.

(a) Typhoid fever (b) Polio (c) Dysentery (d) Diarrhea

2. How much percentage (%) of the Earth's Surface is covered with water?

(a) 70% (b) 60% (c) 90% (d) 75%

3. Which type of bond is formed between H2O molecules:

(a) Hydrogen bond (b) ionic bond (c) covalent bond (d) all of these

4. The permanent hardness of water is due to presence of:

(a) $MgSO_4$ (b) $Mg(HCO_3)_2$ (c) $Ca(HCO_3)_2$ (d) all of these

5. How much freshwater is present on earth:

(a) 0.3% (b) 3% (c) 0.2% (d) 2%

6. Which salts are excessively dissolved to make temporary hard water:

(a) $CaSO_4$ and $CaCl_2$ (b) KNO_3 and KOH (c) $CaCO_3$ and $Ca(OH)_2$ (d) $Ca(HCO_3)_2$ and $Mg(HCO_3)_2$

7. Water is a:

(a) Polar solvent (b) Non polar solvent (c) Amphipathic solvent (d) Non polar charged solvent

8. The taste of water is:

(a) Sour (b) Bitter (c) Sweet (d) Tasteless

9. Which of the following is helpful for removal of permanent hardness:

(a) Na_2CO_3 (b) $Ca(OH)_2$ (c) $CaCO_3$ (d) Na_2SO_4

1.Diarrhea	2.70%	3.Hydrogen bond	4.$MgSO_4$	5. 3%
6.$Ca(HCO_3)_2$ and $Mg(HCO_3)_2$	7.Polar solvent	8.Tasteless	9.Na_2CO_3	

Chapter 7

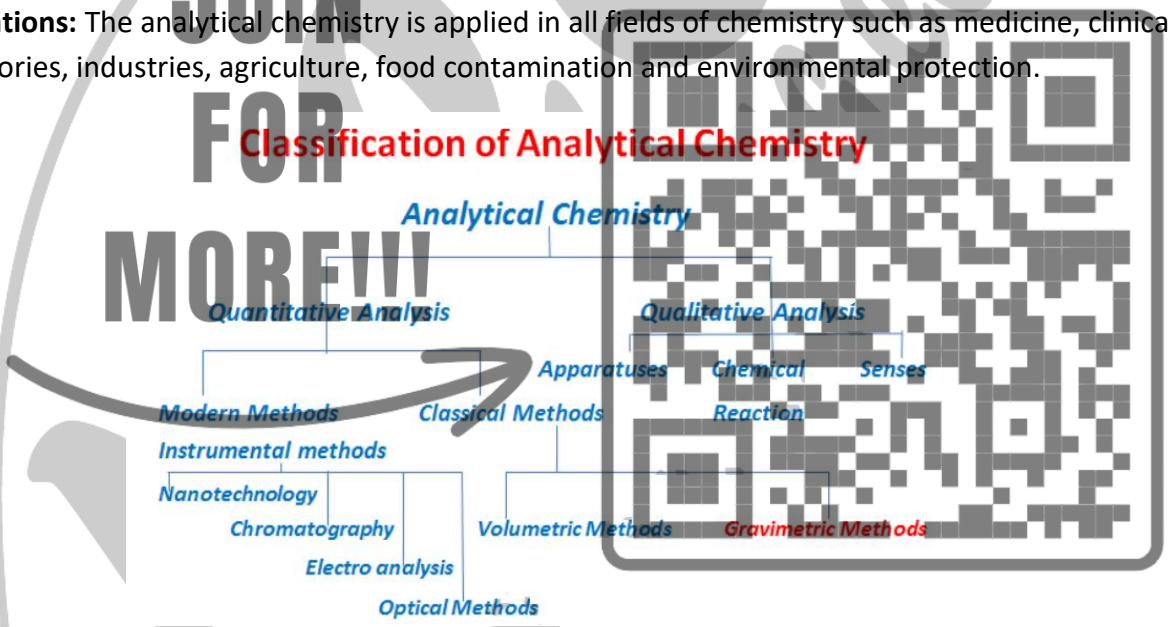
Analytical Chemistry

Q1. Define Analytical chemistry, its objective and applications.

The analysis and separation of sample to detect and estimate its components through various techniques and instruments is known as analytical chemistry.

Objective: The main objective of analytical chemistry is to develop an understanding of analysis of elements and compounds for measurement and problem solving with the help of analytical methods.

Applications: The analytical chemistry is applied in all fields of chemistry such as medicine, clinical laboratories, industries, agriculture, food contamination and environmental protection.



Q2. What do you know about Classification of Analytical Chemistry?

Classification of Analytical Chemistry

Analytical chemistry consists of two main types of analysis which are as follows:

(1) Qualitative analysis: The identification of elements, ions or compounds present in sample is called quality analysis. The sample may be solid, liquid, gas or a mixture. Qualitative analysis does not measure the quantity of substance but measure the quality of that material. Quantitative analysis is performed by selective chemical reactions or with the use of instrumentation.

Example Chemical test and flame test.

Types of qualitative analysis: Qualitative analysis further divided on the basis of chemical test are as follows.

(i) Organic qualitative analysis: It deals with the identification of presence of different classes of organic compounds or functional groups by producing colours in chemical reactions.

Example: Formation of white precipitate by adding silver nitrate ($AgNO_3$) in dilute nitric acid (HNO_3) indicates the presence of halide (X=F,Cl,Br,I).

(ii)Inorganic qualitative analysis: It deals with the identification of elements. Example: Flame test of copper halide which shows bluish-green colour due to presence of copper. Some other flame test of halide are given in the table.

LiCl	**Red Flame**
NaCl	**Yellow flame**
Kcl	**Light lilac flame**
RbCl	**Violet Flame**
$CaCl_2$	**Orange Flame**
$SrCl_2$	**Red or Crimson flame**
$BaCl_2$	**Light green flame**
$CuCl_2$	**Blue or green flame**

Q3. What is Quantitative analysis?

Quantitative analysis

The determination of how much amount or quantity of one or more substance present in compound or sample is called quantitative analysis. It deals with large number of quantifying methods which are classified as physical or chemical.

Q4. What is Physical methods of analysis?

Physical methods

It measures physical properties such as density, temperature, absorption of light, magnetic influences, colour, and texture.

The physical methods used to measure these properties are Fourier transform infrared spectroscopy (FTIR), atomic emission spectroscopy (AES), trace element analysis and energy dispersive X-ray spectroscopy (EDS).

Q5. How Chemical methods is use to analysis?

Chemical methods

They measure chemical reactions such as precipitation, oxidation or neutralization and are measured by volumetric analysis, gravimetric analysis and combustion analysis.

Q6. What do you know about Parameters? Also give its importance.

Parameters

The parameter is a measurable factor or boundary which defines performance and quality of analytical methods.

Important Parameters

The validation of any analytical method is observed by parameters and various parameters of validation are selectivity, linearity, range, accuracy, precision, and error.

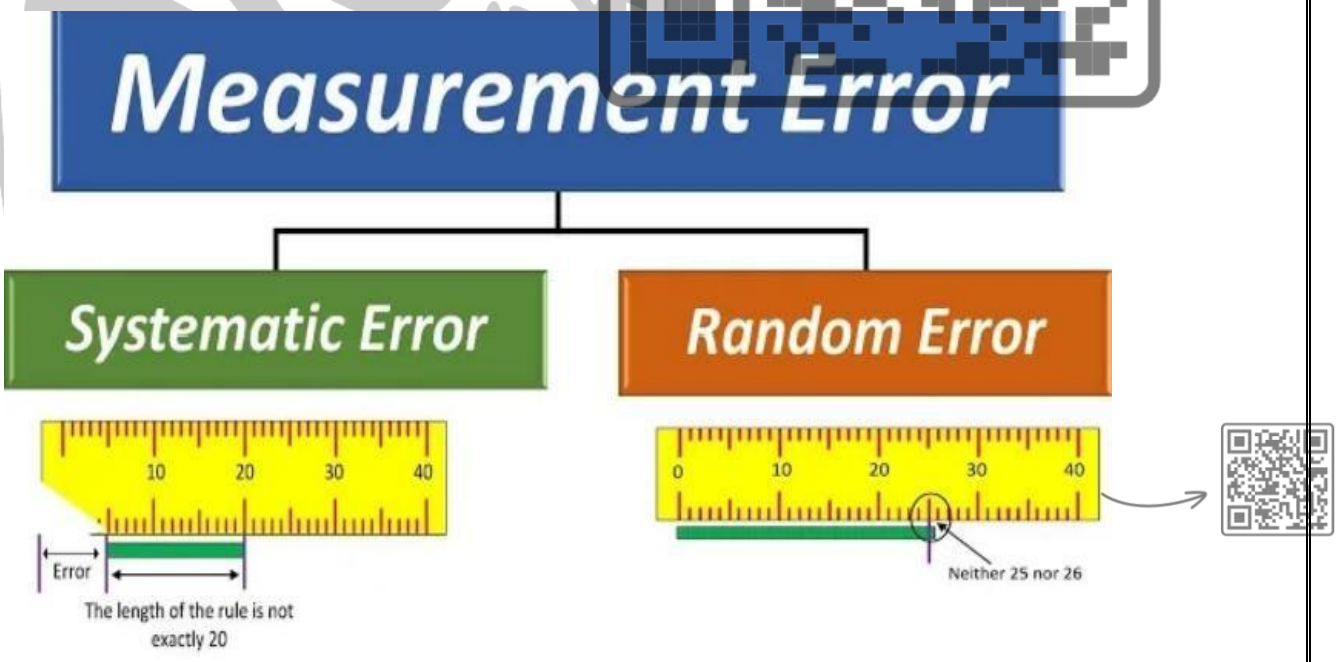
Q7. What do you know about Error? How are they classified?

Error

Error can be defined as numerical difference between observed value and true value.

Classification of errors: Errors in analytical chemistry are classified as systematic and random errors.

1. Systematic errors
2. Random errors



A. Systematic errors or determinate errors

They are caused by defect in analytical method or improper functioning of instrument. Systematic error may be instrumental, observational, environmental and theoretical. Systematic error is also known as determinate error.

B. Random error

Random error may be positive and negative and cannot be eliminated from experiment due to this reason we take many readings and average them.

Q8. What is Accuracy and precision?

Accuracy

Accuracy is an agreement between a measured value and the accepted true value.

Precision

The precision is defined as the degree of agreement between replicate measurements of the same quantity.

Not depend on precision

Accuracy is not dependent on precisions.

Q9. Explain the Different aspects of precision and accuracy with an example.

A measurement can be precise but not accurate, accurate but not precise, neither or both. A measurement system is valid if it is both precise and accurate.

For example

4 Students are performing an experiment to measure the density of aluminum (2.7 g/ml) and note down the following data which shows different aspects of precision and accuracy,

such as measurement of student number 1 is precise because 2.9 is repeating but not accurate because it is not closest to true value.

Measurement of student number 2 is not precise and not accurate because values are not closest to true value and not repeatable.

In the same manner measurement of student number 3 is not precise but accurate due to the closeness of measurement with true value,

while measurement of student number 4 is precise and accurate which may consider a valid measurement system.

Student 1	Student 2	Student 3	Student 4
2.924 g/ml	2.316 g/ml	2.649 g/ml	2.701 g/ml

2.923 g/ml	2.527 g/ml	2.731 g/ml	2.699 g/ml
2.925 g/ml	2.941 g/ml	2.695 g/ml	2.702 g/ml
2.926 g/ml	2.136 g/ml	2.742 g/ml	2.698 g/ml
Precise	Not Precise	Not Precise	Precise
Not Accurate	Not Accurate	Accurate	Accurate

The above example shows that good precision does not assure good accuracy but a valid measurement system needs good precision as well as accuracy.

Q10. What is Classical Method or Wet Chemical Method? Also classified it.

Classical Method or Wet Chemical Method

Classical methods are those analytical techniques which do not use any mechanical or electronic instrument rather than weighing balance. This method is basically related with the chemical reactions between analyte and reagents. It is also known as wet chemical method.

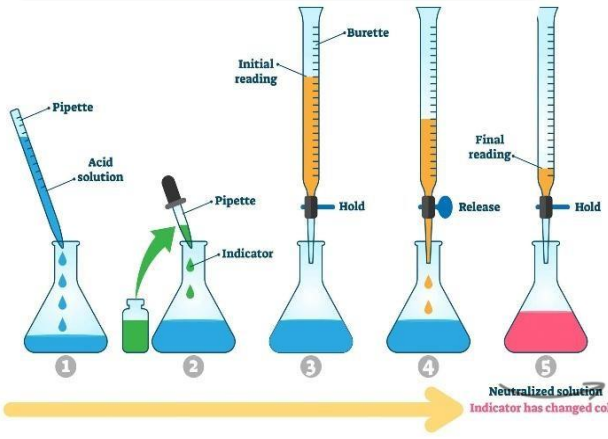
Classification of classical method:

1. Titrimetric Analysis
2. Volumetric Analysis

Q11. Discus the Titrimetric Analysis or volumetric analysis.

Titrimetric Analysis or volumetric analysis

The titrimetric analysis is used to determine the volume of a solution with known concentration which reacts with the measured volume of solution of a substance quantitatively. The titrimetric analysis is also known as volumetric analysis.



General rule: In this analysis general rule of titration is applied in which volumetric measurement of a reagent takes place which is known as analyte and this analyte completes its chemical reaction with titrant. The general chemical reaction for titrimetric analysis is as follows

$$\alpha A + tT \rightarrow \text{Product}$$

Where α is the number of moles of analyte A contained in the sample that reacts with t moles of the titrant T in the titrant solution.

Construction

This reaction is carried out in a flask containing dissolved analyte and indicator while a burette contains titrant solution. An indicator is also added in flask to show the end point of the whole reaction.

Working: Titrant is volumetrically delivered to the flask for reaction. The titration is completed when a sufficient amount of titrant added with analyte for chemical reaction and an equivalence point reached.

Titration: The comparison of volume of a solution of known concentration with the volume of solution of unknown concentration is titration.

Q12. Describe the Gravimetric Analysis.

Gravimetric Analysis

Gravimetric analysis is the oldest and important technique for quantitative estimation in chemical analysis.

Working: In this analysis an amount of analyte is determined by converting the analyte to some product and then weighing it.

For example

you want to determine the amount of chlorine (Cl) present in solution of AgCl then you have to go through following 4 steps for Gravimetric analysis.

(1) Preparation of a solution with known weight of sample (AgCl).

(2) Separation of the desired constituent (Cl).

(3) Weighing separated constituent.

(4) Computation of amount of separated constituent in the sample.

The gravimetric calculation based on gravimetric factor which converts the grams of the compound into grams of the single element.

Q13. Name the Types of gravimetric analysis

Types of gravimetric analysis

There are four types of gravimetric analysis which are

Physical, Thermos, Precompetitive and Electro gravimetric analysis.

Q14. What do you know about Advanced instrumental methods?

Advanced instrumental methods

These advanced methods involve usage of instrument for analysis and separation of mixtures and compounds. The methods used as quantitative and quantitative analysis. These analytical advanced instrumental methods include spectroscopy, chromatography, electrochemical methods, ultraviolet and visible spectroscopy, infrared spectroscopy, HPLC, gas chromatography, potentiometry and conductometry.

Q15. What is Spectroscopic method? Also give it application.

Spectroscopic methods

Spectroscopy is the interaction of light with matter.

Application:

1. Spectroscopy is used in physical and analytical chemistry for the identification of substances through the emission or absorption spectrum.
2. The spectroscopy is used to assess concentration or amount of given chemical (atomic, molecular or ionic.

Q16. Name the Measuring device of spectroscopy.

The instruments used for measurement through spectroscopy are called spectrometer, spectrophotometer, and spectrograph.

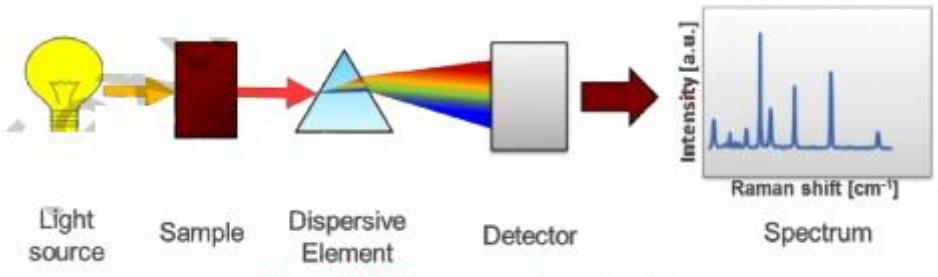


Figure 7.13 Spectroscopic methods

Q17. Name and discus Types of spectroscopic methods.

Types of spectroscopic methods are given below.

1. Ultraviolet and visible spectroscopy.
2. Infrared spectroscopy.

Ultraviolet and visible spectroscopy

It is a quantitative technique which measures how much a chemical compound absorbs light. This is done by measuring the intensity of light passing through the sample. It is also known as electronic spectroscopy.

Principle: The basic principle of this spectroscopy is interaction between light and matter but here light wavelength is ultraviolet and the process is formation of spectrum due to absorption of ultraviolet light to the chemical compound or sample.

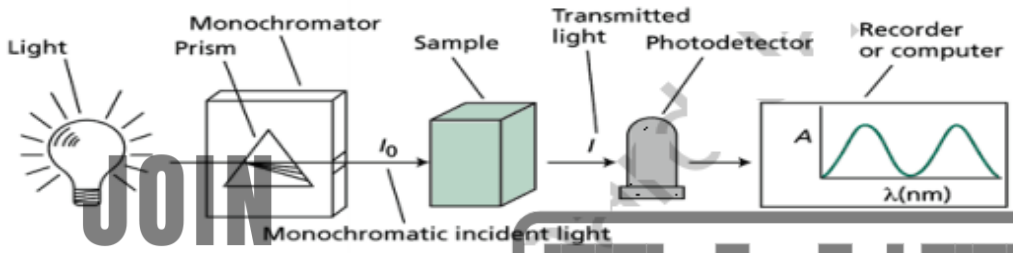


Figure 7.14 Ultraviolet and visible spectroscopy

Infrared spectroscopy or vibrational spectroscopy

Introduction: this technique was introduced in 1950.

Definition: It qualifies and quantifies the information about samples using light whose wavelength is Infrared. It is also known as vibrational spectroscopy.

Properties:

1. It qualifies and quantifies the information about samples in less time and cost effective.
2. It is nonhazardous because no any polluting chemical is required for this analysis.

Uses:

1. It is basically used for specification of functional groups in food products, polymers and industries now a days.
2. It is an effective tool for quality control in different industries.

Q18. What do you know about Infrared radiation?

Definition: Electromagnetic radiations lower in energy than visible radiations are called infra-red radiation.

Wavelength: The ordinary infra-red region extends from 2.5 µm (wavelength) to 15 µm wavelength.

Wavenumber: Wavenumber of infra-red radiation is from 4000 to 625 cm^{-1} wavenumber.

Q19. What is Chromatographic methods? Also list its properties.

Chromatographic methods: Chromatography is the modern analytical technique which is used for the separation of compounds. It also facilitates the purification, isolation and comparison of components of mixture.

Properties:

1. It may be employed with all kinds of volatile and soluble substances, organic and inorganic, polar and nonpolar etc.
2. Chromatography process starts with the mobile phase in which solutes are dissolved in substance and carry to the next stationary phase. The different components of mixture travel from mobile to stationary phase with different speed and retention time.

Q20. Name and discus the Types of chromatography

Types of chromatography

The main types of chromatography are given below.

1. High performance liquid chromatography (HPLC).
2. Gas chromatography.

High performance liquid chromatography (HPLC)

Definition: It is the technique to separate out the substances. It is also considered as pressure liquid chromatography.

Construction: HPLC instrument consists of a reservoir of mobile phase, a pump, an injector, a separation column, a detector and data acquisition computer.

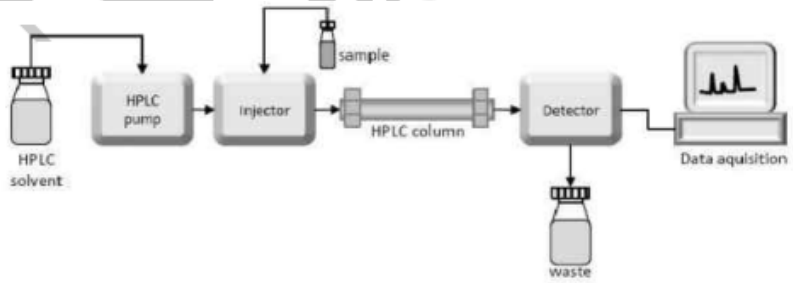


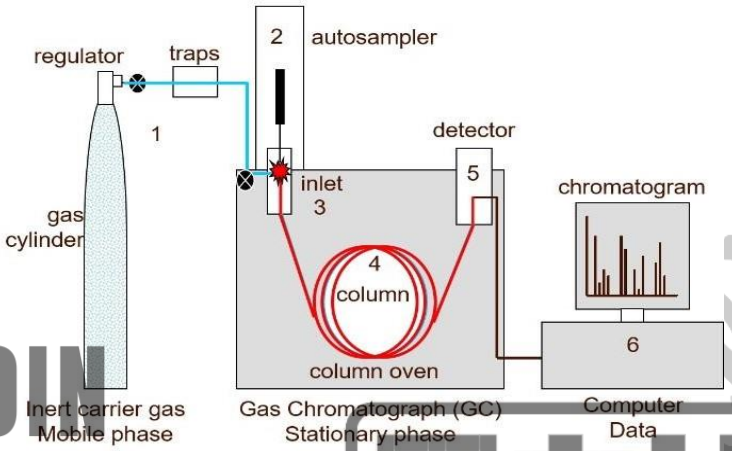
Figure 7.17 HPLC

Working: The mobile phase is pumped through the column packed with the absorbent; hence separation becomes more rapid. The pressure mechanical pump ensures the rapid solvent flow. The flow rate of solvent affects the resolution of sample components. As each component passes through the column, the detector notes its elusion and gives signal to the recorder.

Uses: These instruments are used in drug discovery, clinical analysis, cosmetic analysis, pharmaceutical, environmental chemistry and biochemical genetics.

Gas chromatography

Introduction: This method was introduced by John Potter Martin in 1950.



Definition: A gas chromatography is a technique used in analytical chemistry for the separation of gases and volatile liquids.

Principle: This separation takes place by the exchange between a mobile gas phase and a liquid or solid stationary phase.

Construction: The instruments of Gas chromatography consist of Gas cylinder, sample injector, gas chromatograph detector, and data collection device.

Working: Gas is mobile phase and gas cylinder controls the gas passage up to sample injector, which proceeds toward two columned gas chromatograph it is a stationary phase with uniform temperature. When the compound reaches the detector it detects the elusion and sends signals to data collection device (computer).

Uses: The gas chromatography used in analysis of inorganic compounds, carbohydrates, proteins, lipids, vitamins, pollutants like benzene, plastic minerals and dairy products.

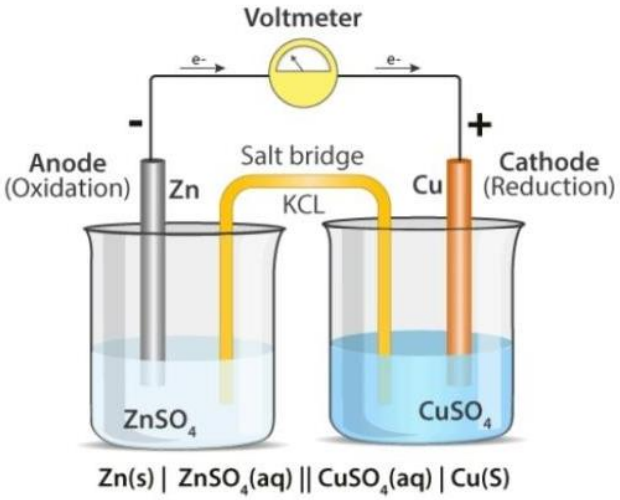
Q21. Describe the construction and working of Electrochemical methods

Definition

The electrochemical method is an analytical technique which deals with measurement of potential, charge, electrical quantity or property of a solution.

Construction

The electrochemical analytical method is carried out with the help of electrochemical cell which is shown in the following figure, generally it consists of electrodes named as anode and cathode. Anode possesses negative sign due to liberation of electrons in oxidation reaction and cathode possesses positive sign due to consumption of electrons in reduction reaction.



The electrochemical cells consist of two half cells, both are connected with an electrode (anode and cathode) and each electrode is dipped in electrolytic solution which is $ZnSO_4$ at anode and $CuSO_4$ at cathode.

The half cells are connected by means of salt bridge (NaCl) which provides a platform for ionic connectivity without mixing.

Working: One of half cells loses electrons due to oxidation and other half gains electrons in reduction process. Always remember that when equilibrium phase comes in both half cells the net voltage becomes zero and production of electricity by cell will stop.

Q22. What is Potentiometry? list its uses.

Potentiometry

The potentiometry is a method used in electroanalytical chemistry to find the concentration of solute in solution in potentiometric measurement.

Measuring device

Potential between two electrodes is measured by voltmeter.

Uses

Potentiometric analysis is used in analysis of pollutants in water, pharmaceutical and drugs, quality control in food industry and clinical chemistry.

Q23. What is Conductometry? Give its application.

Conductometry

Conductometry is one of the important analytical techniques which is used in physic -chemical analysis. It can be defined as a technique of analysis which is based on the measurement of electrical conductance.

Measuring device

It is done by the help of conductivity meter.

Application:

1. Degree of dissociation constant can be determined.
2. Solubility of a sparingly soluble salt can be determined.
3. Rate constant of a reaction can be studied.
4. End point of titration can be determined.

S.No.	Classical Method	Instrumental Method
1.	Procedure is simple and accurate.	Procedure is sensitive and technical.
2.	Equipment needed is cheap.	Equipment needed is expensive.
3.	Methods are based on absolute measurement.	Methods are based on liable measurement.
4.	Specialized training is not required.	Specialized training is required.
5.	Accuracy decreases by decreasing amount.	Accuracy depends upon instruments.
6.	Determination is slow.	Determination is very fast.
7.	Large amount of sample is needed.	Small amount of samples can be used.

MULTIPLE CHOICE QUESTIONS

1. The analytical chemistry deals with instruments and methods to_____, identify and quality the matter.

(a) Mix (b) Separate (c) Differentiate (d) Manipulate

2. The sample may be solid, liquid, gas or —- a in qualitative analysis.

(a) Mixture (b) Compound (c) Substance (d) None of these

3. Analysis deals with the identification of presence of functional groups in compounds is.

(a) Physical qualitative analysis (b) Analytical qualitative analysis

(c) Organic qualitative analysis (d) inorganic qualitative analysis

4. Flame test of Copper Halide with bluish-green colour identify the presence of.

(a) Halogen (b) Hydrogen (c) Copper (d) b and c

5. The physical methods used to measure physical properties is called.

(a) Combustion analysis method (b) Atomic emission spectroscopy method

(c) Volumetric analysis method (d) Gravimetric analysis method

6. The error caused by improper functioning of instrument is:

(a) Determinant Error (b) In determinant Error

(c) Systematic Error (d) Both a and c

7. An agreement between a measured value and the accepted true value.

(a) Error (b) Accuracy (c) Precision (d) All of these

8. Spectroscopy is the interaction of light with:

(a) Liquid (b) Solid (c) Gas (d) Matter

9. The gas is mobile phase in:

(a) Liquid chromatography (b) Solid chromatography

(c) Gas chromatography (d) None of these

10. It is used to assess concentration or amount of given atomic, molecular or ionic chemical.

(a) Chromatography (b) Spectroscopy (c) Conductometry (d) Potentiometry

1.Separate	2.Mixture	3.Analytical qualitative analysis	4.Halogen	5.Atomic emission spectroscopy method
6.Both a and c	7.Accuracy	8.Matter	9.Gas chromatography	10.Potentiometry

CHAPTER 8

INDUSTRIAL CHEMISTRY

Q1. Define the following

Industrial chemistry: Industrial chemistry is the manufacturing art concerned with the transformation of matter into useful materials in useful amounts.

Chemical industry: The chemical industry is the one responsible industry for converting raw materials like petroleum, water, air, minerals, crops, metals, and etc into more valuable products.

Saponification: Saponification is the reaction of triglycerides with sodium or potassium hydroxide to create glycerol and "soap" a fatty acid salt.

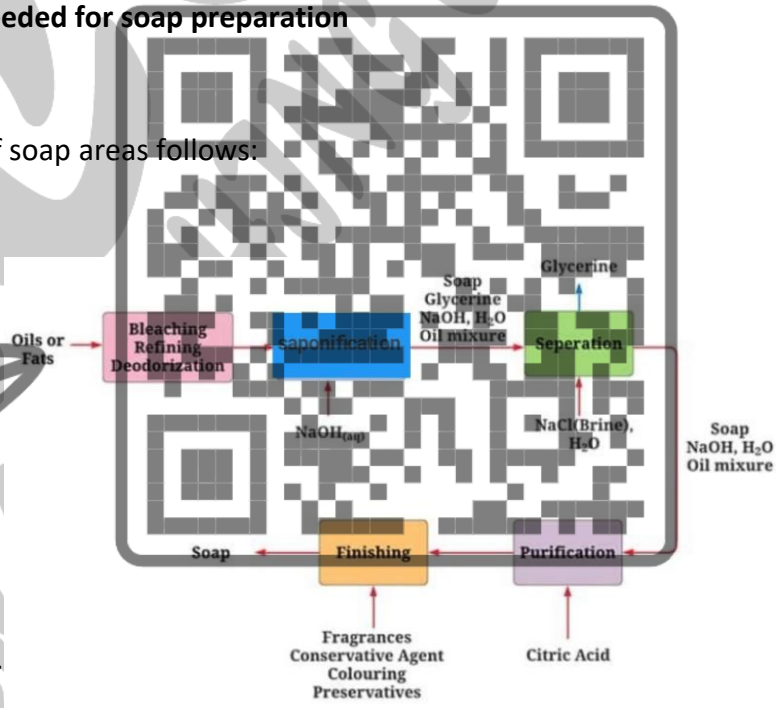
Heart and Soft soap: A hard soap is created when sodium hydroxide is used. The use of potassium hydroxide produces a soft soap.

Q2. Name and describe the Materials needed for soap preparation

Materials needed for soap preparation

The raw materials needed for preparation of soap areas follows:

- Animal Fat
- Plant Oil
- Caustic Soda
- Potassium Hydroxide
- Additives (colour, texture, scent)
- Abrasives (silica, talc, marble)



Flow Diagram for Soap Production

Animal Fat: Animal fat tallows from cows, such as lard, are often used for soap making.

Plant oil: Soybean oil, like canola, safflower, and sunflower, is often used as a potion of a soap making recipe in combination with other "core" oils like coconut, olive, and palm.

It's pretty unremarkable, but if you have it on hand, use it 5-15% of your soap recipe. It is mild, moisturizing, and gives a low creamy leather.

Caustic soda/Potassium hydroxide (Alkali): Caustic soda (NaOH) causes saponification and is an essential ingredient in soap making. When flakes or beads of sodium hydroxide get added to a liquid, it forms a lye solution. This solution, when mixed with oils or fats, will lead to the chemical reaction called saponification.

Sodium hydroxide is employed as alkali for the saponification of soap nowadays. Soap may also be manufactured with potassium hydroxide (caustic potash) as the alkali.

Additives: The major raw materials for soap manufacture are fat and alkali. Other substances, such as optical brighteners, colour, texture, scent, water softeners, are known as additives.

Abrasives: Water-insoluble minerals such as talc, diatomaceous earth, silica, marble, volcanic ash (pumice), Chalk, feldspar, quartz, and sand are often powdered and added to soap or synthetic detergent formulations. Abrasives of an organic nature, such as sawdust, are also used. Abrasives help in removing grease and dirt from skin.

Q3. List the Materials needed for sugar preparation

Materials needed for sugar preparation

The raw materials needed for the preparation of sugar from sugarcane rs follows:

- Sugarcane beads
- Lime
- Water

Q4. Describe the Preparation of sugar from sugarcane

Preparation of sugar from sugarcane

The preparation of sugar from sugarcane composed of following steps.

- Harvesting and delivery
- Juice extraction
- Clarification
- Concentration
- Crystallization
- Crystal separation and drying

Harvesting and delivery of sugarcane: Sugarcane is generally harvested in the cooler months of the year, although it is harvested year-round in all over the Sindh. As much as two-thirds of the world's can crop is harvested by hands but in some countries this process is also done by machines. Harvested cane is transported to the factory by many means and vehicles, such as oxcarts, trucks, railway cars, or barges.

Juice extraction of sugarcane: After weighing, sugarcane is loaded by hand or crane onto a moving table. The table carries that cane into one or two sets of revolving knives, which chop the cane into chips in order to expose the tissue and open the cell structure, thus readying the material for efficient extraction of the juice.

Clarification of extracted juice: Mixed juice from the extraction mills or diffuser is purified by addition of heat, lime, and flocculation aids. The lime is a suspension of calcium hydroxide, often in a sucrose solution, which forms a calcium saccharate compound. The heat and lime kill enzymes in the juice and increase pH from a natural acid level of 5 – 6.5 to a neutral pH. Control of pH is important throughout sugarcane manufacture.

Concentration of clarified juice: Steam is used to heat the first of a series of evaporators. The juice is boiled and drawn to the next evaporator, which is heated by vapour from the first evaporator. The process continues through the series until the clarified juice, which consists of 10-15% sucrose, is concentrated to evaporator syrup, consisting of 55 – 59% sucrose and 60 – 65% by weight total solids.

Crystallization of concentrated juice: Syrup from the evaporators is sent to vacuum pans, where it is further evaporated, under vacuum, to supersaturation. Fine seed crystals are added, and the sugar "mother liquor" yields solid precipitate of about 50% by weight crystalline sugar. Crystallization is a serial process and named as A molasses, B molasses, C molasses, and final molasses which is 25% sucrose and 20% (glucose and fructose).

Crystal separation and drying: Crystals are separated in basket-type centrifuge machines. These machines continuously break the crystals through continuous centrifuge process and a fine jet of water is spread on the sugar pressed against the wall of the centrifugal basket, reducing the syrup coating on each crystal. In modern factories, the washing process is quite extensive in an effort to produce high-purity raw sugar.

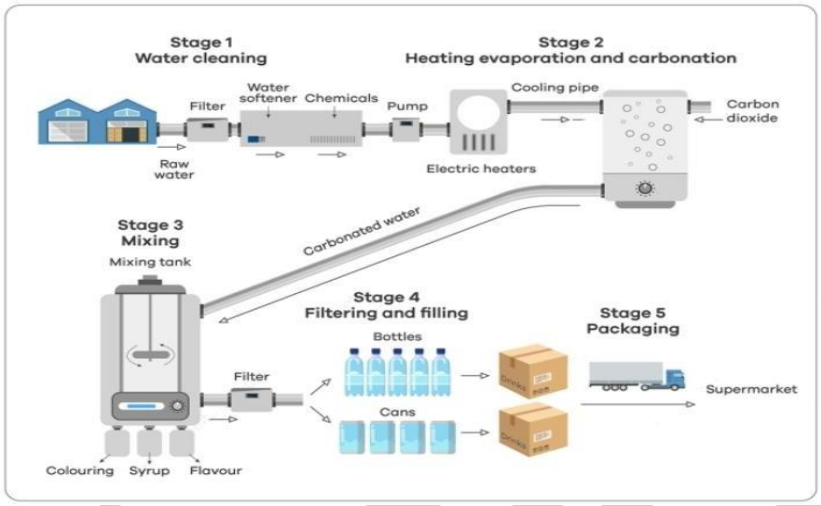
Q5. Describe the Preparation of soft drinks

Preparation of soft drinks: The basis of soft drinks, the syrup, is made up of water, sugar, acid, coloring, and flavoring agents. This syrup is prepared by dissolving these ingredients into water to 65° Brix.

Materials required for preparation of soft drink:

Following materials required for preparation of soft drink:

- Water
- Calcium and other minerals
- Coloring and flavoring agent
- Sugar for microbial growth
- Citric acid for sour taste



Q6. Write a short note on Petroleum

Petroleum: Petroleum is a natural substance in rocks beneath the Earth's crust. The term "petroleum'' refers to rock oil.

Property: It is a liquid that is lighter than water yet insoluble in it.

Formation of petroleum and natural gas: Oil and gas are made up of organic material that is deposited on the seafloor as sediments, then broken down and altered over millions of years. The presence of an appropriate mix of source rock, reservoir rock, cap rock, and a trap in a given location may lead to the discovery of viable oil and gas resources.

The majority of the oil and gas resources on the Norwegian shelf are formed by a thick layer of black clay that lies thousands of meters beneath the seabed.

Composition of petroleum: Petroleum is mostly made up of hydrogen and carbon, but it also includes trace amounts of oxygen, nitrogen, sulfur, and metals including vanadium, cobalt, and nickel. Alkanes (paraffins), naphthene's, aromatics, and hetero compounds are some of the most prevalent organic substances.

The exact molecular composition of crude oil varies widely from formation to formation but the proportion of chemical elements varies over fairly narrow limits as follows

Composition by weight	
Element	**Percent range**
Carbon	83 to 85 %
Hydrogen	10 to 14 %
Nitrogen	0.1 to 2 %
Oxygen	0.05 to 1.5 %
Sulfur	0.05 to 6.0 %
Metals	< 0.1 %

Q7. Describe the Fractional distillation of petroleum

Fractional distillation of petroleum

This is done in oil refineries with the use of massive fractionating columns (also known as fractionating towers). These are frequently found near to the crude oil source. The industrial fractionating column is intended to be cold at the top and hot at the bottom, allowing it to cool and condense crude oil vapour at distinctively different temperature ranges defined by the column's temperature gradient.

Fraction distilled from crude oil	Boiling point range (°C)	Carbon chain length	Hydrocarbons present	Uses
Refinery gas	-160 to -5	1- 4	Methane CH_4 Ethane C_2H_6 Propane C_3H_8 Butane C_4H_{10}	Home heating and cooking, camping fuel
Gasoline (petrol)	40-110	5-8	Octane C_8H_{18}	Car fuel
Naphtha	110-180	8-10	Decane $C_{10}H_{22}$	Plastics
Kerosene (paraffin)	180-260	10-16	Dodecane C12H26	Jet aircraft fuel
Diesel	260-320	16-20	Hexadecane C16H34	Fuels for buses and lorries
Fuel Oil	320-400	20-50	Eicosane C_20H_{42}	Industrial heating systems
Bitumen/Residue	400-600	>50		Surfacing rods

Q8. What is pharmaceutical sector?

Pharmaceutical sectors: Companies authorized to study, manufacture, sell and distribute drugs for the prevention, treatment, and cure of illnesses and other health issues make up the pharmaceutical sector.

Describe the Importance of pharmaceutical industry

Importance of pharmaceutical industry

Here are some of the industry's most important contributions, as well as why pharmaceutical firms are so vital to patients, society, and the life sciences industry.

1. **Treatments increase life expectancy:** The pharmaceutical business has made a significant contribution to the global increase in life expectancy for men and women.

   Pharmaceutical improvements are said to have responsible for 73% of the entire increase in life expectancy between 2000 and 2009 in 30 developing and high-income nations.

2. **The industry strives to eradicate and eliminate diseases:** When it comes to create remedies, the ultimate objective is disease elimination, as this helps ecosystems on a worldwide scale. Smallpox is the first - and so far only - human illnesses to be declared eliminated globally, according to the World Health Organization (WHO).
3. **Reduce pain and suffering:** According to a research conducted by the World Health Organization, people who live with chronic pain are four times more likely to have melancholy, anxiety, and difficulties in work then those who do not.
4. **Vaccines save money:** Vaccines not only serve to save millions of lives, but they also help to save money. Vaccines are commonly regarded as a cost-effective public health intervention that reduces health care costs and prevents lost productivity, hence limiting the economy's overall impact.
5. **Hospital stays are shorter:** Many illnesses that used to necessitate invasive procedures and surgery can now be addressed with medications. Patients' ability to be discharged more quickly has relieved pressure on the healthcare system and personnel.
6. **The industry employees millions of people:** Pharmaceutical forms employ millions of people across the world. Who labor in fields as diverse as scientific research, technological support, and manufacture? Pharmaceutical enterprises demand highly trained and educated employees, with positions ranging from administrative to Ph.D. scientists.
7. **Pharmaceutical companies boost the global economy:** The pharmaceutical business is a vital asset to the global economy. Pharmaceutical businesses, on the whole, play an important role in assisting patients and communities. They supply more than just possible cures and life-saving treatments; they also give rewarding jobs and help to power the global economy.

Q9. What are the Different types of fire require methods to extinguish?

METHODS TO EXTINGUISH FIRE

A self-sustaining chemical chain reaction is a complicated reaction that necessitates the precise combination of fuel, oxygen, and heat energy.

Any of the above-mentioned components can be removed to put out a fire. Various fuels necessitate different strategies for extinguishment.

Extinguishing of wood fire

Water can be thrown on a wood fire to put it out. Water absorbs a lot of heat during the evaporation process, therefore it absorbs a lot of heat and deprives the wood fire of heat, making it impossible to keep the fire going on.

Extinguishing of oil fire

Oil and water do not mix, hence water will not put out on oil fire. Because oil is lighter than water, it floats and spreads across it. Water aids in the propagation of the fire. To put out an oil fire, the oxygen supply must be shut off.

Throwing sand, table salt, or baking soda on the flames will help contain this.

Extinguishing of electrical energy

Because its source of heat is electrical energy, an electrical fire is far more powerful than ordinary flames. To put it out, the oxygen supply must be shut off.

MULTIPLE CHOICE QUESTIONS

1. Soap is the term for a salt of a:

(a) Carboxylic acid (b) Citric acid (c) Sulfuric acid (d) Fatty acid

2. Surfactants reduce the — of water.

(a) Viscosity (b) Surface tension (c) Boiling point (d) Melting point

3. The carboxylate end of the soap molecule that is attracted to water is called _____.

(a) hydrophobic end (b) end point (c) hydrophilic end (d) n.o.t

4. The use of potassium hydroxide produced a:

(a) Hard soap (b) Soft soap (c) Moderate soap (d) All of these

5. The citric acid is used in preparation of cold drinks for:

(a) Sweet taste (b) Bitter taste (c) Sour taste (d) Salty test

6. This centrifuge machine used for separation of:

(a) Juice (b) pH (c) Mud (d) Crystal

7. The abrasives are:

(a) Water soluble minerals (b) Water insoluble minerals

(c) Water semi soluble minerals (d) Water absorbing minerals

8. The harvesting is most important step of:

(a) Preparation of soap (b) Preparation of cold drinks

(c) Preparation of sugar (d) Preparation of medicines

9. Which of the following is used as jet fuel:

(a) Kerosene oil (b) Diesel oil (c) Fuel oil (d) Petrol

10. Which of the following is not a fraction of crude oil?

(a) paraffin wax (b) ammonia (c) fuel oil (d) petroleum coke

1.Fatty acid	**2.Surface tension**	**3.hydrophilic end**	**4.Soft soap**	**5.Sour taste**
6.Crystal	**7.Water insoluble minerals**	**8.Preparation of sugar**	**9.Kerosene oil**	**10.ammonia**