

CHAPTER 1**THE ELECTRONIC STRUCTURES OF ATOMS,
PERIODIC TABLE AND CHEMICAL BONDS****Atom**

An atom is the basic unit of the element and it can enter into chemical combination. It consists of three fundamental particles called protons, electrons and neutrons.

Protons

Protons are positively charged particles reside in the nucleus of the atom.

Electrons

Electrons are negatively charged particles move outside and around the nucleus in circular orbits.

Neutrons

Neutrons are uncharged particles of the nucleus of the atom.

Nucleus

Nucleus is small, dense and positively charged centre of the atom. It contains protons and neutrons.

Atomic Number (Z)

The number of protons in the nucleus of an atom is known as the atomic number of that element.

Atomic number = no of protons = no of electrons

Mass Number (A)

The mass number of an element is the sum of the numbers of protons and neutrons in the nucleus of an atom of that element.

Mass number = no of protons + no of neutrons

Isotopes

Atoms of the same element with different masses are called isotopes.

eg., ${}^{35}_{17}\text{Cl}$ and ${}^{37}_{17}\text{Cl}$ are isotopes.

Electronic structure

The distribution of electrons in an atom of an element is known as the electronic structure of that element.

Complete electronic structure

The arrangement of all the electrons of an atom of the element in appropriate sub-shells is called the complete electronic structure of that element.

Example, ${}_{20}\text{Ca} = 1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$

Essential electronic structure

The arrangement of valence electrons of an atom of the element in appropriate sub-shells is called the essential electronic structure of that element.

Example, ${}_{20}\text{Ca} = 4s^2$

Valence of an element

Valence of the element can be obtained from the essential electronic structure of the elements.

The Groups and the Periods

In modern periodic table, there are arranged in **18 vertical columns and 7 horizontal rows**.

Group

The vertical columns are called groups. Element in the same group have the same number of valence electrons.

Period

The horizontal rows are called periods. Element in the same period have the same number of electron shells.

Alkali metals

The elements in the Group IA with the exception of hydrogen are called alkali metals.

eg. Li, Na, K

Alkaline earth metals

The elements (Be, Mg, Ca) in the Group IIA are called the alkaline earth metals.

Halogens

The elements in the Group VIIB again with the exception of hydrogen are called the halogens.

eg., F, Cl, Br, I

Noble gases or inert gases

The elements in the Group 0 are called noble gases or inert gases.
eg., He, Ne, Ar.

(or)

The noble gases or inert gases are neither electropositive nor electronegative because they have very stable electronic structure and have little tendency to gain or lose electrons.

Transition Element

The elements in the central section of the periodic table are known as the transition elements.

Metals non-metals

The elements to the left of dark line in the periodic table are called metals.

Non-metals

The elements to the right of dark line in the periodic table are called non-metals.

Metalloid

For along each side of the dark line are elements that have properties of both metals and non-metals. These elements are called metalloids.

eg., B, Si .

Electropositive elements

In general, metals are electropositive elements. They tend to lose electrons and form positive ions.

Electronegative elements

In general, non-metals are electronegative elements. They tend to gain electrons and form negative ions.

Ionization energy

The amount of energy required to remove an electron from a gaseous atom to form a gaseous ion is called the ionization energy.

eg., $\text{Na (g)} + \text{energy} \longrightarrow \text{Na}^+(\text{g}) + \text{e}^-$

Recycling metals

Refining and recasting of used iron and aluminium object (cans, bottle caps and iron structure) is called recycling metals.

Long forms

1. STP = Standard Temperature and Pressure
2. IUPAC = International Union of Pure and Applied Chemistry
3. NPK = Nitrogen, Phosphorous and Potassium
4. BHC = Benzene hexachloride
5. IAA = Indole acetic acid
6. NAA = Naphthalene acetic acid
7. POP = Plaster of Paris
8. PVC = polyvinyl chloride
9. PTFE = poly-tetra-fluoro-ethene
10. PS = polystyrene
11. PE = polyethene (or) polythene
12. PP = polypropene (or) polypropylene
13. CNG = Compressed Natural Gas
14. LPG = Liquid Petroleum Gas
15. DERV = Diesel Engine Road Vehicle
16. ICI = Imperial Chemical Industries

Copolymer

Copolymer are molecules which made up of two or more different types of monomers.

Polyesters

Polyesters are condensation polymers made from two monomers. One monomer has an alcohol group (—OH) at each end (diol). The other monomer has a carboxylic acid group (—COOH) at each end (dicarboxylic acid). When the monomers react an ester link is formed with water being, lost each end.

Thermoplastic polymers

They are polymers. They can be softened on heating and melted. They set again when cooled and can be re-moulded.
e.g, poly (chloroethene) PVC

Thermosetting polymers

They can be moulded only once. The chain in the polymers are cross-linked to each other and make the structures more rigid.
e.g, melamine

Biodegradable

There are no natural microorganisms that can break them down.

Soap

Soap is a salt of fatty acid and aqueous sodium hydroxide.
e.g, sodium salt of organic acid.

Soapless detergent

Its structure is similar to the detergent but it cannot react with Mg^{2+} and Ca^{2+} in hard water and so the problem of scum is solved.

Electron Affinity

The electron affinity of an element is the energy released when an electron is added to a gaseous atom to form a gaseous ions.



Ionic compounds (or) Electrovalent compounds

When metals combine with non-metals to form ionic compounds.

(or)

When electropositive elements combine with electronegative elements to form electrovalent compounds.

Covalent compounds

When non-metals combine with one another to form covalent compounds.

(or)

When electronegative elements combine with one another to form covalent compounds.

Ionic bond (or) Electrovalent bond

An ionic bond is formed when there is a complete transfer of an electron or electrons from one atom to another resulting in the formation of cations and anions. These oppositely charged ions are held together by an electrostatic attraction is known as ionic bond.

Coordinate bond (or) Dative bond

A coordinated bond is a special type of covalent bond. A coordinate bond is formed when one of the participant atoms possesses a lone pair of electrons. This lone pair is donated to an atom needing them to build up or complete an electron octet or duplet of great stability.

e.g; NH_3 , PCl_3 ,..., etc.

Metallic bond

In metallic bond, valence electrons of the atoms are very loosely held, forming a common electron cloud. The positively charged metal ions resulting by loss of valence electrons are held together by the attractive force of this electron cloud. It is called a metallic bond.

(or)

In a metal, the electrostatic force of attraction between the positive metal ions and the negatively charged electron cloud is called metallic bond.

The Octet Rule

In forming a chemical bond, atoms gain, lose or share electrons in such a way to attain the stable electronic structures of the noble gases, i.e., to have eight electrons in the outermost shell. This is known as the octet rule.

CHAPTER (2) THE GASEOUS STATE AND GAS LAW

Boyle's Law

When the temperature of a given mass of gas is kept constant, the volume of the gas is inversely proportional to its pressure.

Mathematical expression,

$$V \propto \frac{1}{P} \text{ (mass and temperature are constant)}$$

$$V = \text{constant} \times \frac{1}{P}$$

$$PV = \text{constant}$$

$$P_1 V_1 = P_2 V_2$$

P = pressure of gas, V = volume of gas

Insecticides

Insecticides are chemicals that kill insects. BHC or (benzene hexachloride $C_6H_6Cl_6$)

Growth substances or Plant hormone

The growth substances are indole acetic acid (IAA) and naphthalene acetic acid (NAA).

Cement

Cement is a grey powder which is used in the construction of buildings. It is composed of lime, alumina, silica and haematite.

Bittern

The water that flows out from the fifth solar pond consists of dissolved $MgSO_4$, $MgCl_2$ and $MgBr_2$. This water is called bittern.

Polymer

Polymer is a large organic macromolecule. It is made up of small repeating units known as monomer.

Natural polymer - proteins, starch, cellulose, natural rubber, etc.

Man made polymer - nylon, polyester, PVC, PE, etc.

Monomer

Polymer is a large organic macromolecule. It is made up of small repeating units known as monomer. These units are repeated any number of times from about a hundred to more than a million.

Homopolymer

Homopolymer are molecules which are made up of same types of monomer.

Coal

Coal is our most abundant fossil fuel. Many of the organic chemicals we now make from oil can also be made from coal. It may well be that coal will again become an important source of chemical raw materials.

Biogas

Biogas is produced from organic waste (organic mass), when it decays in the absence of air (anaerobic fermentation). Biogas composed of methane and carbon dioxide. In Myanmar, biogas is used to power the electricity generating engines.

Biomass

Biomass is organic waste. When it decays in the absence of air, methane is produced.

CHAPTER 15 CHEMISTRY IN SOCIETY

Fertilizers

Fertilizers are substances that supply nutrients to plants. There are two fertilizers. These are natural fertilizers and chemical fertilizers.

Natural fertilizer

They are two types of natural fertilizer, manure and humus. Manure is obtained by the decomposition of animal during and urine. Humus comes from plant residues.

Chemical fertilizer

Chemical fertilizer are salts and other chemical compounds containing elements necessary for plant growth.

Absolute Zero temperature

If the constant contraction rate is continued, the volume of the gas will become zero at -273°C . This temperature is known as absolute zero temperature or the zero point of a new scale temperature (Kelvin temperature).

Absolute zero temperature = -273°C or 0 K

Charles' Law

When the pressure of a given mass of gas is kept constant, the volume of the gas is directly proportional to its temperature on the Kelvin scale.

Mathematical expression

$V \propto T$ (mass and pressure are constant)

$V = \text{constant} \times T$

$\frac{V}{T} = \text{constant}$

$\frac{V_1}{T_1} = \frac{V_2}{T_2}$

$V = \text{volume of gas}$

$T = \text{Kelvin Temperature}$

Relationship between Pressure

When the volume of a given mass of gas is kept constant, the pressure of the gas is directly proportional to its temperature on the Kelvin scale.

Mathematical expression

$P \propto T$ (mass and volume are constant)

$P = \text{constant} \times T$

$\frac{P}{T} = \text{constant}$

$\frac{P_1}{T_1} = \frac{P_2}{T_2}$

$P = \text{pressure of gas, } T = \text{Kelvin Temperature}$

STP

STP means standard temperature and pressure.

Standard temperature = 0°C or 273 K

Standard pressure = 760 mmHg or 1 atm

Gay-Lussac's Law of Combining Volumes of Gases

At the same temperature and pressure, the volume of reacting gases and gaseous products are in simple ratios of small whole numbers.

Mathematical expression

e.g; Hydrogen + Nitrogen \longrightarrow Ammonia
 3H_2 + N_2 \longrightarrow 2NH_3
 3 volumes + 1 volume 2 volumes
 (at the same temperature and pressure)

Avogadro's Theory

At the same temperature and pressure, equal volume of all gases contain the same number of molecules.

Mathematical expression

$V \propto n$ (at same temperature and pressure)

n = number of molecules.

V = volume of gas

Avogadro's number

The number of particles as there are atoms in 12g of ^{12}C is known as Avogadro's number.

Avogadro's number = $L = 6.02 \times 10^{23}$

1 mole of gas = 6.02×10^{23} molecules

Ignition Temperature

The ignition temperature is the temperature at which a fuel-air mixture ignites without a flame.

Zeolite

A zeolite is one of a large group of aluminosilicates of sodium, potassium, calcium and barium.

ZSM-5 catalyst

ZSM-5 is an artificial zeolite composed of aluminium, silicon and oxygen.

Diesel

Diesel is heavy liquid fuel containing hydrocarbon (consisting of 6 to 20 carbon atoms) which can power the diesel engine.

Biodiesel

The terms biodiesel means plant and animal oil. At present, the main source of biodiesel is from jatropha plant seed oil

Transesterification

The seed oil has to be converted to biodiesel by the chemical process known as transesterification.

L.P.G

Liquid Petroleum Gas (LPG) is composed of propane and butane.

C.N.G

Compressed Natural Gas (CNG) is composed of 90% methane gas.

Markownikoff's Rule

When an unsymmetrical addendum (HX) adds on to an unsymmetrical alkene, two products are possible, but that product where the negative part of the addendum adds on to the carbon with the least number of hydrogen atoms is the major product.

Fuel

A fuel is a substance which can be conveniently used as a source of energy.

Fossil fuels

Fossil fuels were formed in the Earth's crust from material that was once living. Fossil fuels are coal, crude oil and natural gas.

Crude oil

Crude oil is a mixture of many different hydrocarbon molecules.

Fractional Distillation

Crude oil is a mixture of hydrocarbon molecules. At a refining, crude oil is separated into different fractions consisting of groups of hydrocarbons that have different boiling points.

Catalytic Cracking (Cracking or Catecracking)

Catalyst cracking is the broken down of large hydrocarbon molecules into smaller and useful molecules by heating with suitable catalyst such as silica, alumina, zeolite, etc,...

Flash point

The flash-point is the temperature at which the vapour will ignited in air by using a flame. This temperature is usually low for a fuel.

Dalton's Law of Partial Pressures

When the temperature is kept constant, the total pressure of a gas mixture is the sum of the partial pressure of different gases.

Mathematical expression

$$P_{\text{total}} = P_1 + P_2 + P_3 + \dots \dots \dots (\text{temperature is kept constant})$$

P_{total} = total pressure of gas mixture

P_1, P_2, P_3, \dots = partial pressure of different gas

Diffusion of gas

The process by which the molecules of one gas spreads through the spaces created between the molecules of another gas is known as diffusion.

Graham's Law of Gaseous Diffusion

At the same temperature and pressure, the rate of diffusion of a gas is inversely proportional to the square root of the density of the gas.

Mathematical expression

(at the same temperature and pressure)

$$r = \text{constant} \times \sqrt{d}$$

$$r \sqrt{d} = \text{constant}$$

or

$$r_1 \sqrt{d_1} = r_2 \sqrt{d_2}$$

r = rate of diffusion of gas

d = density of gas

Molar Volume of Gases

One mole of every gas occupies 22.4 dm³ at STP is known as molar volume of gases.

Relative Density of Gas

Relative density of a gas can be defined as the ratio of the mass of a volume of a gas at a certain temperature and pressure to the mass of equal volume of hydrogen at the same temperature and pressure.

Mathematical expression,

$$\text{Relative density of a gas} = \frac{\text{mass of a volume of the gas}}{\text{mass of an equal volume of hydrogen}}$$

CHAPTER 3
STOICHIOMETRY

Stoichiometry

That part of chemistry which deals with the quantities of substances taking part in a chemical reaction is called stoichiometry.

Law of conservation of mass

Matter can neither be created nor destroyed.

(or)

The total mass of the products formed must be equal to the total mass of the reactants.

Formular mass

The mass of formula unit relative to ^{12}C are expressed by the formula mass.

(or)

The formular mass is the amount of that substance which contains the Avogadro's number of particles as represented by the formula.

One mole of the substance

One mole of the substance is the amount of that substance which contain the same number of particles as there are atoms in 12 g of ^{12}C .

Salt Hydrolysis

Salts are strong electrolytes and can be considered completely dissociated in aqueous solution.

Buffer solution

A buffer solution is defined as a solution that resists changes in pH as a result of dilution and small addition of acids or bases.

CHAPTER 14
ORGANIC CHEMISTRY

Organic Chemistry

Organic chemistry is the chemistry of carbon compounds derived from living things, both animals and vegetable.

Organic Chemistry (In modern terms)

Organic chemistry is the chemistry of carbon compound in which there is at least one carbon to carbon bonds or carbon to hydrogen bond.

Structural Isomers

Compounds having the same molecular formula but different structural formula have different physical and chemical properties and are said to be structural isomers.

Homologous series

A series of compounds like the alkanes in which each member differs from the preceding or succeeding one by a CH_2 group is known as a homologous series.

Strong base

A strong base can produce OH^- ion readily and it is completely ionized in aqueous solution.

e.g, NaOH , KOH

Weak base

A weak base can lose OH^- ion partially it is slightly ionized in aqueous solution.

e.g, NH_4OH

Water neutrality

Water neutrality refers to the situation in pure water at 298 K. The pH of pure water at 298 K is 7.

Basicity (of an acid)

The basicity of an acid may be defined as the number of H^+ ions that one molecule of an acid can produce.

Acidity (of a base)

The acidity of a base may be defined as being equivalent to the number of molecules of a monobasic acid which will neutralize one molecule of the base.

Concentrated base

A concentrated base is one which contains the pure base or predominantly large proportion of the base.

Dilute base

A dilute base is one which contains the relatively small amount of base in water or some other solvent.

Hydrolysis

Hydrolysis usually means the cleavage of chemical bonds by the addition of water.

Molarity

The molarity of a solution is the quantity in moles of the solute dissolved in one cubic decimetre of a solution.

Molar solution

A molar solution of a compound is one which contains one mole of the compound in one cubic decimetre (1 dm^3) of the solution.

Molar mass

The relative molecular mass expressed in gram per mole is known as molar mass of a substance.

Dilution of a solution

When a given aqueous solution is diluted with water the quantity or mole of the solute does not change but the concentration or molarity does change.

Titration

The term titration is used for the procedure in which a solution of a standard reagent (reactant) is added to a specific volume of a solution of unknown molarity.

Standard solution

The reagent of exactly known concentration that is used in a titration is called standard solution.

Primary standard

The accuracy of volumetric analysis depends upon the primary standard. A primary standard is a highly pure and stable compound, used to establish the concentration of the standard solution.

Standardization

The process by which the concentration of a standard solution is determined volumetrically by the use of a primary standard is called standardization.

Equivalence point

The point at which the standard solution is exactly react with an unknown solution is the equivalence point.

End point

By the use of an indicator, it is the point used to indicate a change in colour as a result of concentration changes near the equivalence point.

Limiting Quantities

If the reacting mixture contains one of the reactants in lesser quantity than is required by the equation, the reaction will simply stop when the reactant in lesser quantity is exhausted. The quantity is called limiting quantity.

CHAPTER 4
ELECTROLYS

Conductor

A conductor which conducts or allows the passage of electricity is called a conductor.
e.g, iron, zinc, copper.

Non conductor or Insulator

A solid substance which does not conduct electricity is known as a non-conductor or insulator.
e.g, Wood, Rubber, Paper, Plastic, Glass.

Concentrated acid

A concentrated acid is one which contains the pure acid or a predominantly large proportion of the acid.

Dilute acid

A dilute acid is one which contains a relatively small amount of the acid.

Neutralization

Neutralization is a chemical reaction in which an acid and a base react quantitatively with each other.

Amphiprotic molecule

A molecule, such as the water molecule, which can have both proton-accepting (protophilic) and proton-donating (protogenic) properties is called an amphiprotic molecule.

Neutral aqueous solution

A neutral aqueous solution is one in which the concentrations of hydrogen ion, H^+ and hydroxide ion, OH^- are equal at the value of $1 \times 10^{-7} \text{ mol dm}^{-3}$ at 298 K.

The hydrogen ion exponent (pH)

pH is defined as the negative logarithm to base 10 of the molar concentration of hydrogen ions.

$$pH = -\log [H^+] \quad (\text{or}) \quad pH = -\log [H_3O^+]$$

The hydroxide ion exponent (pOH)

pOH is defined as the negative logarithm to base 10 of the molar concentration of the hydroxide ions.

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

Arrhenius alkali (base)

An alkali is a compound which could produce hydroxide ions in water solution.

Bronsted-Lowry acid

An acid is a proton donor.

Bronsted-Lowry base

A base is a proton acceptor.

Conjugate acid

In equilibrium, the original base is related to the acid in the reverse reaction, which is called the conjugate acid.

Conjugate base

In equilibrium, the original acid is related to the base in the reverse reaction, which is called the conjugate base.

Lewis acid

An acid is an acceptor of electron pair.

Lewis base

A base is a donor of electron pair.

Strong acid

A Strong acid is one which is highly ionized in specified conditions.

e.g, HCl , HNO_3 , H_2SO_4 , HBr , HClO_4 .

Weak acid

A weak acid is one which loses a proton with difficulty and is only slightly ionized.

e.g, HCOOH , CH_3COOH , etc,.. (organic acids)

Electrolytes

Those substances other than metal which in the molten state or as a solution in water allow the passage of electricity are called electrolytes.

Non-electrolytes

A substance in a solution that does not conduct electric current is called a non-electrolyte.

e.g, sugar solution.

Electrolysis

The decomposition of a compound in solution or in the molten state brought about by the passage of an electric current through it, is known as electrolysis.

Ionic Theory (By Arrhenius)

- (1) Electrolytes contain electrically charged particles called ions.
- (2) Electrolytes can conduct electricity due to the movement of these ions.
- (3) Non-electrolytes do not contain ions and so they cannot conduct electricity.

Cation

Cation is an ion with positive charged.

Anion

Anion is an ion with negative charged.

Anode

Anode is the positive electrode in electrolysis.

Cathode

Cathode is the negative electrode in electrolysis.

Factors affecting the electrolysis products

- (i) Position of the metal or group in the electrochemical series
- (ii) Concentration and
- (iii) Nature of the electrode.

Electrochemical series

The series obtained by placing the metals in order of decreasing negative potential is known as the electrochemical series.

One Faraday (The Faraday)

The quantity of electricity required to liberate one mole of a univalent element is 96500 coulombs. This quantity is called the Faraday.

One faraday = 96500 C

Faraday's first laws

The mass of element liberated is directly proportional to the quantity of electricity passed through the solution during electrolysis.

$$m \propto Q \quad \text{where, } Q = \text{quantity of electricity (C)}$$

$$Q = It \quad \begin{matrix} t = \text{time (s)} \\ I = \text{current (A)} \end{matrix}$$

Electroplating

Electroplating is the electrical precipitation of one metal on another.

**CHAPTER (5)
OXIDATION AND REDUCTION**

Oxidation and Reduction

(1) In terms of Oxygen

Oxidation is the addition of oxygen to a substance.

Reduction is the removal of oxygen from a substance.

Galvanising

Some steel girders, coal bunkers, steel dustbins and some iron objects are galvanized.

Sacrificial Protection

Bars of Zinc are attached to the hulls of ships and to oil rigs. Zinc is above iron in the reactivity series and will react in preference to it and so iron is protected.

Corrosion

Corrosion is a process in which metals and alloys are chemically attacked by oxygen, water and the other substances from their environments.

Alloys

Alloys are mixtures of two or more metals formed by mixing molten metals thoroughly.

**CHAPTER 12
THE HALOGENS**

Halogen

Halogen means salt formers. It means that the elements readily form salts by metals.

**Chapter (13)
Acids, Bases And Their Neutralization**

Arrhenius acid

An acid is a compound which could produce hydrogen ions in water solution.

CHAPTER 8 & 9
SOME IMPORTANT METALS AND THEIR
COMPOUNDS + METAL REACTIVITY

Thermit reaction (Competition reaction)

Competition reaction in the solid state is called the thermit reaction.

Displacement reaction

Competition reaction in aqueous solution is called the displacement reaction.

Rusting of iron

The process by the action of water and oxygen on iron to form rust ($\text{Fe}_2\text{O}_3 \cdot x\text{H}_2\text{O}$) is called rusting.

Rust Rrevention

To prevent iron rusting , it is necessary to stop oxygen (from air)and water coming into contact with it.

Painting

Ships, lorries, cars, bridges and many other iron and steel structures are painted to prevent rusting.

Oiling or Greasing

The iron and steel in the moving parts of machinery are coated with oil to prevent rusting.

Coating with plastic

The exteriors of refrigerators, freezers and many other items are coated with plastic, such as PVC, to prevent the steel structure rusting.

Plating

Cans for food can be made from steel coated with tin.

(2) In terms of Electronegative Element

Oxidation is the addition of electronegative element to a substance.

Reduction is the removal of electronegative element from a substance.

(3) In terms of Hydrogen

Oxidation is the removal of hydrogen from a substance.

Reduction is the addition of hydrogen to a substance.

(4) In terms of Electropositive Element

Oxidation is the removal of electropositive element from a substance.

Reduction is the addition of electropositive element to a substance.

(5) In terms of Electron Transfer

Oxidation is the loss of electrons by an element, compound or ion.

Reduction is the gain of electrons by an element, compound or ion.

(6) In terms of Oxidation Number

Oxidation is an increase in oxidation number.

Reduction is a decrease in oxidation number.

Oxidation- Reduction Reaction (Redox Reaction)

Reactions in which simultaneous oxidation and reduction are occurring are known as redox reaction.

Oxidizing Agent

An oxidizing agent is an acceptor of electrons.

Reducing Agent

A reducing agent is a donor of electrons.

CHAPTER 6

RATES OF REACTIONS AND EQUILIBRA

Reactants

A substance or substances that take part in a chemical reaction are called reactants.

Products

A new substance or substances are formed in a chemical reaction are called products.

Rate of reaction

Rate of reaction the change in concentration of reactants or products per unit time.

Factors Influencing Rate of Reactions

- (i) Effect of concentration of reactants
- (ii) Effect of pressure
- (iii) Effect of temperature
- (iv) Effect of catalysts
- (v) Effect of radiation
- (vi) Effect of surface area of reactants

Collision theory

The more frequent the contact between reacting species, the greater can be the rate of reaction.

Intermediate state or transition state

Intermediate state (also known as transition state) is a species of high energy would be highly unstable and the activated complex can be broken.

Thermochemical equation

The equations (exothermic as well as endothermic), which include information regarding heat changes as well as physical states are called thermochemical equations.

Types of Heat Change

- (1) Heat of combustion
- (2) Heat of formation of a compound
- (3) Heat of neutralization

Heat of combustion

The heat of combustion of a substance is the heat change which takes place when one mole of the substance is completely burned in oxygen.

Bomb calorimeter

The heat required to increase 1°C when 1g of water is heated.

Heat of formation of a compound

The heat of formation of a compound is the heat change when one mole of a compound is formed from its elements in their standard state (1 atm pressure and 298 K).

Heat of neutralization

The heat of neutralization is the heat change when one mole of hydrogen ions from an acid reacts with one mole of hydroxide ions from a base.

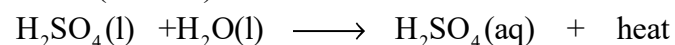
**Hess's Law of Constant Heat Summation**

The net enthalpy change of a given chemical reaction remains the same, no matter by what methods the change is carried out.

Exothermic reactions

An exothermic reaction is one which releases heat to the surrounding.

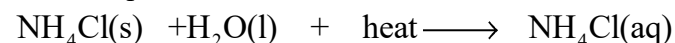
Example; When sulphuric acid is slowly poured into water, the beaker(or flask) become hot.



Endothermic reactions

An endothermic reaction is one which absorbs heat from the surrounding.

Example; When ammonium chloride is dissolved in water, the beaker become quite cool to the touch.



Calorie (one calorie)

A calorie is the heat required to raise the temperature of 1 gram of water by 1°C

Enthalpy Change

The heat absorbed or released in a process occurring at constant pressure is called the enthalpy change.

Standard Enthalpy Change

The heat absorbed or released in a process occurring at standard conditions of temperature (298K) and pressure (1atm) is called the standard enthalpy change.

The standard conditions for standard enthalpy change

Standard temperature = 298 K or 25°C

Standard pressure = 1 atm or 760 mmHg

Activated complex (Intermediate complex)

Activated complex is a species of high energy and highly unstable formed in the intermediate or transition state in a chemical reaction.

Activation energy

The minimum energy required to form the activated complex or intermediate complex is called activation energy.

The rate of reaction becomes double when the temperature is increased by ten degrees.

Catalyst

A catalyst is a substance which alters the rate of a chemical reaction, but remains chemically unchanged at the end of the reaction.

Positive catalyst (promotor)

A catalyst that increases the rate of reaction is called a positive catalyst.

Negative catalyst (inhibitor)

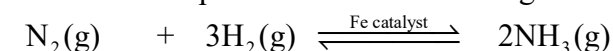
A catalyst that decreases the rate of reaction is called a negative catalyst or inhibitor.

Enzymes

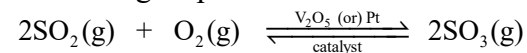
An enzyme is a biocatalyst and is found in living tissues. eg., ptyalin in saliva and the pepsin in gastric juice.

Some catalyst reaction are:

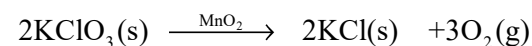
(a) Iron in the Haber process for manufacturing ammonia.



(b) Vanadium(V)oxide or platinized asbestos in the Contact Process for manufacturing sulphur trioxide.

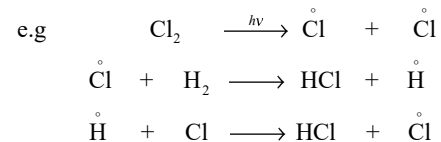


(c) Manganese(IV)oxide in the preparation of oxygen from potassium chlorate.



Photochemical reaction

A photochemical reaction is a reaction which takes place only when the reactant molecules absorb the light radiation ($h\nu$) when it is expressed.



Reversible reaction

A reversible reaction is a reaction, which can be proceeding in the forward as well as reverse directions, under appropriate conditions.

Forward Reaction

The reaction proceeding to the right is called the forward reaction.

Reverse Reaction

The reaction proceeding to the left is called the forward reaction.

Le Chatelier's Principle

When any one of the factors affecting the equilibrium of a chemical system such as temperature, pressure or concentration is changed, the system reacts in such a way as to nullify the effect of the change.

Factors influencing Equilibrium

- (1) Effect of temperature
- (2) Effect of pressure
- (3) Effect of concentration

Free radicals

Free radicals are very reactive gaseous atoms.

CHAPTER (7) ENERGY CHANGES IN CHEMICAL REACTIONS

Kinetic energy

Kinetic energy is the energy due to the moving of a body.

Potential energy

Potential energy is the energy due to the position of a body.

Thermal energy

Thermal energy is the energy due to the effect of temperature.

Chemical energy

Chemical energy is the energy due to the structure of a substance.

Electrical energy

Electrical energy is the energy produced from a generator.

Mechanical energy

Mechanical energy is the energy produced from a motor.

Chemical Energetic

The study of energy changes in chemical reactions is a subject in itself and is called chemical energetic.