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SUBJECT:- CHEMISTRY
CLASS-XII
LAST MINUTE REVISION STUDY MATERIAL
2020-21

CLASS XII (2020-21)
(THEORY)

Total Periods (Theory 98 + Practical 36)

Time : 3 Hours **70 Marks**

Unit No.	Title	No. of Periods	Marks
Unit I	Solid State	8	23
Unit II	Solutions	8	
Unit III	Electrochemistry	7	
Unit IV	Chemical Kinetics	5	
Unit V	Surface Chemistry	5	
Unit VII	p -Block Elements	7	19
Unit VIII	d -and f -Block Elements	7	
Unit IX	Coordination Compounds	8	
Unit X	Haloalkanes and Haloarenes	9	28
Unit XI	Alcohols, Phenols and Ethers	9	
Unit XII	Aldehydes, Ketones and Carboxylic Acids	10	
Unit XIII	Amines	7	
Unit XIV	Biomolecules	8	
	Total	**98**	**70**

S No	Unit	Portion to be Reduced
1	Solid State	Electrical and magnetic properties. Band theory of metals, conductors, semiconductors and insulators and n and p type semi conductors.
2	Solutions	Abnormal molecular mass, Van't Hoff factor
3	Electrochemistr y	Lead accumulator, fuel cells, corrosion, law of electrolysis (elementary idea), dry cell-electrolytic cells and Galvaniccells,
4	Chemical Kinetics	Concept of collision theory (elementary idea, no mathematical treatment), activation energy, Arrhenius equation.
5	Surface Chemistry	emulsion - types of emulsions, catalysis: homogenous and heterogeneous, activity and selectivity of solid catalysts; enzyme catalysis,
6	General Principles and Processes of Isolation of Elements	Entire unit
7	p-Block Elements	Preparation and properties of Phosphine, Sulphuric Acid: industrial process of manufacture, Oxides of Nitrogen (Structure only); Phosphorus - allotropic forms, compounds of Phosphorus: Preparation and properties of Halides and Oxo acids (elementary idea only).
8	d and f Block Elements	Chemical reactivity of lanthanoids, Actinoids -Electronic configuration, oxidation states and comparison with lanthanoids. Preparation and properties of $KMnO_4$ and $K_2Cr_2O_7$
9	Coordination Compounds	Structure and stereoisomerism, importance of coordination compounds (in qualitative analysis, extraction of metals and biological system).
10	Haloalkanes and Haloarenes	Uses and environmental effects of -dichloromethane, trichloromethane, tetrachloromethane, iodoform, freons, DDT.
11	Alcohols, Phenols and Ethers	uses with special reference to methanol and ethanol.
12	Aldehydes, Ketones and Carboxylic Acid	---
13	Amines	Diazonium salts: Preparation, chemical reactions and importance in synthetic organic chemistry.
14	Biomolecules	Oligosaccharides (sucrose, lactose, maltose), polysaccharides (starch, cellulose, glycogen), importance of carbohydrates. Vitamins– classification and functions. Enzymes. Hormones Elementary idea excluding structure.
15	Polymers	entire chapter
16	Chemistry in Everyday life	entire chapter

Chapter1-Solid State

1. Amorphous solids: In amorphous solid arrangement of constituent particles is not regular, these have a short range order and their melting point is not sharp and isotropic in nature**. Ex** rubber.

2. Crystalline solids: The arrangement of constituent particles is regular throughout the entire 3-D networks, these have a long range order and sharp melting point. They are anisotropic in nature. **Ex:** Sodium chloride.

3.Types of crystalline solids.

(a)Metallic Solid: In metallic solids, constituent particles are +ve ions in sea of delocalized e^- bonded with metallic bond.They are conductor .e.g. Ag, Cu ,Fe.

(b) Covalent solid: In covalent solids, constituent particles are atoms bonded with covalent bond They are insulator. e.g. SiO_2.

(c) Ionic solid: In ionic solid, constituent particles are ions $^-$ bonded with electrostatic forces. They are conductor in molten and aq state e.g. NaCl.

(d) Molecular solid:-(i) Non polar molecular solid: In nonpolar solids constituent particles are molecules bonded with dispersion forces. They are insulator. Ex. CO, I_2, $H_{2,}$ CCl_4

(ii)Polar molecular solid: In polar molecular solids constituent particles are molecules bonded with dipole-dipole interactions. They are insulator. Ex. HCl, SO_2.

(iii)Hydrogen bonded molecular solid: In this type of solids constituent particles are molecules bonded with hydrogen bonding. They are insulator Ex. H_2O

4.Crystal lattice: *A regular three dimensional arrangement of points in space.***Unit cell :***It is the smallest portion of a crystal lattice which, when repeated in different directions, generates the entire lattice*.

5.**Number of atoms per unit cell (z)**: Simple cubic:1, Body centered Cubic (bcc): 2, Face-centered cubic (fcc): 4.

6.Density of unit cell: $d = \dfrac{Z \times M}{a^3 \times N_A}$ (Z=no. of atoms/unit cell, M=molar mass, Na=Avogadro's no., a=edge length , a^3 =volume of unit cell)

7.Relationship between edge length (a) of unit cell and radius of atom(r):-

Simple Cubic **(r=a/2)**, BCC (**r=√3a/4)** , FCC**(r=a/2√2)**

8.Coordination number: The number of nearest neighbors in a close packing.

C.No in 3-D hcp & ccp =12, bcc=8 2D- Sqaure close packed layer=4, 2-D hcp & ccp =6, Rock salt (NaCl, $Na^+ = 6$, $Cl^- = 6$), CsCl, ($Cs^+ = 8$,$Cl^- = 8$), ZnS ($Zn^{+2} =4$,$S^{-2} = 4$) CaF_2 Flourite ($Ca^{+2}=8$,$F^-=4$)

9.Packing Efficiency:

P.E =Volume occupied by sphere(atoms)/Volume of unit Cell X100

1. Simple Cubic→ $\dfrac{1\times\frac{4}{3}\pi r^3}{(2r)^3}\times 100 = 52.4\%$ 2. FCC→ $\dfrac{4\times\frac{4}{3}\pi r^3}{(2\sqrt{2}r)^3}\times 100 = 74\%$ 3. BCC→ $\dfrac{2\times\frac{4}{3}\pi r^3}{(4r/\sqrt{3})^3}\times 100 = 68\%$

10.**Octahedral void:** One octahedral void per atom in a crystal. The radius of the Octahedral void relative to radius of sphere is <u>0.414</u>**. Note :-** The number of octahedral voids generated = N ,[**N**= Total number of close packed atoms]

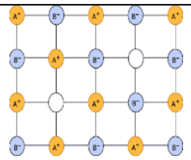
<u>11.</u>**Tetrahedral void :-** There are two tetrahedral void per atom in a crystal. The radius of the tetrahedral void relative to radius of sphere is <u>0.225</u>. Note :- The number of tetrahedral voids generated = 2N

12.**Hexagonal close packing:** The third layer of atoms covers the tetrahedral voids of the second layer. The different layers are packed in <u>AB AB AB</u>.....pattern .

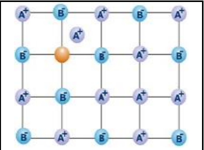
13.**Cubic close packing: T**he third layer of atoms covers the octahedral voids of the second layer. The different layers are packed in <u>ABC ABC ABC.</u>.....pattern.

14. **Vacancy Defect**: When some of the lattice sites are vacant, the crystal is said to have **vacancy defect.** Density decreases due to vacancy defect.

15.**Interstitial Defect**: When some constituent particles (atoms / molecules/ions) occupy an **interstitial** site. Density increases due to interstitial defect.16. **Schottky Defect: E**qual number of cations and anions of similar sizes are missing from lattice positions in order to maintain electrical neutrality. Density decreases due to Schottky defect. Ex. NaCl, KCl, CsCl and **AgBr*.**



17.Frenkel Defect: Smaller ion (usually cation) is dislocated from its normal site to an interstitial site, shown by ionic substance with large difference in the size of ions. Ex. ZnS, AgCl, **AgBr*** and AgI.



18.**Impurity Defect :** When foreign atoms or ions are present in the lattice sites. Ex. when NaCl is doped with $MgCl_2$ or $SrCl_2$. **The cationic vacancies = No. of Sr^{2+}/Mg^{2+} ions occupied**

19.Metal excess defect due to anionic vacancies: A negative ion from the crystal lattice may be missing from its lattice site leaving a hole or vacancy which is occupied by the electron originally associated with the anion. **Called F-centre) Ex. NaCl (yellow colour), LiCl (pink colour), KCl (violet colour).**

20.Metal excess defect due to the presence of extra cations at interstitial sites: An extra cation occupies interstitial position in the lattice & free electron is trapped nearby this interstitial cation. Ex.On heating ZnO loses oxygen and turns yellow.

Chapter-2 Solution

Example : Gas in solid solution (H_2 in Pd) , Liquid in solid (Amalgam-Hg and Na)

***Concentration terms :**

Molarity (M) = $\frac{No.of\ moles\ of\ solute}{Volume\ of\ solution(L)} = \frac{wx1000}{MxV(ml)}$	Molality (m)=$\frac{No.of\ moles\ of\ solute}{mass\ of\ solvent\ (kg)} = \frac{wx1000}{MxW(g)}$
Mole fraction: $x_B = \frac{n_B}{n_A + n_B}$	Part per million(ppm)= $\frac{Mass\ of\ solute(g)}{Mass\ of\ solution\ (g)}X10^6$

w=Mass of solute, W= Mass of solvent, M = Molar mass of solute, V=Volume of solution

1.Henry's law:At constant temp,the solubility of a gas in a liquid is directly proportional to the pressure of the gas. $p=K_H.X$ K_H=Henry's law constant. When pressure increases, solubility of gases also increases. (greater the K_H value lower the solubility). **Application:** 1.To increase the solubility of CO_2 in soft drinks , the bottle is sealed under high pressure. 2.To avoid bends ,the tanks used by scuba divers are filled with air diluted with He.

*When temperature increases K_H value also increases hence solubility of gases decreases.

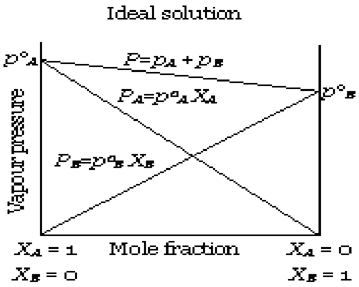
2.Raoult's law for volatile liquids: The partial vapour pressure of each component in the solution is directly proportional to its mole fraction $p_1 \alpha x_1$ $p_1 = p_1^0 x_1$

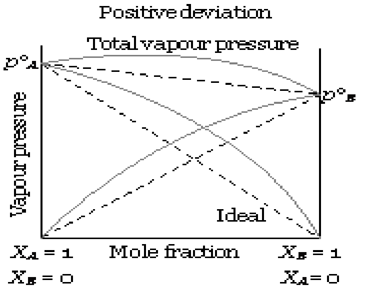
3.Ideal Solutions: The solutions which obey Raoult's Law over the entire range of concentration are known as ideal solutions. (For ideal solution $\Delta_{mix}H=0$, $\Delta_{mix}V=0$) Example: Solution of n-hexane and n-heptane.

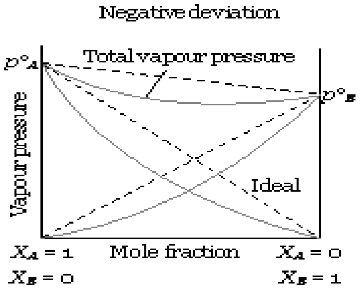
4.Non-ideal Solutions: The solutions which don't obey Raoult's Law over the entire range of concentration . ($\Delta_{mix}H\neq0$, $\Delta_{mix}V\neq0$).

Deviation from ideal behavior :

Positive Deviation	Negative Deviation
1.A-B interactions are weaker than those between A-A or B-B 2. $\Delta_{mix}H$=+ve (endothermic), $\Delta_{mix}V$=+ve ,temp decreases 3.Ex..1.Mixtures of ethanol and acetone, 2. $CS_2$and acetone	1.Forces between A-A and B-B are weaker than those between A-B. 2.$\Delta_{mix}H$=-ve(exothermic), $\Delta_{mix}V$=-ve , temp. decreases 3.Ex..-1.mixture of phenol+aniline 2. mixture of chloroform +acetone







5.Azeotropes: Mixtures have same composition in liquid and vapour phase and boil at a constant temp.

1. **Minimum boiling azeotrope** (positive deviation) Ex.-95%aq ethanol **2. Maximum boiling azeotrope** (negative deviation) Ex.-68% aq. nitric acid (by mass) .

6.Colligative properties: Depend on the number of solute particles not upon the nature of solute.

Relative lowering of vapour pressure	Elevation in boiling point	Depression in freezing point
$\frac{P_A^{\circ} - P}{P_A^{\circ}} = X_B$, $x_B = \frac{n_B}{n_A + n_B}$ $\frac{P_A^{\circ} - P}{P_A^{\circ}} = \frac{W_B}{M_B} \times \frac{M_A}{W_A}$ [for a very dilute solution $n_B << n_A$] Where P_A^0 is vapour pressure of pure component 'A' P is partial vapour pressure of solution $(P_A^0 - P_{A)} = \Delta P$=lowering of vapour pressure	$\Delta T_b = K_b$ x**m** $\Delta T_b = T_b - T^0_b$ K_b =molal elevation constant or Ebulloscopic constant K_b is the elevation in the **boiling point** of one molal solution. Its **unit** is K kg mol^{-1} m = molality M=molar mass =$\frac{Kbx1000\ x\ w}{\Delta Tb\ x\ W}$	$\Delta T_f = K_f$ x**m** $\Delta T_f = T^0_f - T_f$ K_f =molal depression constant or cryoscopic constant K_f =The depression of **freezing point** of one Molal solution. Its **unit** is K kg mol^{-1} m = molality M=molar mass =$\frac{Kfx1000\ xw}{\Delta TfxW}$

6.Osmotic pressure : The extra pressure applied on the solution that just stops the flow of solvent.

$\Pi = \mathrm{CRT} = \frac{n}{V}\mathrm{RT}$ (This equation is called van'tHoff equation for dilute solutions)

Π=osmotic pressure, 'V'=volume of the solution, n'=number of moles of the solute, T= temperature in Kelvin , R=solution constant (0.0821 L atm mol-)

7.Isotonic solutions: Two solutions having same osmotic pressure. 0.91% of sodium chloride is isotonic with fluid present inside blood cell hence used in injection.

8.Hypertonic solution: Higher osmotic pressure than a particular solution.

9.Hypotonic: Lower osmotic pressure than a particular solution.

10.Reverse osmosis (R.O.) The direction of osmosis can be reversed if a pressure larger than the osmotic pressure is applied to the solution side. That is now the pure solvent flows out of the solution **Application**: Desalination of sea water.

11. Membrane used in RO =cellulose nitrate .

Chapter : 3. ELECTROCHEMISTRY

1. **Electrochemistry** tells about relationship between chemical energy and electrical energy.
2. **Standard cell Potential or** *electromotive force(emf)* is the difference between the electrode potentials of the cathode and anode. $E^0_{cell} = E^0_{cathode} - E^0_{anode}$
3. **Standard hydrogen electrode (SHE)** Reference electrode which is assigned a value of zero for it electrode potential
4. **Nernst's Equation**: $\boxed{Ecell = E^o - \frac{0.0591}{n}\log Q}$ by this emf may be calculated on any concentration.
5. **Relation between E^0_{cell} and Gibbs Energy: Δ_r G^0 =-nF** E_{cell}°
6. **Relation between E^0_{cell} and Equilibrium constant K_c** : $\boxed{\log K_c = \frac{E_{cell}^{\circ} \times n}{0.059}}$
7. **Resistance** *R=p l /A* Where ρ resistivity. Unit is **ohm^{-1}cm**
8. The **Resistivity** for a substance is its resistance when it is one metre long and its area of cross section is one m^2 in contact with solution.
9. **Conductance** : It is reciprocal of the resistance G=1/R .The SI unit is Siemens, represented by the symbol 'S' and is equal to **ohm^{-1} .**
10. **Conductivity** : of any conductor is the reciprocal of specific resistance and is denoted by κ .The SI units of conductivity are Sm^{-1} but quite often, κ is expressed in **S cm^{-1}**.
11. Conductivity is its conductance of one unit volume of solution (*l*=A=1cm) **Unit : Sm^{-1}, Scm^{-1}**

$\kappa = 1/\rho$ $\kappa = \frac{1}{R}\frac{l}{A} \Rightarrow \kappa = G\,G^*$

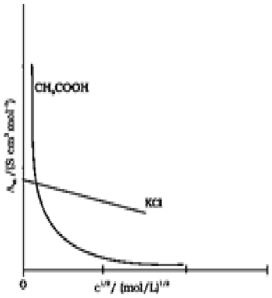
12. **Cell constant** (G^*) The quantity *l/A* is called cell constant d. It depends on the distance between the electrodes and their area of cross-section and has the dimension of length^{-1} and can be calculated if we know *l* and *A*. G^*(cell constant) = *l/A*

Molar Conductivity of all the ions produced by one gram mol of an electrolyte in a solution. $\Lambda_m = \frac{\kappa}{C}$,

$\Lambda_m = \frac{\kappa \times 1000}{M}$ unit = **S cm^2 mol$^-$ or ohm$^-$ cm^2 mol$^-$**

Limiting molar conductivity : When concentration approaches zero, at infinite dilution the molar conductivity is known as limiting molar conductivity and is represented by the symbol $\wedge^0$

1. Conductivity of a solution decrease with dilution because **Conductivity of a solution is the conductance of ions present in a unit volume of the solution. On dilution the number of ions per unit volume decreases. So the conductivity decreases.**
2. **Variation of molar conductivity with concentration** : The increase in molar conductivity of strong and weak electrolyte upon dilution is due to the different reasons:



a) **In strong electrolytes** the dissociation of the electrolyte in to ions is already almost complete (ά =1), however interionic forces are quite strong. upon dilution the distance in the ions becomes more and interionic forces are reduced. This leads to **increase in ionic mobility** ,but the decrease is not large .

b) **In weak electrolytes** the dissociation of electrolyte into ions is comparatively less (ά is less).Dilution helps in dissociation of electrolyte .As a result **more ions are formed** or ά increases and corresponding value of conductivity also increases .This increase quite large.

3. **Kohlrausch's Law** : The law states that limiting molar conductivity of an electrolyte can be represented as the sum of the individual contributions of the anion and cation of the electrolyte.
   (i) $\wedge^o\ \mathrm{CaCl_2} = \lambda^o(\mathrm{Ca^{2+}}) + 2\lambda\ ^o(\mathrm{Cl^-})$ (ii) $\wedge^o\ Al_2(SO_4)_3 = 2\lambda^o(Al^{3+}) + 3\lambda(SO_4)^{2-}$
4. **Application of Kohlrausch's Law** 1. Calculation of limiting molar conductivity of weak electrolyte
   2. Calculation of degree of dissociation: Degree of Dissociation is ratio of molar conductivity at a specific concentration 'C' to limiting molar conductivity. It is denoted by α $\boxed{\alpha = \frac{\Lambda_m^c}{\Lambda_m^0}}$
   Calculation of dissociation constant $\boxed{K_a = \frac{c\alpha^2}{(1-\alpha)} = \frac{c\Lambda^2}{\Lambda^o(\Lambda^o - \Lambda)}}$
5. **Quantity of electricity carried by n moles of electrons= nF (**1F = 96500 coulombs)
6. **Products of electrolysis**

NaCl (molten)	Cathode : $Na^+(l) + e^- \rightarrow Na(s)$ Anode : $Cl^- \rightarrow \frac{1}{2}Cl_2 + e^-$
NaCl (aq)	Cathode : $H_2O\,(l) + e^- \rightarrow \frac{1}{2}H_2(g) + OH^-$ Anode : $Cl^- \rightarrow \frac{1}{2}Cl_2 + e^-$
H_2SO_4(dil)	Cathode : $H^+ + e^- \longrightarrow \frac{1}{2} H_2$ Anode: $2H_2O(l) \rightarrow O_2(g) + 4H^+(aq) + 4e^-$
H_2SO_4(conc)	Cathode : $H^+ + e^- \longrightarrow \frac{1}{2} H_2$ Anode: $2SO_4^{2-}(aq) \rightarrow S_2O_8^{2-}(aq) + 2e^-$
$AgNO_3$(aq)-Ag electrodes	Cathode : $Ag^+(aq) + e^- \longrightarrow Ag(s)$ Anode: $Ag(s) \longrightarrow Ag^+(aq) + e^-$
$AgNO_3$(aq)- Pt electrodes	Cathode : $Ag^+(aq) + e^- \longrightarrow Ag(s)$ Anode: $2H_2O(l) \rightarrow O_2(g) + 4H^+(aq) + 4e^-$
CuCl(aq)- Pt electrodes	Cathode : $Cu^+(aq) + e^- \longrightarrow Cu(s)$ Anode: $2H_2O(l) \rightarrow O_2(g) + 4H^+(aq) + 4e^-$

4. CHEMICAL KINETICS

1. **Rate of Reaction**: The change in concentration of a reactant or product in unit time.
2. Consider a reaction: aA + bB → cC + dD

Average Rate of reaction $= -\frac{1}{a}\frac{\Delta[A]}{\Delta t} = -\frac{1}{b}\frac{\Delta[B]}{\Delta t} = +\frac{1}{c}\frac{\Delta[C]}{\Delta t} = \frac{1}{d}\frac{\Delta[D]}{\Delta t}$ **For Instantaneous rate of reaction Δ will be replaced by d**

Units of rate of a reaction: mol $L^{-1}s^{-1}$. However, in gaseous reactions, atm s^{-1}

3. **Rate law** is the expression in which reaction rate is given in terms of molar concentration of reactants with each term raised to some power, which may or may not be same as the stoichiometric coefficient of the reacting species in a balanced chemical equation $aA + bB \rightarrow cC + dD$ Rate = $k[A]^x[B]^y$
4. **Rate constant** may be defined as the rate of reaction when the concentration of each reactant in the reaction is unity.
5. **Order of Reaction= x + y**
6. The reactions taking place in one step are called **elementary reactions**. When a sequence of elementary reactions gives us the products, the reactions are called **complex reactions.**
7. **Units of rate constant (K) = units** of k = (mol $L^{-1})^{1-n} s^{-1}$ where 'n' is order of reaction.
8. **The molecularity greater than three is not observed**. Because the probability that more than three molecules can collide and react simultaneously is very small**.**

Sr no	ORDER OF REACTION	MOLECULARITY OF REACTION
1	Definition:-The sum of powers of the concentration of the reactants in the rate law expression.**.**	Definition :-The number of reacting species (atoms, ions or molecules) taking part in an elementary reaction, which must collide simultaneously.
2	Order of a reaction can be 0, 1, 2, 3 and even a fraction	Molecularity cannot be zero or a non-integer
3	Order of reaction is helpful in deciding of mechanism of reaction.	Molecularity of reaction is not helpful in deciding of mechanism of reaction
4	It is a practical data	This is a theoretical value.

9. **Rate determining step**.:The overall rate of the reaction is controlled by the slowest step in a reaction called the **rate determining step**.

Zero Order Reaction:

K = $\frac{[R]_0 - [R]}{t}$

Half life period for a zero order reaction:

$$t_{1/2} = \frac{[R]_o}{2K}$$

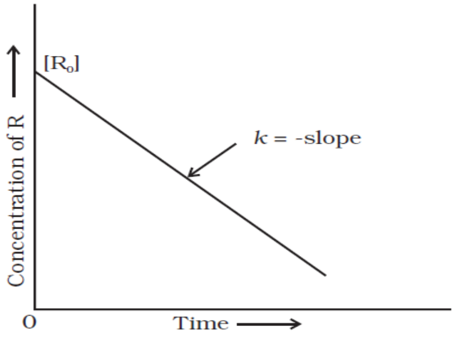
first order reaction :

$$\boxed{k = \frac{2.303}{t}\log\frac{[R\,]_0}{[R]}}$$

1. **Half life period for a First order reaction :**

$$t_{1/2} = \frac{0.693}{K}$$

If we plot [R] against t, with **slope = –*k*** and intercept equal to $[R]_0$



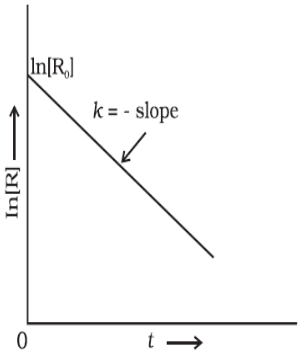


Fig. 4.4: A plot between ln[R] and t for a first order reaction

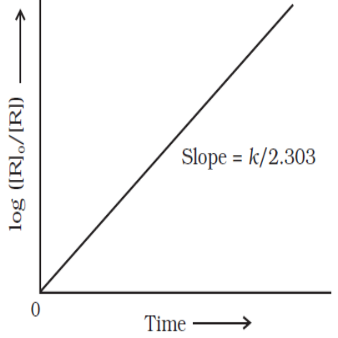


Fig. 4.5: Plot of log $[R]_0/[R]$ vs time for a first order reaction

PROPERTY	ZERO ORDER	FIRST ORDER
Unit of rate constant	k =$molL^{-1}s^{-1}$	k=Sec^{-1}
Rate of reaction	Do not depends on initial concentration	Directly proportional to initial concentration
Half life $t_{1/2} \ \alpha \ [R]_0^{1-n}$	$t_{1/2} = \frac{[R]_o}{2K}$ directly proportional to initial concentration	$t_{1/2} = \frac{0.693}{K}$ do not depend on initial concentration

13.Integrated rate equation for a gaseous system **:** $K_1 = \frac{2.303}{t}\log\frac{p_i}{(2P_i - P_t)}$ (for $A_{(g)} \rightarrow B_{(g)} + C_{(g)}$ type reaction)

14.Factors affecting the rate of Chemical Reaction

1.Concentration of reactants 2. Surface area of reactant 3. Temperature 4. Catalyst

15. Pseudo First Order Reaction: The reaction which is bimolecular but order is one is known as Pseudo first Order reaction. In this type of reaction one of the reactant is present in large excess

EXAMPLE : ***Hydrolysis of ester*** :- $CH_3COOC_2H_5 + HOH_{(excess)} \xrightarrow{H+} CH_3COOH + C_2H_5OH$

As water is used in excess so the concentration of water $[H_2O]$ does not get altered much during the course of the reaction. ∴ Concentration of water $[H_2O]$ can be is taken as constant.

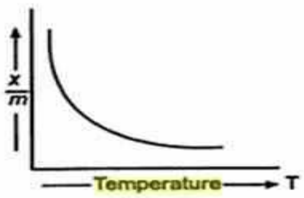
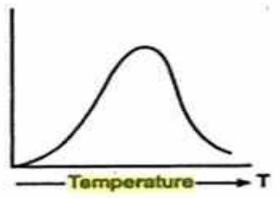
Rate = $k'[CH_3COOC_2H_5][H_2O]^0$ Rate = $k[CH_3COOC_2H_5]$, O.R=1

Inversion of sugar(cane sugar) :- $C_{12}H_{22}O_{11} + H_2O_{(excess)} \rightarrow C_6H_{12}O_6 + C_6H_{12}O_6$

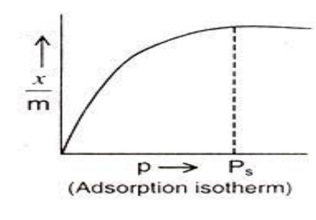
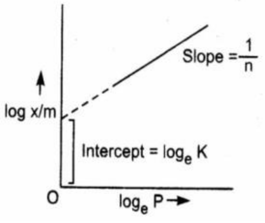
Rate = $K[C_{12}H_{22}O_{11}][H_2O]^0$ O.R= 1

CHAPTER 5: SURFACE CHEMISTRY

- **Adsorption** : Accumulation of molecular species at the surface than the bulk.
- Adsorption arises due to the unbalanced or residual attractive force on the surface of solid and liquid.

Physical adsorption	**Chemical adsorption**	
Weak Vander-Waals forces	Strong chemical forces,	 
Low enthalpy of adsorption	High enthalpy of adsorption,	
Reversible	Irreversible	
Not very specific	Highly specific	
Forms multi molecular layer.	Forms mono-molecular layer	

- **For adsorption:** ΔH = -ve and ΔS = -ve hence ΔG = ΔH-TΔS = -ve , for ΔG to be negative (spontaneous) ΔH>TΔS.
- Adsorption is exothermic :- ΔH of adsorption is always negative.
- Water vapours are adsorbed on silica gel but absorbed on $CaCl_2$.
- Higher the critical temperature of a gas greater is its adsorption. E.g $NH_3 > CO_2 > CH_4 > CO > N_2 > H_2$.
- **Freundlich adsorption isotherm:**

$\frac{x}{m} = k \ P^{1/n}$ (n > 1) , $\log\frac{x}{m} = \log K + \frac{1}{n}\log P$	Plot of log x/m vs log P gives slope = 1/n and intercept = log k  	At low P, x/m = kP At moderate P, x/m = $kP^{1/n}$ At high T, x/m = kP^0

Size of particles of solutions

True solutions	**Colloids**	**Suspensions**
$<10^{-9}$	10^{-9} m to 10^{-6} m	$>10^{-6}$
<1nm	1nm to 100 nm	>1000 nm

- Colloids - Dispersed phase = component present in small proportion, Dispersion medium = component present in large proportion.

- Classification - based on nature of interaction between dispersed phase and dispersion medium:

Lyophilic Colloids	**Lyophobic Colloids**
Particles of dispersed phase have great affinity for dispersion medium, Reversible in nature, Very stable Eg. Gum, gelatine, starch, proteins, rubber	Particles of dispersed phase have no affinity for dispersion medium, Irreversible in nature, Unstable Eg. Solutions of metals like Ag and Au, $Al(OH)_3$, $Fe(OH)_3$, As_2S_3

Classification based on type of particles of dispersed phase :

Multimolecular	**Macromolecular**	**Associated**
Consist of aggregates of atoms or molecules (diameter less than 1 nm). Eg. Sols of gold or sulphur	Consists of large molecules generally polymers. Eg. rubber, nylon, starch	consists of aggregation of large number of ions behaving as colloidal size particles at higher concentrations. Eg. Soap sols

- Aggregated ion particles formed by association of colloid in solution are called ionic micelles. The conc. above which these are formed is called **critical micelle concentration** (CMC). The temp. above which these are formed is called **kraft temperature** (T_k).
- **Properties of colloids :**

  Brownian movement - zig-zag motion of colloidal particles. It is is responsible for stability of sol

  Tyndall effect-scattering of light by colloidal particles by which path of beam becomes clearly visible.

Tyndall effect is observed only when the following two conditions are satisfied.

(i) The diameter(size) of the colloidal is not be much smaller than the wavelength of the light used.

(ii) There should be large difference in magnitude of The refractive indices of the dispersed phase and the dispersion medium.

***Charge on colloidal particles** – Colloidal particles which carry on electric charge and nature of charge is same on all particles.*

- due to preferential adsorption of ions from solution and/or due to formulation of electrical double layer

  When two or more ions are present in the dispersion medium, preferential adsorption of the ion common to the colloidal particle generally occur and the sol particles acquire positive or negative charge.

Example :-

- Positively charged sol is formed when KI is added to $AgNO_3$ solution.

  This is due to adsorption of Ag^+ ions on the precipitation silver iodide.

$$\mathbf{AgI + Ag^+ \rightarrow AgI / Ag^+} \text{ (Positively charged sol)}$$

Positively charged sols – metallic hydroxide like $Al(OH)_3$, $Fe(OH)_3$, $Al(OH)_3$, $Cr(OH)_3$ and metallic oxides like $Al_2O_3.xH_2O$	Negatively charged sols Metallic particles Cu, Ag, Au ,Pt and sulphides like As_2S_3 , Sb_2S_3

Hardy Schulze Rule: Greater the valency of the active ion or flocculating ion, greater will be its coagulating power. For negative sols like As_2S_3 order of coagulation power $Al^{3+}>Mg^{2+>}Na^{+}$ and for positive sols like $Fe(OH)_3$

Coagulation power of anions is $[Fe(CN)_6]$- >PO_4^{3-} >SO_4^{-2}>Cl^-

- The minimum number of moles of the electrolyte required for coagulation of 1L of colloidal sol is called **coagulation value or flocculation value**.
- **Application of coagulation of colloids :**

1.Formation of Delta : Coagulation of clay in river water by cations present in sea water.

2. Electrical precipitation of smoke (Cottrell precipitator) :- Electrical coagulation of smoke particles .

3. Tanning of leather- Tanning is the process of treating the skins of animals to obtain the leather. Skin of animals is also a colloidal system in which the colloidal particles are positively charged. 4.**Artificial rain** are caused by spraying AgI (electrolyte) on the clouds .

UNIT : 7 : THE P-BLOCK ELEMENTS

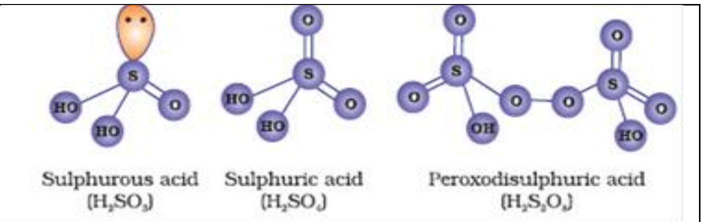
A. Group-15 elements are collectively known as the *pnicogens*. **Electronic Configuration** (ns^2np^3).

Atomic radii: Covalent and ionic radii increase down the group. From As to Bi only a small increase in covalent radius is observed due to the presence of completely filled *d* and/or *f* orbitals in heavier members.

1. **Ionisation enthalpy:** Ionisation enthalpy decreases down the group due to gradual increase in atomic size. Due to extra stable half-filled *p* orbitals electronic configuration and smaller size, the ionisation enthalpy of the group 15 elements is much greater than that of group 14 elements in the corresponding periods.
2. **Electronegativity**: The electronegativity value, in general, decreases down the group with increasing atomic size.
3. **Physical state**: Dinitrogen is a diatomic gas while all others are solids.Nitrogen and phosphorus are non-metals, arsenic and antimony metalloids and bismuth is a metal.
4. **Melting & boiling Point:** The boiling points increase from top to bottom in the group but the melting point increases upto arsenic and then decreases upto bismuth
5. **Catenation:** N–N bond is weaker than the single P–P bond because of high interelectronic repulsion of the nonbonding electrons, owing to the small bond length. As a result the catenation tendency is weaker in nitrogen.
6. **Oxidation states:** The common oxidation states are +3, +5, –3. Nitrogen due to the absence of *d* orbitals in its valence shell restricts its covalency to four
7. **Anomalous behaviour of nitrogen:** Nitrogen differs from the rest of the members of this group due to its smaller size, high electronegativity, high ionisation enthalpy andnon-availability of *d* orbitals.
8. Nitrogen exists as a diatomic molecule with a triple bond .Consequently, its bond enthalpy (941.4 kJ mol^{-1}) is very high
9. Nitrogen cannot form ***d*π –*p*π bond** as the heavier elements (Phosphorus and arsenic) can e.g., $R_3P = O$ or $R_3P = CH_2$ (R = alkyl group).
10. **Reactivity towards hydrogen** : **Hydrides of Group 15 Elements (a)** Bond dissociation enthalpy : $NH_3 > PH_3 > AsH_3 > SbH_3 > BiH_3$ (b) Basic character: $NH_3 > PH_3 > AsH_3 > SbH_3 > BiH_3$ (c)Boiling point/K $PH_3 < AsH_3 < SbH_3$

$< BiH_3 < NH_3$, (**NH_3 is an exception due to H-Bonding**) (d) HEH angle (°) $NH_3 > PH_3 > AsH_3 > SbH_3$

11. **Reactivity towards oxygen**: All these elements form two types of oxides: E_2O_3 and E_2O_5. The oxide in the higher oxidation state of the element is more acidic than that of lower oxidation state.
12. **Reactivity towards halogens**: These elements react to form two series of halides: EX_3 and EX_5. Nitrogen does not form pentahalide due to non-availability of the d orbitals in its valence shell. Pentahalides are more covalent than trihalides.
13. **REACTIONS OF GROUP 15**

(a) $3Cu + 8\,HNO_3(\text{dilute}) \longrightarrow 3Cu(NO_3)_2 + \mathbf{2NO} + 4H_2O$ (b) $Cu + 4HNO_3(\text{conc.}) \longrightarrow Cu(NO_3)_2 + \mathbf{2NO_2} + 2H_2O$ (c) $4Zn + 10HNO_3(\text{dilute}) \longrightarrow 4Zn(NO_3)_2 + 5H_2O + \mathbf{N_2O}$ **(d)** $Zn + 4HNO_3(\text{conc.}) \longrightarrow Zn(NO_3)_2 + 2H_2O + \mathbf{2NO_2}$ (e) $NO_3^- + 3Fe^{2+} + 4H^+ \rightarrow NO + 3Fe^{3+} + 2H_2O$ (f) $[Fe(H_2O)_6]^{2+} + NO \rightarrow [Fe(H_2O)_5(NO)]^{2+}$**(brown)** + H_2O	 Sulphurous acid (H_2SO_3) Sulphuric acid (H_2SO_4) Peroxodisulphuric acid ($H_2S_2O_8$) ***Structures- Oxoacids of sulphur***

B. Group-16 elements are collectively known as the *chalcogens*. Oxygen, sulphur are non-metals, selenium,tellurium metalloids, whereas polonium is a metal.& radioactive **Electronic Configuration**: (ns^2np^4).

15. **Atomic radii:** Due to increase in the number of shells, atomic radii increase from top to bottom in the group.
16. **Ionisation enthalpy:** Ionisation enthalpy decreases down the group.
17. **The negative value of electron gain enthalpy of** oxygen atom is less than that of sulphur.Due to small size of oxygen a the electron-electron repulsions are comparatively large.
18. **Electronegativity**: Next to fluorine, oxygen has the highest electronegativity value amongst the elements.
19. **Catenation**: S-S bond is much stronger than Se-Se bond thus S shows greater tendency for catenation than selenium.
20. **Physical state**: Dioxygen is a gas because O_2 is Diatomic molecules, hence weak Vander Waal's force of attraction but Sulphur is a solid. because S_8 is octaatomic hence Stronger Vander Waal's force of attraction thus it is solid.
21. **Melting & boiling Point:** Melting and boiling points increase with an increase in atomic number down the group.

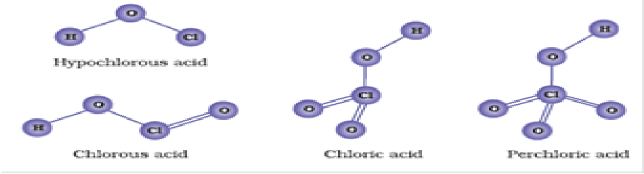
22. **Oxidation states:** Oxygen generally exhibit oxidation state of –2 only because Oxygen is a electronegative element other members of the family exhibit +2, +4, +6 oxidation states because other members of the family have d orbitals and therefore, can expand their octets and show + 2, + 4, + 6 oxidation states. Oxygen shows oxidation states of +2 and +1 in oxygen fluorides OF_2 and O_2F_2 respectively because Fluorine is more electronegative element than O.
23. **Anomalous behaviour of oxygen** : The anomalous behaviour of oxygen, like other members of *p*-block present in second period is due to its small size and high electronegativity.
24. **Properties of Hydrides of Group 16 Elements** (a) **Physical States:** H_2O is a liquid due to intermolecular hydrogen bonding and H_2S is a gas. (b) **Bond dissociation enthalpy** in the order: $H_2O > H_2S > H_2Se > H_2Te$ (c) **Boiling point:** $H_2S < H_2Se < H_2Te < H_2O$ **[**The boiling point of H_2O **is highest due to intermolecular hydrogen bonding** , $H_2S < H_2Se < H_2Te$. (As the size increases van der Waals forces increases and hence boiling point increases.**(d)The acidic strength of hydrogen halides varies in the order** $H_2O < H_2S < H_2Se < H_2Te$.**This is b**ecause bond (H–X) dissociation enthalpy decrease in the order: $H_2O > H_2S > H_2Se > H_2Te$.
25. The **Structures** of (a) SF_6 is octahedral (b) SF_4 *see-saw* geometry
26. **Sulphur vapours exhibits paramagnetism** because in vapour state sulphur partly exists as S_2 molecule which has two unpaired electrons in the antibonding π* orbitals like O_2 and, hence, exhibits paramagnetism.
27. **Reactions of Group 16:**
    (a)$Cu + 2H_2SO_4 \text{ (Conc.)} \longrightarrow CuSO_4 + SO_2 + 2H_2O$ **(d)**$2Fe^{3+} + SO_2 + 2H_2O \rightarrow 2Fe^{2+} + SO_4^{2-} + 4H^+$ **(reducing nature of** SO_2**)**

C. Group-17 elements: Fluorine, chlorine, bromine, iodine and astatine are members of Group 17. These are collectively known as the halogens

29. **Electronic Configuration**:General outermost **Electron configuration of group 17 is** (ns^2np^5) .
30. **Atomic radii:** The halogens have the **smallest atomic radii** in their respective periods **due to maximum effective nuclear charge**. Atomic and ionic radii increase from fluorine to iodine due to increasing number of quantum shells.
31. **Ionisation enthalpy:** They have very **high ionisation enthalpy**. Due to **increase in atomic size**, ionisation enthalpy decreases down the group.
32. **Electron gain enthalpy:** Halogens have **maximum negative electron gain enthalpy** in the corresponding periods.. Electron gain enthalpy of the elements of the group becomes less negative down the group. **The negative value of electron gain enthalpy of fluorine is less than that of Chlorine.** Due to small size of fluorine the electron-electron repulsions are comparatively large and hence incoming electron is not accepted with the same ease as in the case of Cl atom .
33. **Electronegativity**: They have very high electronegativity. The electronegativity decreases down the group. **Fluorine is the most electronegative element in the periodic table.**
34. **Physical State:** Fluorine and chlorine are gases, bromine is a liquid and iodine is a solid.
35. **Melting & boiling Point:** Increases down the group because of increase in size resulting in greater Vander Waal forces of attraction**.**
36. All halogens are coloured. This is due to absorption of radiations in visible region which results in the excitation of outer electrons to higher energy level. By absorbing different quanta of radiation, they display different colours.
37. **Bond dissociation enthalpies:** Cl_2 (242.6 kJ mol^{-1})> Br_2 (192.8 kJ mol^{-1})> F_2(158.8 kJ mol^{-1}), > I_2(151.1 kJ mol^{-1}) **Bond dissociation energy of** F_2 **is less than** Cl_2**.** Due to smaller size there is large electron-electron repulsion among the lone pairs in F_2 molecule whereas because of comparatively larger size the lone pairs of Cl atoms do not repel the bond pair of Cl-Cl bond. As result Bond dissociation energy of F_2 is less than Cl_2.
38. **Oxidation states:** All the halogens exhibit –1 oxidation state. **Fluorine exhibit oxidation state of –1 only.** Because fluorine atom is most electronegative & has no *d* orbitals in its valence shell and therefore cannot expand its octet.
39. **Chlorine, Bromine and Iodine exhibit + 1, + 3, + 5 and + 7 oxidation states**. because halogens have *d* orbitals and therefore, can expand their octets and show + 1, + 3, + 5 and + 7 oxidation states also.

40. **Anomalous behaviour of fluorine**: The **anomalous behaviour of fluorine is due to its small size, highest electronegativity, low F-F bond dissociation enthalpy, and non-availability of d orbitals in valence shell**
41. **Oxidizing power:** All halogens are strong oxidizing agents because they have a strong tendency to accept electrons. Order of oxidizing power is $F_2 > Cl_2 > Br_2 > I_2$ **F_2 is a stronger oxidising agent than Cl_2 It is due to (i) low enthalpy of dissociation of F-F bond (ii) high hydration enthalpy of F.**
42. **Properties of Hydrogen Halides(HX): (a)** HF is a liquid due to intermolecular hydrogen bonding ,while all other Hydrogen Halides(HCl, HBr, HI) are gases**. (b) Bond dissociation enthalpy** in the order: **H–F > H–Cl > H–Br > H–I (c) Boiling point: HCl < HBr < HI < HF [**The boiling point of **HF is highest due to intermolecular hydrogen bonding** (d) **The acidic strength of hydrogen halides varies in the order HF<HCl<HBr<HI**.**This is b**ecause bond (H–X) dissociation enthalpy decrease in the order: H–F > H–Cl >H–Br > H–I
43. **Oxoacids of halogens:**

(a) Acid strength: HOCl < $HClO_2$ < $HClO_3$ < $HClO_4$
(b) Acid strength: HOF > HOCl > HOBr > HOI
(c) Oxidising power:
$HClO_4$ <$HClO_3$<$HClO_2$ < HOCl



44. **Interhalogen compounds:** Binary compounds of two different halogen atoms of general formula XX^{I}_{n} are called interhalogen compounds where n = 1, 3, 5, or 7. Interhalogen compounds are more reactive than related elemental halogens. This is because X–X′ bond in interhalogens is weaker than X–X bond in halogens.
45. **Shapes of Interhalogen compounds:** XX' (ClF, BrF, BrCl, ICl, IBr, IF) **(Linear shape)** XX'_3 (ClF_3, BrF_3, IF_3, ICl_3)

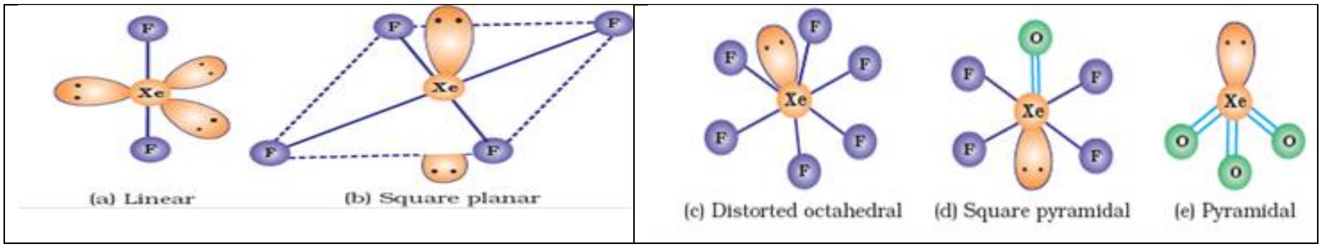
(Bent T- shape) XX'_5 – ClF_5, BrF_5, IF_5, **(square pyramidal shape)** XX'_7 – IF_7 **(Pentagonal bipyramidal shape)**

46. **Reactions of Group 17 : Reaction of Chlorine with Ammonia: (a)** $8NH_3$ (excess)+ $3Cl_2 \rightarrow 6NH_4Cl + N_2$ (b)$NH_3 + 3Cl_2$(excess) $\rightarrow NCl_3 + 3HCl$ (c) 2NaOH(**Cold and dilute**)+$Cl_2 \rightarrow NaCl+NaOCl+H_2O$ (d) 6NaOH(**Hot & conc**)+$3Cl_2 \rightarrow 5NaCl+NaClO_3+3H_2O$ (e)$2FeSO_4 + H_2SO_4 + Cl_2 \rightarrow Fe_2(SO_4)_3 + 2HCl$ (f)$Na_2SO_3 + Cl_2 + H_2O \rightarrow Na_2SO_4 + 2HCl$

D. Group 18 as noble gases: Group 18 consists of six elements: helium, neon, argon, krypton, xenon and radon The elements present in Group 18 have their **valence shell orbitals completely filled** and, therefore, react with a few elements only under certain conditions. Therefore, they are now known as noble gases.

47. **Electronic Configuration**: All noble gases have general electronic configuration **ns^2np^6 except helium**
48. **Monatomic:**They have **stable electronic configuration** so they cannot form covalent bonds hence exist as monoatomic
49. **Ionisation Enthalpy:** They have very high ionization enthalpy **due to stable electronic configuration.** Ionisation enthalpy decreases down the group because of increase in size.
50. **Atomic radii:** Increases down the group because number of shells increases down the group. Noble gases have comparatively largest atomic sizes. Because we measure them in **Van der Waals radii which are larger than covalent radii**
51. **Electron Gain Enthalpy:** Since noble gases have **stable electronic configurations**, they have no tendency to accept the electron and therefore, have large positive values of electron gain enthalpy
52. **Melting and boiling point:** They have very **low melting and boiling points** because the only type of interatomic interaction in these elements is **weak dispersion forces**. Helium has the lowest boiling point (4.2 K) of any known substance.
53. **Chemically Inert:** Their inertness to chemical reactivity is attributed to the following reasons: Due to stable electronic configuration. (ii) high ionisation enthalpy and more positive electron gain enthalpy.
54. The **Structures** of (a) XeF_2 (Linear) (b) XeF_4 (Square planar) (c) XeF_6 (Distorted octahedral) (d) $XeOF_4$ Square pyramidal (e) XeO_3 (Pyramidal)
55. Helium is a non-inflammable and light gas. Hence, it is used in filling balloons for meteorological observations & for inflating aeroplane tyres
56. Helium is used as a diluent for oxygen in modern diving apparatus because of its very low solubility in blood

57. **Reactions of Group 18** **(i)** $2XeF_2 + 2H_2O(l) \rightarrow 2Xe(g) + 4HF(aq) + O_2(g)$ (ii) $6XeF_4 + 12H_2O \rightarrow 4Xe + 2XeO_3 + 24 HF + 3O_2$ (iii) $XeF_6 + 3H_2O \rightarrow XeO_3 + 6HF$ (iv) $XeF_2 + PF_5 \rightarrow [XeF]^+ [PF_6]^-$ (v) $XeF_4 + SbF_5 \rightarrow [XeF_3]^+ [SbF_6]^-$ (vi)$XeF_6 + MF \rightarrow M^+[XeF_7]^-$ (M = Na, K, Rb or Cs)


(a) Linear (b) Square planar (c) Distorted octahedral (d) Square pyramidal (e) Pyramidal

THE d- AND f-BLOCK ELEMENTS

1. **DEFINITION:** A transition element is defined as the one which has incompletely filled *d* orbitals in its ground state or in any one of its oxidation states. Zinc, cadmium and mercury of group 12 have full d^{10} configuration in their ground state as well as in their common oxidation states and hence, are not regarded as transition metals.

2. **GENERAL ELECTRONIC CONFIGURATION**: $(n-1) d^{1-10} ns^{1-2}$

3. **MELTING AND BOILING POINTS:** High MP & BP which is due to their **strong metallic bond** (strong interatomic bonding) due to unpaired electrons in (n-1) d orbitals .In any row the melting points of these metals rise to a maximum at d^5 except for anomalous values of Mn and Tc.

4. **ENTHALPIES OF ATOMIZATION**: High enthalpies of atomization Because of large number of unpaired electrons in their atoms they have **stronger interatomic interaction (metal-metal bonding**)

5. **VARIATION IN ATOMIC AND IONIC SIZES :** In general, ions of the same charge in a given series show progressive decrease in radius with increasing atomic number The atomic radii decreases from group 3 to 6 because of increase in effective nuclear charge gradually, The atomic radii of group 7,8,9 &10 elements is almost same because Screening effect counter balances increased effective nuclear charge, Group 11 &12 elements have bigger size due to increase inter-electronic repulsion as result electron cloud expands and size increases.

6. Members of second(4d) and the third (5*d*) series in each group of transition elements have similar radii and shows similar properties because **lanthanoid contraction** essentially compensates for the expected increase in atomic size with increasing atomic number.

7. **DENSITY:** d-block elements have high density because of their small atomic size and strong metallic bonding..

8. **VARIATION IN IONISATION ENTHALPIES OF TRANSITION METALS:** There is an increase in ionisation enthalpy along each series of the transition elements from left to right due to an increase in nuclear charge which accompanies the filling of the inner *d* orbitals. Irregular variation of ionisation enthalpies is mainly attributed to varying degree of stability of different 3*d*-configurations (e.g., d^0, d^5, d^{10} are exceptionally stable).

7. **OXIDATION STATES:** The transition elements show **variable oxidation state due to small energy difference between (n-1) d & ns orbital** as a result both (n-1) d &ns electrons take part in bond formation. The highest oxidation state of an element is equal to number of unpaired e^- present in (n-1) d & ns orbital.

8. **MAGNETIC PROPERTIES** : Most of the transition metal ions are paramagnetic. due to the presence of unpaired electrons in d-orbitals. Magnetic moment is given by $\mu = \sqrt{n(n+2)}$ B.M. Where, n = number of unpaired electrons and BM = Bohr magneton (unit of magnetic moment).

9. **FORMATION OF COLOURED IONS:** Due to the presence of unpaired electrons in d-orbitals of the transition metal ions. It is because of these **d– d transitions** occurring in a transition metal ions by absorption of visible light.

2 **FORMATION OF COMPLEX COMPOUNDS :- D**ue to **smaller sizes of the metal ions, their high ionic charges and the availability of *d* orbitals for bond formation**. A few examples are: $[Fe(CN)_6]^{3-}$ etc.

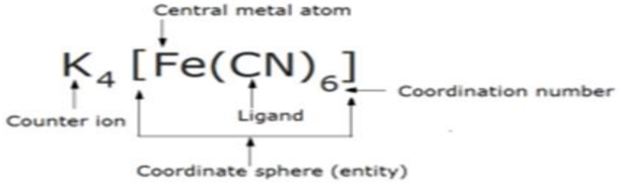
7. **CATALYTIC PROPERTIES:** due to (a) V**ariable oxidation states** & **Large surface area**.

8. **FORMATION OF INTERSTITIAL COMPOUNDS:** Transition elements form interstitial compounds because size of C, N, O, and B is similar to size of interstitial voids of transition metal
9. **ALLOY FORMATION:** As the atomic sizes are very similar one **metal** can replace the other **metal** from its lattice and **form** a solid solution which is the **alloy**.
10. **STANDARD ELECTRODE POTENTIALS:** Transition elements have lower negative value of **Standard Electrode Potentials** due to high ionization potential, high heat of sublimation & low enthalpy of hydration. The E^0 (M^{2+}/M) values are not regular which can be explained from the irregular variation of ionization energy and sublimation energy of Mn due to half-filled orbitals.
11. The **oxide of transition metals** in lower oxidation states are generally basic while those in the higher oxidation states are acidic. Acidic character increases with increase in oxidation state is due to decrease in size of metal ion and increase in effective nuclear charge .e.g. MnO (basic), Mn_3O_4 (amphoteric), Mn_2O_7 (acidic).
12. The 14 elements after Lanthanum having atomic number 58 to 71 are collectively known as Lanthanoids. The general electronic configuration of these elements is [Xe] $4f^{1-14}$, $5d^{0-1}$,$6s^2$.
13. **LANTHANOID CONTRACTION (ATOMIC AND IONIC SIZES):** The overall decrease in atomic and ionic radii from lanthanum to lutetium is due to poor shielding of 4f electrons is known as **lanthanoid contraction.**

    <u>Due to lanthanoid contraction:-</u> basic character of oxides and hydroxides decreases from $La(OH)_3$ to $Lu(OH)_3$, *Sizes of 4d and 5d metal paisr like Zr and Hf; Nb and Ta are almost similar.*
14. **OXIDATION STATES:**Most common oxidation state of these elements is +3, However, occasionally +2 Eu^{+2} and Yb^{+2})and +4 ions (Ce^{+4} and Tb^{+4}) in solution or in solid compounds are also obtained.
15. **COLOUR FORMATION** :Many trivalent lanthanoid ions are coloured both in the solid state and in aqueous solutions. Colour of these ions may be attributed tothe presence of ***unpaired* electrons** in f subshell.
16. **MAGNETIC BEHAVIOUR**: The lanthanoid ions other than the f^0 type (La^{3+} and Ce^{4+}) and the f^{14} type (Yb^{2+} and Lu^{3+}) are all paramagnetic.
17. A well-known alloy is *mischmetall* which consists of a lanthanoid metal(~ 95%) and iron (~ 5%) and traces of S, C, Ca and Al. A good deal of *mischmetall* is used in Mg-based alloy to produce bullets, shell and lighter flint.

<u>Chapter: Coordination Compounds</u>

- **Coordination Compounds** – Complex compounds in which transition metal atoms or ions are bound to a number of anions or neutral molecules called ligands.

	**Nomenclature :** $[Co(NH_3)_6]Cl_3$=Hexaamminecobalt(III) chloride, $K_3[Cr(C_2O_4)_3]$=potassiumtrioxalatochromate(III) $[Zn(OH)_4]^{-2}$ = tetrahydroxozincate(II) ion

Werner's coordination theory :

Metal exhibits two types of valencies (linkages) : primary valencies and secondary valencies

Primary valency	**Secondary valency**
Ionisable	non-ionisable
satisfied by negative ions	satisfied by negative ions or neutral molecules
Written outside the square bracket	Written inside the square bracket
Represented by dotted line	Represented by solid line
Primary valency is equal to Oxidation state	Sec- valency is equal to Coordination number of metal

- **Denticity of ligands** : number of coordinating atoms / attachment sites in a ligand.

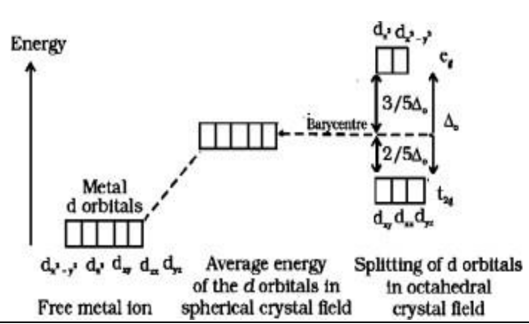
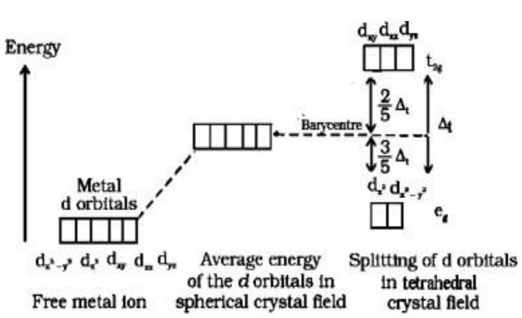
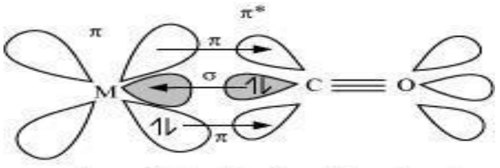
Monodentate	**Didentate**	**Polydentate**	**Ambidentate ligand**
One atom/ attachment site. e.g. Cl^-,NH_3,H_2O	Two atoms/attachment sites.e.g.$C_2O_4^{2–}$, (ethane-1,2-diamine)	More than two atoms or attachment sites .e.g. $EDTA^{4–}$	Two attachment sites but uses only one at a time. e.g. NO_2 , SCN^-, CN^-

- **Chelate ligand -** When a di- or polydentate ligand uses its two or more donor atoms to bind a single metal ion, it is said to be a **chelate** ligand.e.g. $H_2NCH_2CH_2NH_2$ (ethane-1,2-diamine)
- **Valence Bond Theory(VBT):**

C.N. 6	d^2sp^3,Octahedral , diamagnetic except $[Cr(NH_3)_6]^{3+}$,Low spin complex ,inner orbital complex eg. $[Fe(CN)_6]^{2-}$,$[Co(NH_3)_6]^{3+}$,$[Co(CN)_6]^{3-}$etc	Sp^3d^2 Octahedral, Paramagnetic, High spin complex, Outer orbital complex. Eg. $[Fe(H_2O)_6]^{2+}$,$[CoF_6]^{3-}$,$[FeF_6]^{3-}$ etc
C.N. 4	d sp^2, Square planer ,diamagnetic .Low spin complex . eg- $[Ni(CN)_4]^{2-}$	Sp^3, Tetrahedral, High spin complexes. Eg- $[NiCl_4]^{2-}$(Paramagnetic) $[Ni(CO)_4]$ (diamagnetic)

Spectrochemical series: arrangement of ligands in a series in the order of increasing field strength. $I^- < Br^- < SCN^- < Cl^- < S^{2-} < F^- < OH^- < C_2O_4^{2-} < H_2O < NCS^- < edta^{4-} < NH_3 < en < CN^- < CO$

- **CFT in octahedral and tetrahedral complexes :**

Octahedral complexes 	Tetrahedral complexes 	→Strong field ligands (high Δ∘) hence form – low spin complexes →Weak field ligands (low Δ∘) hence form – high spin complexes
 Synergic bonding in metal carbonyls	**Bonding in metal carbonyl–** They are organometallic compounds having both σ and π bonds. They have M← CO, σ bond and M →CO π back bond **(synergic bonding)**	

Coordination compounds like $[Ni(H_2O)_6]^{2+}$, $[Fe(CN)_6]^4$, $^-[Fe(H_2O)_6]^{2+}$ shows colour due to d-d transitions.

Chapter :- Haloalkane & Haloarenes

*****Boiling point of alkyl halide increases,as the size of halogen atom increases(R-I > R-Br > R-Cl > R-F)

*Boiling point of alkyl halide increases as the Size of alkyl group increases(having same halogen)-($CH_3CH_2X > CH_3X$)

*In isomers of alkyl halide branching increases,B.P. decreases-$(CH_3)_2CH\text{-}CH_2\text{-}Br > (CH_3)_3C\text{-}Br$

*Boiling point in aryl halides increases as the size of halogen atom increases or size of aryl gp. inreases(Ar-I>Ar-Br>Ar-Cl>Ar-F)

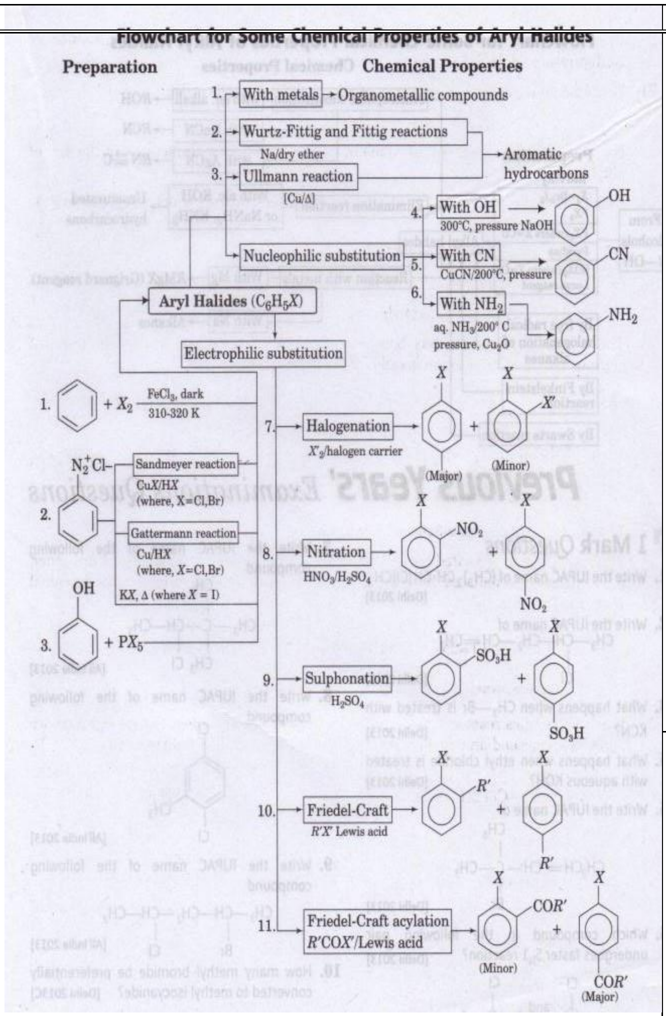
*M.P. of p-isomer is more than ortho- & meta- isomer as p-isomer is closed packed lattice due to symmetry p-isomer

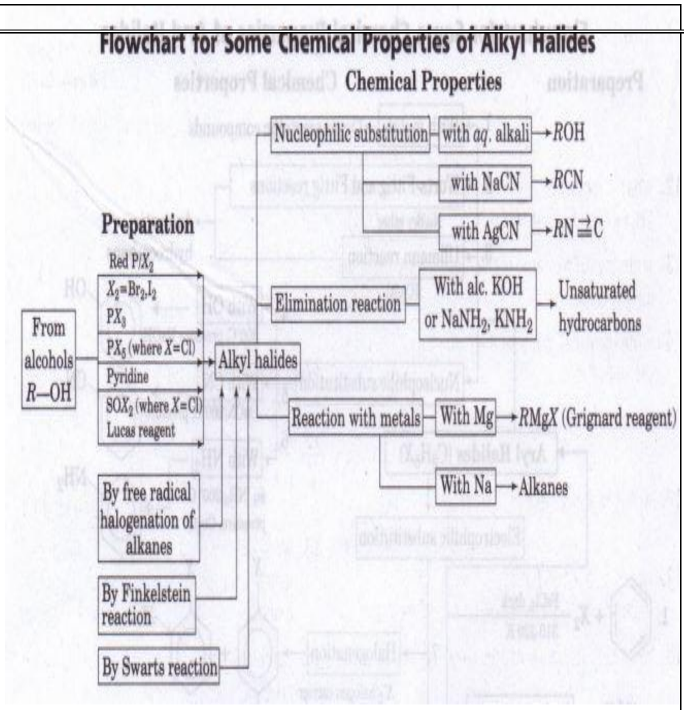
*C-Cl bond length is shorter in chlorobenzene due to resonance/partial double bond character

*Aryl halide less reactive towards Substitution Nucleophilic (SN) reaction due to partial double bond character, instability of phenyl carbocation.

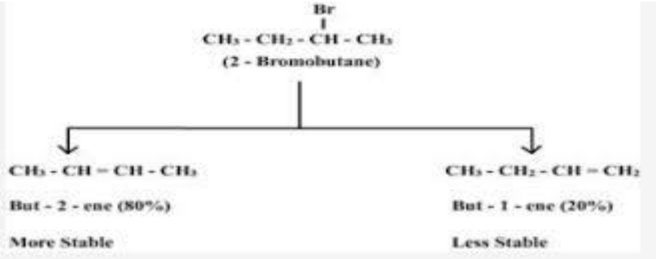
*Allyl halides are more reactive than alkyl halide because allyl carbocation is **resonance stabilised**.

*Benzyl halides are highly reactive **due to resonance** stabilised Benzyl carbocation.
Vinyl halides are less reactive than alkyl halides due to **partial double bond character** in (C-X) bond of vinyl halide





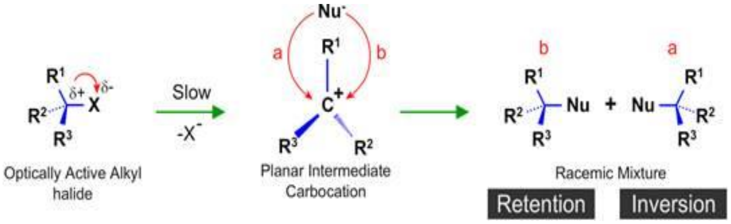
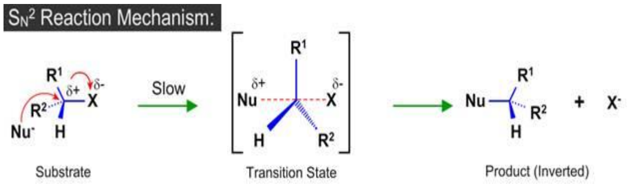
According to saytzeff rule-more stable alkene (having more no. of alpha H)formed will be the major product.



Nucleophilic substitution reaction : A substitution reaction carried out by a nucleophile is called Nucleophilic substitution reaction. It is characteristic reaction of halo alkanes.

R—$CH_2^{\partial+}$–$X^{\partial-}$ + Na^+ OH^-(aq) -------→ R-CH_2-OH+NaX

3.Nucleophilic substitution reactions proceed by two different mechanisms:

Substitution Nucleophilic unimolecular ($S_N{}^1$)	**Substitution Nucleophilic bimolecular ($S_N{}^2$)**
The rate of reaction depends only on the concentration of alkyl halide ie rate=K [R X] 2. It is two step reaction. In the first step forming a carbocation .In the second step, the carbocation combines with the nucleophile to form final product.  4.Racemic mixture is formed. 5 order of reactivity of alkyl halide in $S_N{}^1$ $3^0 > 2^0 > 1^0$ due to stability of carbocation	1.The rate of reaction depend on the concentration of both the alkyl halide and Nucleophile ie rate = [R X] [Nu^-] 2.It is a single step reaction involving formation of a transition state in which incoming Nucleophile and outgoing group are bonded to carbon atom.  4.Inversion of configuration takes place. 5.Order of reactivity of alkyl halide in SN^2 $1^0 > 2^0 > 3^0$ due to steric hindrance

Racemic mixture-Equimolar mixture of dextrorotatory & levorotatory isomers.

<u>Markovnikov's rule</u> : -ve part of addendum added to the cation having less no of H- Atoms.

CH_3-CH=CH_2 + H Br --------→ CH_3 CH(Br) CH_3 + CH_3 CH_2CH_2 Br

Anti markonikov's addition or Peroxide effect (kharasch effect) in the presence of organic peroxide(-ve) part added to the cation having more no of H- of Atoms (only for addition of HBr)

$$CH_3\ CH = CH_2 + H\ Br \xrightarrow{Peroxide} CH_3\text{-}CH_2\text{-}CH_2\text{-}Br$$

Reasoning Questions

1 Explain why thionyl chloride reaction is preferred for preparing alkyl chlorides from alcohols?

(**Ans**) $ROH + SOCl_2 \xrightarrow{Pyridine} RCl + SO_{2(g)} + HCl_{(g)}$ (side products are gaseous)

2. Why is sulphuric acid not used during the reactions of alcohols with KI?

(**Ans**) Sulphuric acid is an oxidizing agent. It oxidizes HI produced during the reaction, to I_2

3. **Grignard reagent should be prepared under anhydrous conditions**.

Ans-because they are react with H_2O to form alkanes.

4. **Haloarens are less reactive towards nucleophilic substitution than haloalkanes.**

Ans-Due to resonance ,partial double bond character(in c-x bond)in haloarenes.

5.Haloalkanes with KCN form alkyl cyanide while with AgCN they give alkyl isocyanide.

Ans-CN^- is ambidentnucleophile ,KCN provides CN^- ions in solution and attack takes place through C-atom as C-C bond is more stable. AgCN is mainly covalent and N-atoms attack the alkyl group.

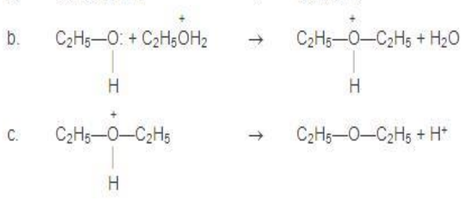
6. Halogen atom attached to benzene ring is o,p- directing and act deactivating.

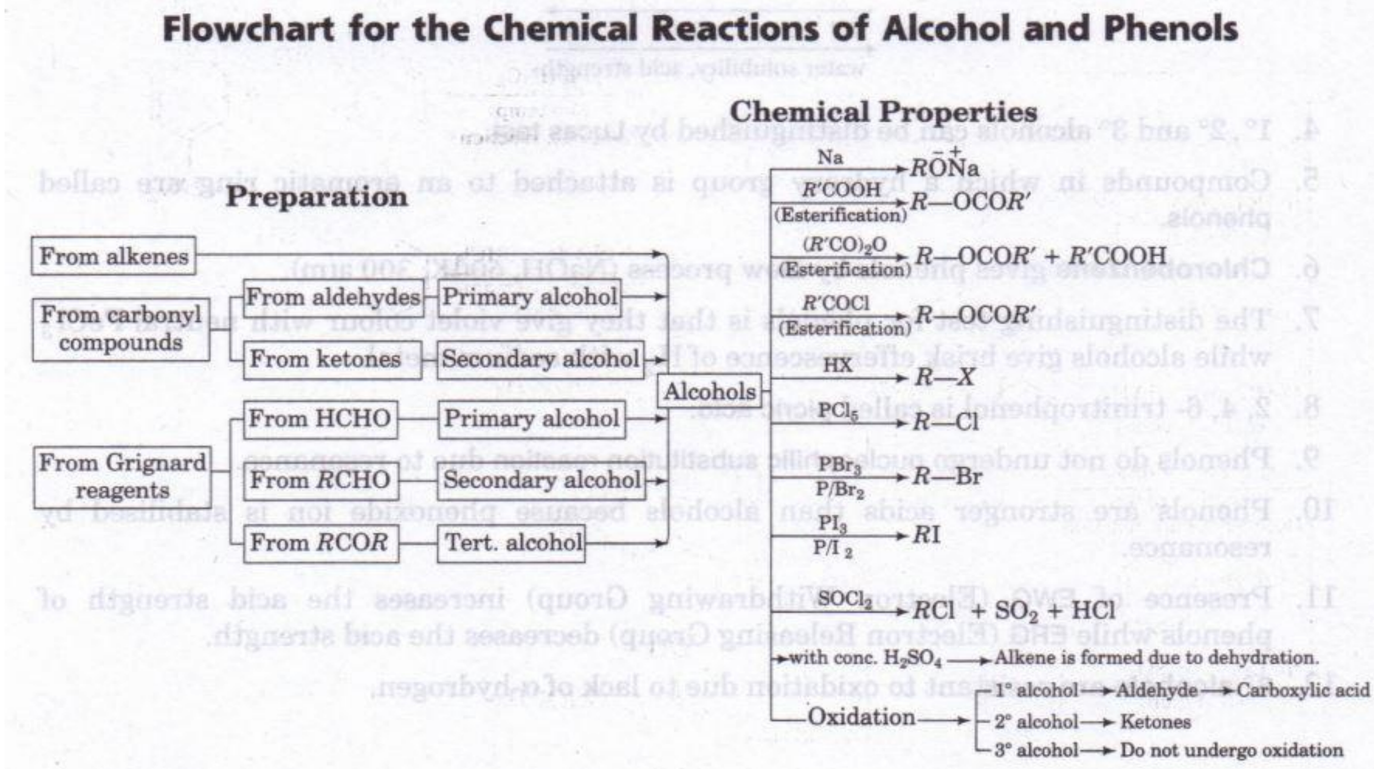
Ans –Due to resonance e^- density increase at o,p-positions and due to –I effect of halogen atom it is deactivating.

CHAPTER :-ALCOHALS,PHENOLS & ETHERS

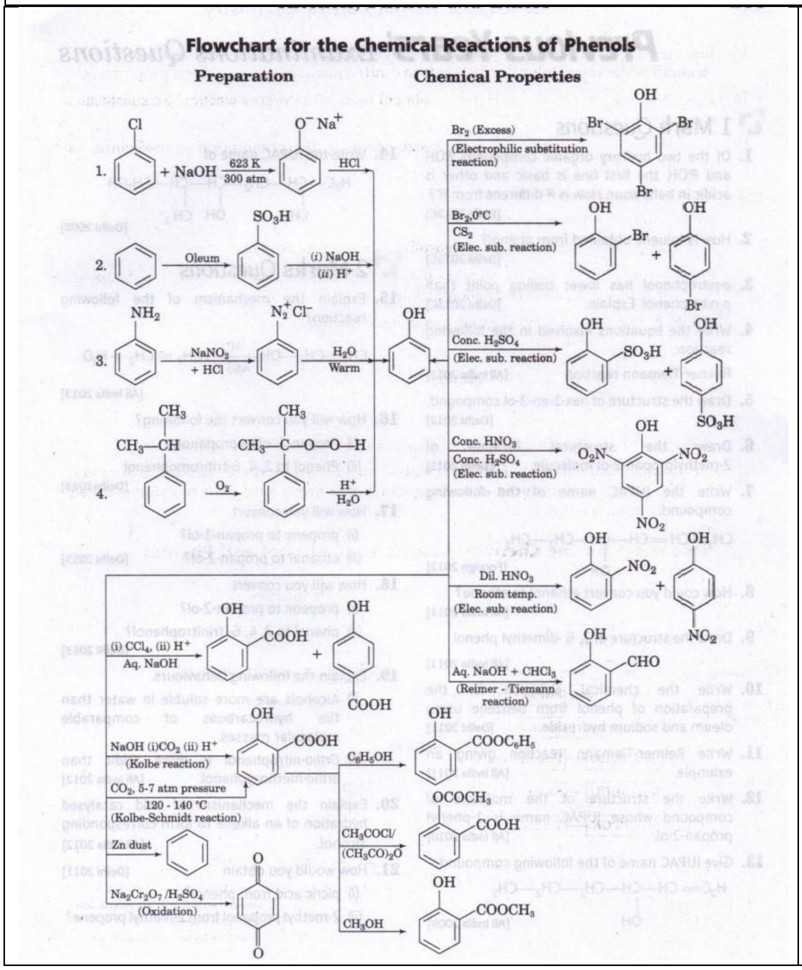
1	Propanol has higher B.P. than butane.	Due to intermolecular H Bonding
2	Alcohals are more soluble in water	Due to H bonding in Alcohals
3	O-nitro phenol is steam volatile	Due to intramolecular H Bonding
4	p-nitro phenol is less volatile	Due to intermolecular H Bonding
5	Phenol is more acidic than alcohals	Due to resonance in phenoxide ion
6	o-nitrophenol is more acidic than o-methoxyphenol	Because in o-nitro phenol –NO_2 is EWG
7	Ethanol has higher B.P. than methoxymetahne	H-Bonding in Ethanol
8	Ethers having dipole moment	Ethers are weakly polar
9	Diethyl ether behave as a base	Presence of 2 lone pair of electrons
10	Lower ethers soluble in water.	weakly polar, can form H-bonding
11	Phenol has higher B.P. than toluene	Phenol forms intermolecular –H Bond
12	Phenol can be easily nitrated than benzene	-OH is an EDG, it increase e^-density
13	Phenol has smaller dipole moment than ethanol	Because C-O bond in ethanol is more polar than phenol
14	Glycol having high B.P.	Due to H- bonding
15	Phenol become coloured after sometime	Due to oxidation
16	Phenol do not undergo substitution reaction at C-OH	Due to partial double bond character
17	Unlike phenols ,alcohols are easily protonated	Lone pairs on O are delocalized over benzene

Lucas test- **1^0 alcohal + lucas reagent→No turbidity** **2^0 alcohal + lucas reagent→ Turbidity in 5 min.** **3^0 alcohal + lucas reagent →No turbidity**	**Reactivity of alcohols** 3° > 2° > 1° methyl. The order of reactivity of the hydrogen halides is HI > HBr > HCl (HF is generally unreactive)	**Test for phenol & Alcohol** **Phenol + $FeCl_3$- → violet colour** **Alcohal + $FeCl_3$ → No colour**

Mechanism of hydration of alkenes- *i). Protonation;* $H_2O + H^+ \rightarrow H_3O^+$ $CH_2 = CH_2 + H_3O^+ \rightarrow CH_3 - CH_2^+$ ii) *Nucleophilic attack of H_2O* ; $CH_3\text{-}CH_2^+ + H_2O \rightarrow CH_3\text{-}CH_2\text{-}^+OH_2$ iii) Deprotonation ; $CH_3\text{-}CH_2\text{-}^+OH_2 \rightarrow CH_3\text{-}CH_2\text{-}OH + H^+$	Mechanism of formation of diethyl ether at 413 K :ss 	Mechanism of Dehydration of ethanol at 443K i) ***Protonation***; $CH_3\text{-}CH_2\text{-}OH + H^+ \rightarrow CH_3\text{-}CH_2\text{-}^+OH_2$ ii) ***Cleavage of C-O Bond to form carbocation*** ; $CH_3\text{-}CH_2\text{-}^+OH_2 \rightarrow CH_3\text{-}CH_2^+ + H_2O$ iii)***Deprotonation***; $CH_3\text{-}CH_2^+ \rightarrow CH_2=CH_2 + H^+$

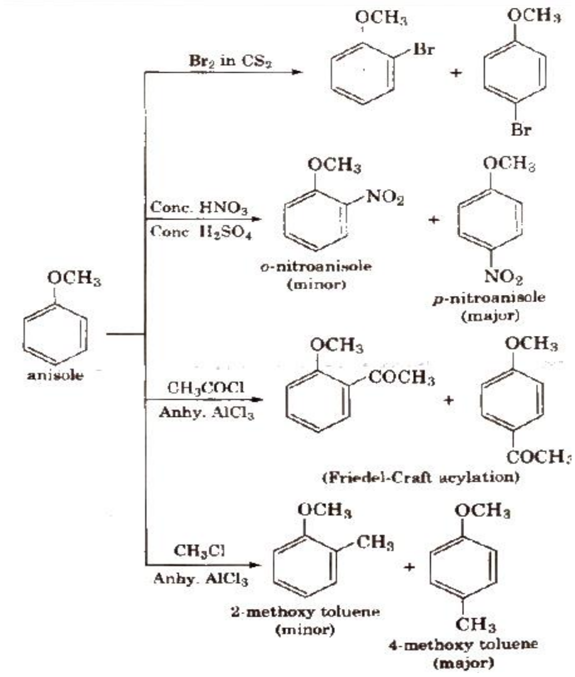


Flowchart for the Chemical Reactions of Alcohol and Phenols



Flowchart for the Chemical Reactions of Phenols

Reactions of ether



Esterification :-

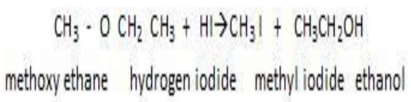
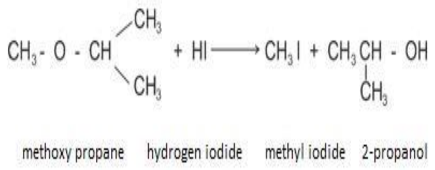
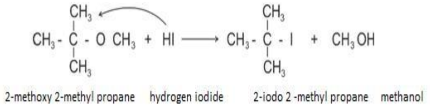
$$R-COOH+R'-OH\xrightarrow{H^+}R-COOR'+H_2O$$

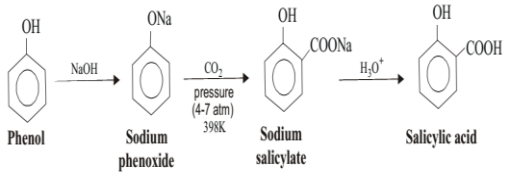
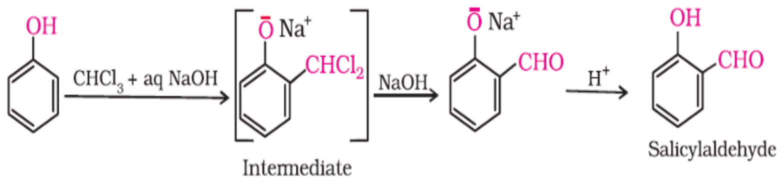
ESTERIFICATION

Iodoform test:-alcohol containing the group **CH_3-CH-** is heated with iodine and aqueous NaOH or Na_2CO_3 solution, a yellow ppt of iodoform is obtained.

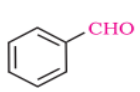
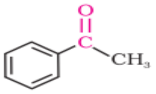
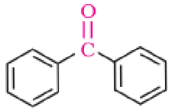
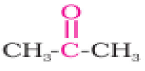
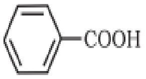
CH_3-CH_2-OH +4 I_2 +6NaOH $\xrightarrow{\Delta}$ CHI_3 + HCOONa + 5NaI +5H_2O

Reactions of Ether with HI-(In case of unsymmetrical ether)

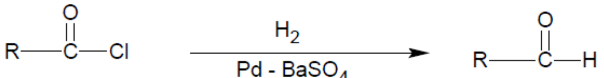
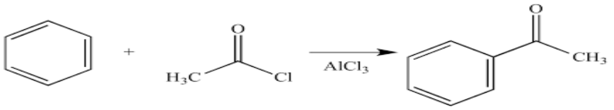
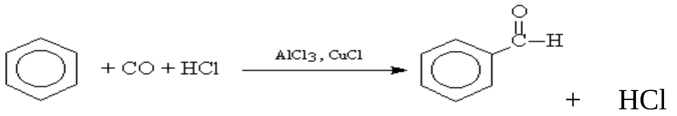
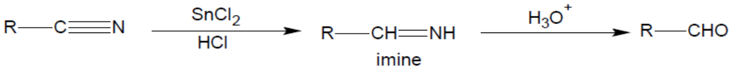
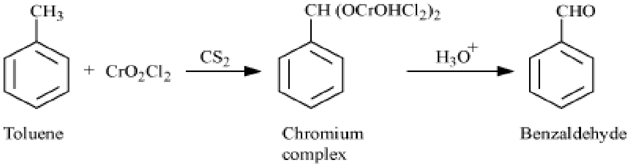
		If we take tertiary than Iodide goes with tertiary gp. 

Kolbe's reaction 	Reimer-Timann reaction 

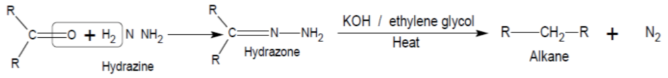
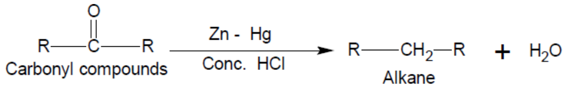
CH-12 : ALDEHYDE, KETONES AND CARBOXYLIC ACIDS

HCHO (Formaldehyde), CH_3CHO(Acetaldehyde) ,CH_3COOH (Acetic Acid)  Benzaldehyde  Acetophenone  Benzophenone  $CH_3-\overset{O}{\overset{\Vert}{C}}-CH_3$ Acetone  **Benzoic Acid**	***Fehling solution*** :- Fehling A= **alkaline copper(II) sulphate** solution + Fehling B = **sodium poatssium tartarate** (Rochelle salt) ***Tollen's reagent*** = Ammonical silver nitrate

PREPARATION OF ALDEHYDES AND KETONES

Oxidation of Alcohols- 1^0 alcohol $\xrightarrow{oxidation}$ Aldehyde , 2^0 Alcohol $\xrightarrow{oxidation}$ Ketones	Rosenmund Reaction –  Acid chloride Aldehyde
Alkene $\xrightarrow{OZONOLYSIS-REDUCTION}$ Aldehyde / Ketones	Friedal craft acylation:- 
Alkynes $\xrightarrow{Acid-catalysed-Hydration}$ Aldehyde / Ketones	
Gattermann-Koch reaction:-  **Stephen reaction** 	Etard reaction:-  Toluene Chromium complex Benzaldehyde

PROPERTIES OF ALDEHYDES AND KETONES:

Imines $\xleftarrow{NH_3}$	ALDEHYDES AND KETONES	$\xrightarrow{HCN}$ Cynohydrins
Oximes $\xleftarrow{NH_2OH}$		$\xrightarrow{ROH-HCl}$ Hemiacetals and Acetals
2,4- dinitro Phenyl Hydrazones $\xleftarrow{2,4-DNP}$		$\xrightarrow{NaHSO_3}$ Bisulphite Adduct
Semicarbazones $\xleftarrow{Semicarbazides}$ **(Due to resonance one –NH_2 gp involve in reaction)**		$\xrightarrow{OXIDATION}$ Carboxylic acids
Hydrazones $\xleftarrow{NH_2NH_2}$		$\xrightarrow{REDUCION}$ Alcohols
(**Wolf-kishner reduction**) ALKANES $\xleftarrow{NH_2NH_2 / KOH / GLYCOL / \Delta}$ 		$\xrightarrow{Zn-Hg/HCl}$ ALKANES(***Clemmensen reduction***) 

Aldol Condensation:- Aldehyde and Ketones Which **contains α-H-**atom give this reaction

$$CH_3-CHO+H-CH_2-CHO\xrightarrow{dilNaOH}CH_3-CH-CH_2-CHO\xrightarrow{\Delta/H_2O}CH_3CH=CH-CHO$$

Cross-Aldol Condensation- Reaction b/w two different aldehyde, aldehyde and ketones.

Cannizzaro reaction:-Aldehyde which **do not contain α-H-atom**, Undergo self oxidation(to give salt of acid) and reduction (to give alcohol) (Disproportionation)

$$2C_6H_5CHO\xrightarrow{NaOH}C_6H_5CH_2OH+C_6H_5COONa \qquad 2HCHO\xrightarrow{NaOH}CH_3OH+HCOONa$$

CARBOXYLIC Ar/R-COOH ACID

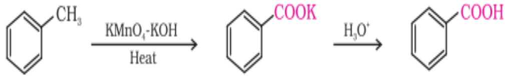
PREPARATION

Nitriles $\xrightarrow{Hydrolysis/H^+/OH^-}$

Acid derivatives $\xrightarrow{H_2O/OH^-}$

Grignard Reagent $\xrightarrow{CO_2/Hydrolysis}$

Alkyl Benzene $\xrightarrow{Oxidation(KMnO_4-KOH)}$



[The entire side chain is oxidized to carboxylic acid irrespective of length of side chain]

PROPERTIES

$\xrightarrow{NH_3}$ Amide

$\xrightarrow{NaOH/CaO}$ Alkanes(R-H)

$\xrightarrow{R'OH}$ Ester

$\xrightarrow{X_2(Cl.Br)/P}$ RCH(X)COOH (**HVZ reaction-(**α-Halogenation**)**

Acidic Character of Carboxylic acids

*Smaller the pK_a or larger K_a , stronger the Acid

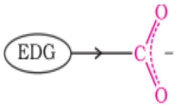
Caroxylic Acids are stronger acid than Alcohols and phenols- Due to more stable carboxylate ion.

Presence of –I gp = Acidity Inc.

Presence of +I gp = Acidity Dec.

Electron withdrawing group (EWG) stabilises the carboxylate anion and strengthens the acid

EWG like :- X , $-NO_2$ etc



Electron donating group (EDG) destabilises the carboxylate anion and weakens the acid

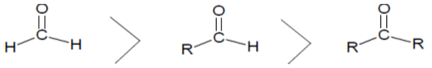
EDG :$-CH_3$, $-CH_2CH_3$ etc

Phy &Chem- Properties of Ald/Ketones-

*High BP than alkane of comparable mass- - Due to Dipolar attraction

* Isomeric ketones have higher MP & BP than aldehydes-due to more polarity in carbonyl gp of ketones.

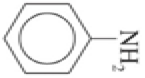
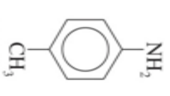
* The order of reactivity of aldehydes and ketones toward nucleophilic addition reaction:



Due to Steric and +I effect.

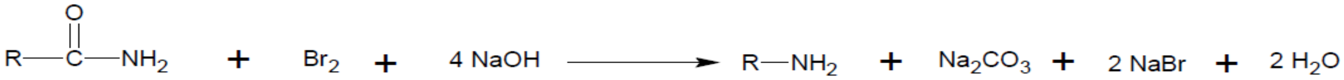
DISTINGUISHING TEST	
Aldehyde and ketones	Aldehyde gives - Fehling & Tollen's test (ammonical silver nitrate sol)
Acetophenone and benzophenone	Acetophenone gives iodoform test
Acetic acid & Formic Acid	Formic acid→ Tollen's Test
All - 2-ones & Acetaldehyde	Iodoform Test
Benzaldehyde & Acetaldehyde	Fehling Test (Benzaldehyde gives only Tollen's)

CH-13 AMINES

Important compounds	CH_3NH_2 Methylamine	$CH_3CH_2NH_2$ Ethylamine	$CH_3NHCH_2CH_3$ Ethylmethylamine (*N*-methylethanamine)	$(CH_3CH_2)_2NH$ Diethylamine (*N*-ethylethanamine)	 Aniline	 *p*-Toluidine

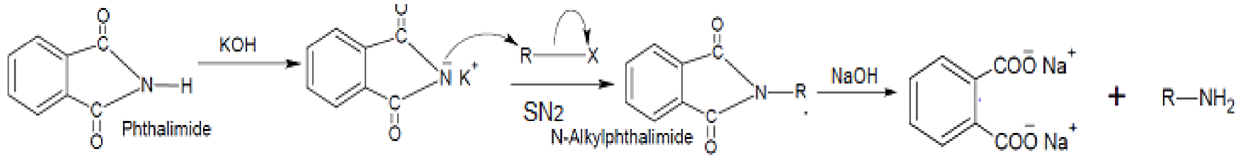
Reduction of Nitro Compounds	Reduction of Amides :-
$R-NO_2\xrightarrow[Zn/HCl \text{ or } Sn/HCl \text{ or } Fe/HCl]{H_2/Pt \text{ or } H_2/Pd \text{ or } H_2/Ni \text{ or } LiAlH_4}R-NH_2$	$CH_3CONH_2\xrightarrow[H_2O]{LiAlH_4}CH_3-CH_2-NH_2$

Hoffmann bromamide degradation Reaction :-primary acid amide is heated with aq. Solution of NaOH/KOH and Bromine gives primary amine. ***Amine formed with one carbon less then amide.***



$$R-\overset{O}{\overset{\|}{C}}-NH_2+Br_2+4\,NaOH\longrightarrow R-NH_2+Na_2CO_3+2\,NaBr+2\,H_2O$$

Gabriel Phthalimide Synthesis:-Preparation of aliphatic primary amines.



Aromatic primary amines cannot be prepared by this method because aryl halides do not undergo nucleophilic substitution due to partial double bond character with the anion formed by phthalimide.

Ammonolysis of alkyl halides :-

$$RX \xrightarrow{NH_3} R—NH_2 \xrightarrow{RX} R_2NH \xrightarrow{RX} R_3N \xrightarrow{RX} R_4\overset{+}{N}\overset{-}{X}$$

product – 1^0 Amine = NH_3 In excess, If RX in excess product $1^0,2^0,3^0$ amines and quaternary ammonium salt.

Physical Properties :-

In Tertiary amines H-Bonding is not possible due to absence of H atoms.

Boiling point 1 ° > 2 ° > 3 °

Amines have lower MP & BP than Alcohols of comparable mass (due to High EN Of Oxygen)

Solubility in water 1 ° > 2 °> 3 °

In case of substituted aniline basic character:-

The electron withdrawing groups on aromatic ring **reduce the basicity** of substituted anilines like –NO_2 , –SO_3H, –COOH, –X etc.

The electron (donating) releasing groups like –OCH_3 ,
–CH_3 **increase basic strength**

Basic Nature :- The basicity of amines in **gaseous phase** :

3° > 2° >1° amine > NH_3 (due to +I effect)

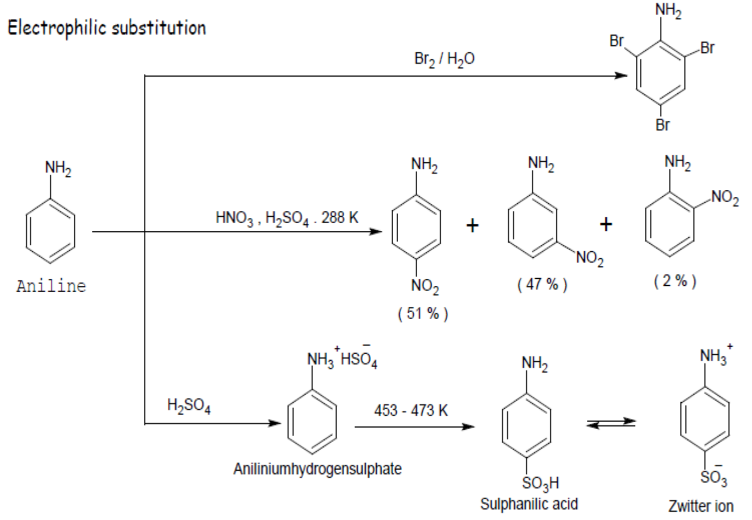
In **Aqueous Basic** properties :-

$$(CH_3)_2NH > CH_3NH_2 > (CH_3)_3N > NH_3 \quad (213)$$

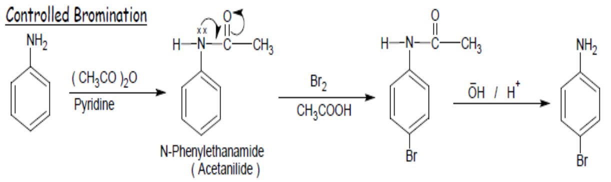
$$(C_2H_5)_2NH > (C_2H_5)_3N > C_2H_5NH_2 > NH_3 \quad (231)$$

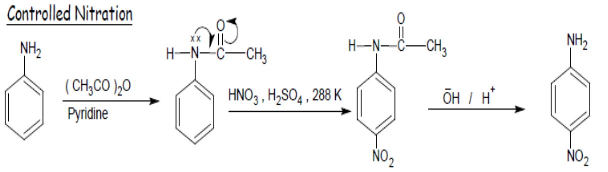
Greater the value of K_b, smaller will be the pK_b value and stronger will be the base.

Aromatic amines are less basic than ammonia (due to resonance in aromatic amines).



In direct Nitration meta product is formed :- due to formation of anilinium ion which is meta directing.





The lone pair of electrons on nitrogen is less available for donation to benzene ring by resonance. Therefore, activating effect of -$NHCOCH_3$ group is less than that of amino group.

* Aniline does not undergo Friedel-craft reaction (Alkylation and acylation) due to salt formation with aluminium chloride.

Carbylamines reaction (isocyanide test):- primary amines react with chloroform and KOH give isocyanides (Carbylamines) which has unpleasant smell.

$$R-NH_2 + CHCl_3 + 3KOH \xrightarrow{heat} R-NC + 3KCl + 3H_2O$$

DIAZONIUM SALTS:-

Amine $\xrightarrow{NaNO_2 + HCl(273-278K)}$ Diazonium salt → Alcohol

Aniline $\xrightarrow{NaNO_2 + HCl(273-278K)}$ Benzene diazonium salt (Aromatic diazonium salts - Stable Due to resonance)

(Hinsberg's test)

Benzene sulphonyl chloride $(C_6H_5SO_2Cl)$ called as **Hinsberg's reagent**. It is used to distinguish between primary secondary and tertiary amines.

$C_6H_5SO_2Cl + 1^\circ$ amine $\longrightarrow$ Product $\xrightarrow{KOH}$ Dissolve

$C_6H_5SO_2Cl + 2^\circ$ amine $\longrightarrow$ Product $\xrightarrow{KOH}$ Insoluble

3° amine does not react with benzene sulphonyl chloride

CHAPTER : BIOMOLECULES

- **Carbohydrates :** Polyhydroxy aldehydes or polyhydroxy ketones or compounds on hydrolysis give carbohydrates.

Simple carbohydrates	**Complex carbohydrates**
Monosaccharides – 1 sugar unit. e.g. glucose fructose, galactose **Disaccharides** - 2 sugar units. e.g.lactose, sucrose, maltose.	**Oligosaccharides** – 3 to10 sugar units.e.g.raffinose **Polysaccharides** – more than 10 sugar units.e.g. Starch, glycogen.

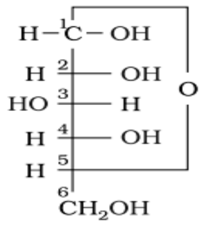
- **Glycosidic linkage -** the linkage between two monosaccharide units through O atom.

Reducing sugar	**Non reducing sugar**
carbohydrates which reduce Fehling's solution and Tollens' reagent.e.g glucose, fructose, maltose, lactose	carbohydrates which does not reduce Fehling's solution and Tollens' reagent.e.g.sucrose

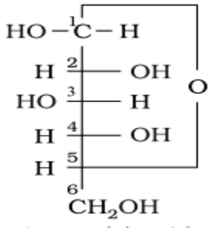
- **Reactions of glucose :**

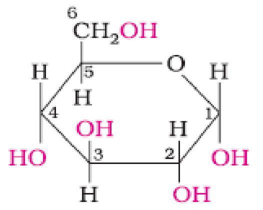
With HI = n -hexane (6 C atoms are in straight chain)	With NH_2OH = Cyanohydrin (Presence of carbonyl group)	With Br_2 water = gluconic acid (carbonyl group present is an aldehyde group)	With HNO_3 = saccharic acid (presence of primary alcoholgroup)	With acetic anhydride = Glucose pentaacetate (presence of 5 –OH groups)

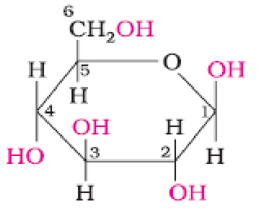
- **Cyclic structures (Haworth Structures) of glucose and fructose :**

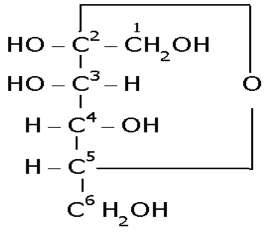

α – D – (+) – Glucose

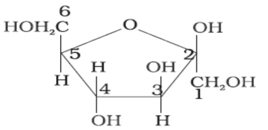
$\rightleftharpoons$

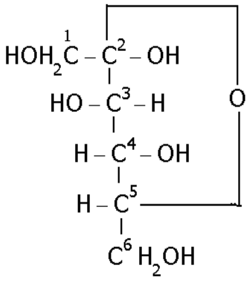

β – D– (+) – Glucose

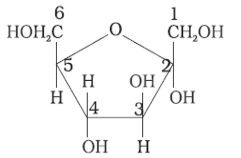

α – D – (+) – Glucopyranose


β – D – (+) – Glucopyranose


β – D – (–) – Fructofuranose


β – D – (–) – Fructofuranose


α – D – (–) – Fructofuranose


α – D – (–) – Fructofuranose

- **Proteins** – polymers of alpha amino acids joined through peptide bonds.
- **Peptide bond** – amide linkage formed by condensation of –COOH group of one amino acid and NH_2 group of another amino acid.
- **Amino acids -** contain amino ($–NH_2$) and carboxyl (–COOH) functional groups.

Essential amino acids - Cannot be synthesized in body and obtained through diet.e.g. valine, leucine	**Non essential amino acids -** Can be synthesized in body.e.g. glycine, alanine

- **Zwitter ion -** In aqueous solution, the carboxyl group of an amino acid can lose a proton and amino group can accept a proton, giving rise to a dipolar ion which is neutral and amphoteric.

Fibrous proteins - The polypeptide chains run parallel and are held by H-bond or disulphide linkage, insoluble in water.e.g. keratin, myosin	**Globular proteins -** Polypeptides coil around to give a spherical shape, soluble in water.e.g. insulin, albumins

- **Structure and shape of proteins :**

Primary structure - specific sequence of amino acids.	**Secondary structure -** Shape in which a polypeptide chain exists.

Secondary structure – two types: **α – helix** and **β- pleated** sheet structures

α –helix - : polypeptide chain twisted in to a right handed screw by forming H-bonds between NH group and >C=O group.	**β- pleated** - peptide chains laid side by side and held together by H-bonds.

- **Denaturation of proteins** : Disturbing the secondary and tertiary structures of proteins by heating or changing pH . eg : coagulation of egg white on boiling .
- **Nucleic acids** : Polymer of nucleotides linked by phosphodiester linkage .3’ 5’ linkage .

Nucleotide : Each nucleotide contains N-base, Sugar ,Phosphate.	**Nucleoside :** contains N-base & Sugar.

- **Double helical structure of DNA :** Two strand of DNA coiled around each other and held together by H-bonds between pairs of bases. Such as − C≡G−, and -A =T-
- **Purines** : A and G, **Pyrimidines** : C, U and T

DNA - N-Bases : A,G ,C &T, Double helix, Contains 2-deoxy ribose sugar, Transfer heredity characters.	RNA - N-Bases: A,G, C & U, Single helix, Contains Ribose sugar, Helps in proteins synthesis.

Links for detailed material

Chapter name	**link**
The Solid state	https://drive.google.com/file/d/1YJ3dpCxCseCkZftja2Py6ZGJvakBNqPz/view?usp=sharing
Solutions	https://drive.google.com/file/d/1UuyrZsxHd_3fpZX2bdk72RdNeJM95OR/view?usp=sharing
Electrochemistry	https://drive.google.com/file/d/1DR89mhf38xUrPpluI8AkQt_SH2qZ_lRT/view?usp=drivesdk
Chemical kinetics	https://drive.google.com/file/d/1DOgejG76PIteNODIKe4R0uCgezGGXEoL/view?usp=drivesdk
Surface chemistry	https://drive.google.com/file/d/1fFuUWqPiFHt7gepDlqwOhwN1dsdz5Tbr/view?usp=sharing
P-Block elements	https://drive.google.com/file/d/1ygOX9sqIKZMliWgq1Pmrsndjd5l0vGEH/view?usp=sharing
d & f Block elements	https://drive.google.com/file/d/17jMyijC15y5yHOml_5s9qXOOEcHPFTW5/view?usp=sharing
Coordination chemistry	https://drive.google.com/file/d/1FeqBuih6rLmC_fvrD_iMhQ0UlBSY5atD/view?usp=sharing
Haloalkanes & Haloarenes	https://drive.google.com/file/d/1IvXbiy2iD6ISKbcLa3HfBvy_0LnZl1HG/view?usp=drivesdk
Alcohals, phenols & ethers	https://drive.google.com/file/d/1DY8NyWdNhdDHyh39od9wyOVp340JN3_k/view?usp=drivesdk
Aldehydes, ketones & carboxylic acids	**https://drive.google.com/drive/u/1/folders/18nDzY_MGa9Rl5z8HQ1vI2fSuuqlyRdpG**
Amines	https://drive.google.com/drive/u/1/folders/1FxYQebkBqgwgfnLi5UOuOvj-mYwn4g4M
Biomolecules	https://drive.google.com/file/d/1ET0irPcvK530eGBuDNgnA8kMnnJq6x-r/view?usp=sharing

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