പൊതുവിദ്യാഭ്യാസ
സംരക്ഷണ യജ്ഞം

ജനകീയാസൂത്രണം 2019– '21

ജില്ലാ പഞ്ചായത്ത്, പത്തനംതിട്ട

കൈത്താങ്ങ്

ഹയർ സെക്കന്ററി പരീക്ഷാഫലം ഉയർത്താനുള്ള പദ്ധതി

പ്രത്യേക പഠനസഹായി

CHEMISTRY

പത്തനംതിട്ട ജില്ലാപഞ്ചായത്ത് ഭരണസമിതി

അന്നപൂർണ്ണാദേവി
പ്രസിഡന്റ്

ജോർജ്ജ് മാമ്മൻ കൊണ്ടൂർ
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ആരോഗ്യ വിദ്യാഭ്യാസ സ്റ്റാന്റിംഗ് കമ്മിറ്റി

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സാം ഈപ്പൻ

എസ്. വി. സുബിൻ

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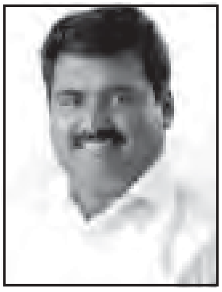
ബിനിലാൽ



അഡ്വ: R.B. രാജീവ് കുമാർ

ബി. സതികുമാരി

വിനീത അനിൽ

ജോൺസൺ പ്രേംകുമാർ
ജില്ലാപഞ്ചായത്ത് സെക്രട്ടറി

ആമുഖം

അന്നപൂർണ്ണാദേവി
(പ്രസിഡന്റ്)

2020 മാർച്ചിൽ നടക്കുന്ന രണ്ടാം വർഷ ഹയർ സെക്കണ്ടറി പരീക്ഷയിലും, തുടർ വർഷങ്ങളിലെ പരീക്ഷകളിലും ജില്ലയിലെ ഹയർ സെക്കണ്ടറി ഫലം മികവുറ്റതാക്കാൻ വേണ്ടി പത്തനംതിട്ട ജില്ലാ പഞ്ചായത്ത്, ജില്ലാ ഭരണകൂടവും പൊതുവിദ്യാഭ്യാസ വകുപ്പുമായി ചേർന്ന് പത്തനംതിട്ട ഡയറ്റിന്റെ അക്കാദമിക പിന്തുണയോടെ, വിവിധ മേഖലകളിൽ നിന്നും അഭിപ്രായങ്ങൾ സ്വീകരിച്ച്, ചർച്ച ചെയ്ത്, ആശയങ്ങൾ ക്രോഡീകരിച്ച്, 2015-16 വർഷം ആവിഷ്കരിച്ചു നടപ്പിലാക്കിയ പദ്ധതിയുടെ മാതൃകയിലും, രാജ്യത്തിന് മാതൃകയായ കേരളാ സർക്കാരിന്റെ പൊതുവിദ്യാഭ്യാസ സംരക്ഷണ യജ്ഞത്തിന്റെ ഭാഗമായും, ‘കൈത്താങ്ങ്‘ എന്ന പേരിൽ ഒരു തുടർ പദ്ധതി തയ്യാറാക്കി.

ഇതിൻറെ ഒന്നാം ഘട്ടം എന്ന നിലയ്ക്ക് പഠനത്തിൽ പിന്നോക്കം നിൽക്കുന്ന വിദ്യാർഥികൾക്കായി, 15 വിഷയങ്ങളിൽ അടിസ്ഥാന പാഠഭാഗങ്ങൾ ഉൾപ്പെടുത്തി ‘കൈത്താങ്ങ്’ എന്ന പേരിൽ തന്നെ ഒരു പഠന സഹായി രണ്ടാംവർഷ ഹയർ സെക്കണ്ടറി വിദ്യാർഥികൾക്കായി സജ്ജമാക്കിയിരിക്കുന്നു.

രക്ഷിതാക്കളും, വിദ്യാർത്ഥികളും, അദ്ധ്യാപകരും ഒരുമിച്ചുനിന്നുള്ള ’കൈത്താങ്ങ്’ പദ്ധതി നമ്മുടെ ജില്ലയിലെ ഹയർ സെക്കൻഡറി പരീക്ഷാഫലം മെച്ചപ്പെടുത്തും എന്ന് പ്രത്യാശിക്കാം.

വിശ്വസ്തതയോടെ

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കൈത്താങ്ങ് അക്കാദമിക കൗൺസിൽ

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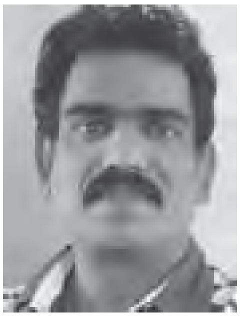

രാജേഷ് S. വള്ളിക്കോട്
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അസിസ്റ്റൻറ് ജില്ലാ കോഡിനേറ്റർ)

പി. ആർ. ഗിരീഷ്.
(എച്ച്. എസ്. എസ്. ടി. ഗവ.ബോയ്സ്
എച്ച്.എസ്.എസ്, അടൂർ)

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(ലക്ചറർ, ഡയറ്റ്, പത്തനംതിട്ട)

മോണിറ്ററിംഗ് സമിതി

1. ജില്ലാ പഞ്ചായത്ത് പ്രസിഡൻറ്
2. ജില്ലാ കളക്ടർ
3. ജില്ലാ പഞ്ചായത്ത്വിദ്യാഭ്യാസ – ആരോഗ്യ സ്റ്റാൻഡിങ് കമ്മിറ്റി ചെയർപേഴ്സൺ
4. ജില്ലാ പഞ്ചായത്ത് വിദ്യാഭ്യാസ– ആരോഗ്യ സ്റ്റാൻഡിങ് കമ്മിറ്റി അംഗങ്ങൾ
5. ജില്ലാ പഞ്ചായത്ത് അംഗങ്ങൾ
6. ജില്ലാ പഞ്ചായത്ത് സെക്രട്ടറി
7. ഹയർസെക്കൻഡറി റീജിയണൽ ഡെപ്യൂട്ടി ഡയറക്ടർ
8. ഹയർസെക്കൻഡറി ജില്ലാ കോർഡിനേറ്റർ
9. ഹയർസെക്കണ്ടറി അസിസ്റ്റൻറ് ജില്ലാ കോർഡിനേറ്റർ
10. പൊതു വിദ്യാഭ്യാസ സംരക്ഷണ യജ്ഞം ജില്ലാ കോർഡിനേറ്റർ
11. ജില്ലാ കോർഡിനേറ്റർ എസ്.എസ്. കെ
12. പ്രിൻസിപ്പാൾ, ഡയറ്റ്, പത്തനംതിട്ട.
13. നിർവഹണ ഉദ്യോഗസ്ഥൻ
14. ശ്രീമതി. ജോളി ഡാനിയേൽ, പ്രിൻസിപ്പാൾ, ഗവ. എച്ച്. എസ്. എസ്, ചിറ്റാർ.
15. ശ്രീമതി. പ്രീത.സി. ആർ, പ്രിസിപ്പാൾ, SVGV HSS, കിടങ്ങന്നൂർ.
16. പി. ആർ. ഗിരീഷ്, HSST ഗവ. ബോയ്സ് HSS, അടൂർ. (അദ്ധ്യാപക പ്രധിനിധി & കൺവീനർ)

1. THE SOLID STATE

Based on structural features solids are classified in to two. Crystalline solids and amorphous solids.

Crystalline solids	**Amorphous solids**
Long range order	Short range order
Sharp melting point	No sharp melting point
Anisotropic in nature (Physical properties are different in different directions.)	Isotropic in nature (Physical properties are the same in all directions.)

Crystalline solids are classified into four.

ionic solids	covalent solids	Molecular solids	metallic solids
Eg; NaCl	Diamond	ice, wax, I_2	Metals

Crystal lattice : The three dimensional arrangement of constituent particles in a crystal is called crystal lattice or space lattice.

Unit cell : The smallest repeating unit in a crystal lattice is called unit cell.

Number of atoms in a unit cell:

i)Primitive (or simple) unit cell – 1 (particles at all the corners)

ii) Face centred unit cell – 4 (particles at all corners and centre of each faces)

iii) Body centred unit cell – 2 (particles at all corners and at the centre)

Close packing in three dimensions:

(i) Hexagonal close packing (hcp): The AB, AB …pattern of arrangement of constituent particles in crystal. Zn, Cd etc possess hcp structure.

ii) Cubic close packing (ccp) or face centred cubic (fcc) : The ABC, ABC. .pattern of arrangement of particles in crystal. Cu, Ni etc possess ccp structure.

Void : The vacant space in a crystal lattice is called void.

The void enclosed by 4 particles in tetrahedral manner is tetrahedral void.	The void enclosed by 6 particles in octahedral manner is octahedral voids.

Packing efficiency = $\frac{\text{Volume occupied by spheres x 100}}{\text{Total volume of unit cell.}}$

Packing efficiency of simple cubic lattice – 52.4% , Body centred cubic – 68% and hexagonal close packing - 74%

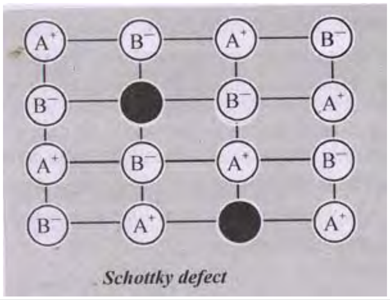
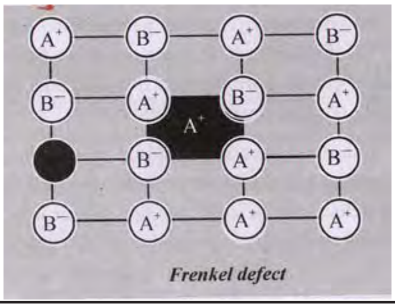
Density of a crystal

$d = zM / a^3 N_A$ (z - number of unit cell, M-atomic mass, a-edge length, N_A- Avogadro number)

Imperfection or defect in solids : Any deviation from the ordred arrangement of constituent particles in a crystal is called imperfection. If the imperfection is localised in the vicinity of only few particles, it is called point defect. Point defects are of three types- Stoichiometric defect, Non - Stoichiometric defect, impurity defect.

Stoichiometric defects : These are of two types – vacancy defect and interstitial defect.

Ionic solids exhibits Schottky defect and Frenkel defect.

Schottky defect	Frenkel defect
Arises due to the missing of equal number of +ve and –ve ions.	Arise due to the shifting of one of the ions to the interstitial site.
Density decreases	Density remains the same
Shows AgBr, NaCl, KCl etc	Shows AgBr, AgCl, ZnS etc.
	

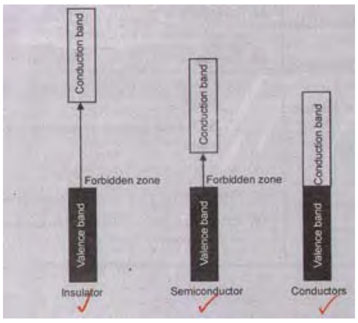
F-centre : The electron entrapped in the anion vacancy of a crystal. It impart colour to the crystal.

Eg : When NaCl is heated in an atmosphere of sodium, yellow colour is formed. Similarly, excess potassium in KCl makes it violet and excess Li in LiCl makes it pink.

When ZnO is heated, it loses oxygen reversibly and turns yellow in colour.

ZnO <===> Zn^{2+} + O +2e. Zn^{2+} occupy the interstitial position and electrons enters in the nearest interstitial position (metal excess defect due to excess cation)

Electrical properties of solids: In metals (conductors) the Valence band (VB) is overlapped with conduction band (CB). In semiconductors (Si,Ge) there is a small energy gap (forbidden energy gap) between VB and CB. Thermal excitation increases its conductivity. In insulators, the energy gap is very large.



Magnetic properties: Based on magnetic properties solids are classified into

Ferromagnetic substance	**anti ferromagnetic substances**	**Ferrimagnetic substances**
Magnetic moments are in one direction.	magnetic moments are aligned in opposite directions in equal proportions.	magnetic moments are aligned in unequal proportions.
Eg: Fe, Co, Ni	MnO, MnO_2	Fe_3O_4
↑ ↑ ↑ ↑ ↑	↓ ↑ ↓ ↑ ↓ ↑ ↓	↓ ↓ ↓ ↑ ↓ ↓ ↑ ↑

2. SOLUTIONS

$$\text{Molarity} = \frac{\text{Mass of solute x 1000}}{\text{Molecular mass of solute x Volume in litre}}$$

$$\text{Molality} = \frac{\text{Mass of solute x 1000}}{\text{Molecular mass of solute x Mass of solute in gram}}$$

Molality is independent of temperature.

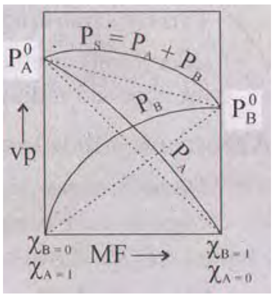
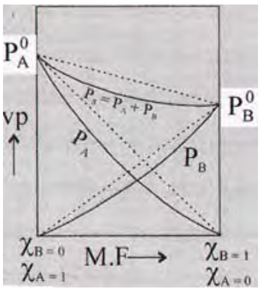
Henry's law : The solubility of a gas in a liquid is directly proportional to the pressure of the gas at constant temperature. *Applications* : Scuba divers use a mixture of air and helium to avoid bends, People living at high altitude lacks oxygen in their blood (anoxia).

Raoult's law : The vapour pressure of a solution containing a non volatile solute is directly proportional to the mole fraction of the solvent.

Ideal solution : A solution which obeys Raoult's law at all temperatures and concentrations. ΔHmix and ΔVmix are zero for ideal solutions.

Eg: benzene and toluene, n hexane and n heptane, ethyl bromide and ethyl iodide.

Non ideal solutions : Does not obey Raoult's law, ΔHmix $\neq 0$, ΔVmix $\neq 0$.

Non ideal solution showing Positive deviation	Non ideal solution showing Negative deviation
 Shown by liquid pairs for which A-B interaction is weaker than A-A and B-B interactions. Eg : water and alcohol Acetone and alcohol	 Shown by liquid pairs for which A-B interaction is stronger than A-A and B-B interactions. eg : Water and nitric acid acetone and aniline

Colligative properties :

The properties of a solution which depends only on the number of solute particles.

Eg : (i) Relative lowering of vapour pressure

(ii) Elevation of boiling point : The rise in the boiling point of a liquid due to the dissolution of a non volatile solute is elevation of boiling point.

$\Delta Tb = Kb.m$ (Kb is molal elevation constant or ebullioscopic constant). Kb is defined as the elevation of boiling point produced when molality of the solution is unity.

(iii) Depression of freezing point : The fall in the freezing point of a liquid due to the dissolution of a non-volatile solute is called depression of freezing point.

$\Delta Tf = Kf.m$ (Kf is molal depression constant or cryoscopic constant). Kf is defined as the depression of freezing point produced when molality of the solution is unity.

(iv) Osmotic pressure : The excess pressure applied on the solution to prevent osmosis is called osmotic pressure.

Isotonic solutions : Different solutions having same osmotic pressure.

Colligative property	Equation for colligative property	
Relative lowering of VP	$\frac{P^o_S - P_S}{P^o_S} = X_{solute}$	$M_B = \frac{P^o_A.W_B.M_A}{W_A(P^o_A - P_A)}$
Elevation of BP	$\Delta T_b = K_b.\, m$	$M_B = \frac{K_b.W_B.1000}{\Delta T_b.W_A}$
Depression of FP	$\Delta T_f = K_f.\, m$	$M_B = \frac{K_f.W_B.1000}{\Delta T_f.W_A}$
Osmotic pressure	$\pi = CRT$	$MB = \frac{W_B.R.T}{\pi V}$

Osmotic pressure is used to measure molecular mass of proteins and other macromolecules because (i) osmotic pressure is measured at room temperature (ii) molarity is used instead of molality.

Anti freeze solutions are used in automobile radiators to prevent the freezing of water(depression of freezing point).

NaCl and $CaCl_2$ is used to remove ice from road because it depress the freezing point of water.

Abnormal molar mass : The molar mass values higher or lower than the normal values are called abnormal molar mass. It arises due to (i) molecular association (ii) molecular dissociation.

Vant Hoff factor i = $\frac{\text{Normal molar mass}}{\text{abnormal molecular mass.}}$

i>1, the solute under goes dissociation. i<1, the solute undergoes association.

When NaCl is dissolved in water, dissociation takes place.So the number of effective particles increases, the colligative propertiers increases and hence molecular mass will be lower.
A solution of acetic acid in benzene undergoes association and hence molecular mass will be higher.
Azeotropes : Constant boiling liquid mixtures which distilled without any change in their composition are called azeotropes.
Maximum boiling azeotropes : These are non-ideal solutions showing negative deviation.
Minimum Boiling azeotropes : These are non ideal solutions showing positive deviation.

Reverse osmosis : When pressure greater than osmotic pressure is applied on solution the solvent molecules flow from solution to pure solvent. This phenomenon is reverse osmosis
eg: Desalination of sea water.

3. ELECTRO CHEMISTRY

Galvanic cell or voltaic cell: A device which convert chemical energy to chemical energy eg; Daniel cell

Standard electrode potential (E^0) : The electrode potential measured at standard conditions.ie at 298K,1 atm pr,1 molar concentration.

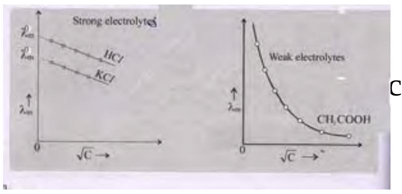
Standard hydrogen electrode (SHE): The reference electrode used to measure single electrode potential . Its potential is assumed to be zero. It consist of a platinum wire dipped in HClof 1 molar concentration. Hydrogen gas at 1 atm. is passed through the solution. The electrode can be represented as Pt, H_2/H^+(1M)

Nernst equation : The relation connecting electrode potential and concentration of the electrolyte is Nernst equation.

$E=E^0+\frac{0.0591}{n}\log[M^{n+}]$ For Daniel Cell, $E=E^0+\frac{0.0591}{n}\log\frac{[Cu^{2+}]}{[Zn^2]^+}$

Variation of conductivity with dilution : Conductivity of a the solution decreases with increase in dilution.

Variation of molar Conductivity with dilution : Molar Conductivity (λm) increases with increase in dilution.



For strong electrolytes (KOH, NaOH etc):

During dilution , the interionic interaction decreares, the mobility creases and hence λm increases.

For weak electrolytes (CH_3COOH, NH_4OH):

During dilution, the degree of ionisation increases, the number of ions increases and hence λm increases.

Kohlrausch's law : Molar conductance at infinite dilution of a strong electrolyte is equal to the sum of molar ionic conductances of the cation and anion at infinite dilution.

eg : $\lambda^o m\ NaOH = \lambda^o m\ Na^+ + \lambda^o m\ OH^-$

Application : i) Used to calculate λ^om of weak electrolytes. ii) To calculate degree of dissociation of weak electrolytes.

Debye Huckel Onsagar equation is $\lambda m= \lambda^o m -b \sqrt{c}$

Limiting molar conductance (λ^om) : For strong electrolytes, the molar conductivity increases with dilution and reaches a maximum value when concentration approaches zero. This is known as λ^om.

Primary cell - A cell which cannot be used again by recharging. These are not rechargable.
eg: Drycell, Mercury cell

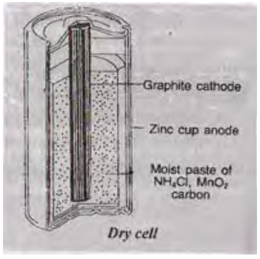
Secondary cell: A cell which can be used again and again by recharging .

eg: Lead storage cell, Nicad cell

Dry Cell

Anode reaction : $Zn \rightarrow Zn^{2+} +2e^-$

Cathode : $MnO_2+NH_4^++e^- \rightarrow Mn_2O_3 + NH_3+ H_2O$



Dry cell

Lead Storage Cell

Anode : Lead **Cathode :** Lead coated with Lead Dioxide **Electrolyte :** Sulphuric acid

Anode reaction : $Pb + SO_4^{2-} \rightarrow PbSO_4 + 2e^-$

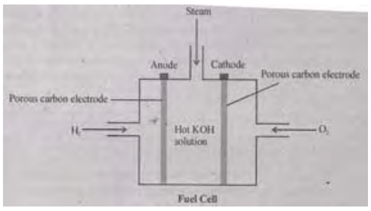
Cathode reaction : $PbO_2 + SO_4^{2-} + H^+ + 2e \rightarrow PbSO_4 + H_2O$

Cell reaction : $Pb + PbO_2 + H_2SO_4 \rightarrow PbSO_4 + H_2O$

Use of adding water to batterry : During recharging, the reaction is reversed and water is used up.

Fuel Cell : A cell in which chemical energy produced by combustion of fuels is converted to electrical energy .

eg: H_2-O_2 fuel cell



Cathode & Anode : Carbon

Electrrolyte : NaOH or KOH

Fuels : H_2 & O_2

Cell reaction : $2H_2 + O_2 \rightarrow 2H_2O$

Advantage of fuel cell : i, Free from pollusion ii, electrodes are not affected iii) provides contineous energy.

Corrosion : The destruction of a metal as a result of its contact with atmosphere.

eg: Rusting of iron, turnishing of silver etc.

Prevention of corrosion : i) Barrier protecrtion ii) Sacrificial protection iii) Cathodic protection

Rust is hydrated iron (III) Oxide-$Fe_2O_3 . x H_2O$

Coating of iron objects with Zinc is called galvanisation

Notes:

4. CHEMICAL KINETICS

Average rate of a reaction $= \frac{\text{change in concentration of reactant / product}}{\text{Time interval}}$

Instantaneous rate : Change in concentration of reactant or product at a particular instant.

For the reaction $A + B \longrightarrow C$, Average rate $= \frac{-\Delta[A]}{\Delta t}$ or $\frac{-\Delta[B]}{\Delta t}$ or $\frac{\Delta[C]}{\Delta t}$

Instantaneous rate $= \frac{-d[A]}{dt}$ or $\frac{-d[B]}{dt}$ or $\frac{d[C]}{dt}$

Rate constant (k) of a reaction is equal to the rate of a reaction when concentrations of reactants are unity.
For the reaction $A + B \rightarrow C$, rate = $k[A][B]$. This equation is called rate law or rate equation.

Order	Molecularity
It is sum of powers of concentration . terms in the rate equation	It is sum of number of molecules takespart in a reaction
It may be zero,fraction or whole number	Always whole number .

Factors affecting rate of a reaction:
i) concentration of reactant ii) temperature iii) catalyst

Unit of rate constant (k)

Order	0	1	2
Unit of k	$Mol.L^{-1}.s^{-1}$	s^{-1}	$Mol^{-1}.L.s^{-1}$

Order of reactions :

Zero order	$N_2 + 3H_2 \longrightarrow 2NH_3$, $H_2 + Cl_2 \longrightarrow 2HCl$
First order	$NH_4NO_2 \longrightarrow N_2 + H_2O$, radioactive decay
Second order	$H_2 + I_2 \longrightarrow 2HI$, $2NO_2 \longrightarrow 2NO + O_2$
Fractional order	$CH_3CHO \longrightarrow CH_4 + CO_2$; order = 3/2
Pseudo order	Inversion of sugar, hydrolysis of ester

Molecularity of reaction

Uni molecular	$H_2O_2 \longrightarrow H_2O + ½ O_2$
Bi molecular	$H_2 + I_2 \longrightarrow 2HI$

Zero order reaction : Rate does not depends on the concentration of reactants.

Pseudo order reaction: Reaction which appears to be higher order but follow low order kinetics.

Inversion of sugar or hydrolysis of ester is a pseudo order reaction because in these reactions water is present in large excess and hence concentration of water remains a constant. Therefore, rate depends only on the concentration of sugar/ester.

Integrated rate equation and half lfe of reaction

Order	Rate equation	Half life
Zero	$k = \frac{[A]_0-[A]}{t}$	$t_{1/2} = \frac{[A]_0}{2k}$
First	$k = \frac{2.303}{t} \log \frac{[A]_0}{[A]}$	$t_{1/2} = \frac{0.693}{k}$

Half life of a reacton : The time required to complete half of a chemical reaction. Half life of a first order reaction is independent of initial concentration of the reactant, $t_{1/2} = \frac{0.693}{k}$

Arrhenius equation : The relation connecting temperature and rate of constant

$K=Ae^{-Ea/RT}$ or $\log \frac{k_2}{k_1} = \frac{Ea}{2.303\ RT}\left[\frac{T_2 - T_1}{T_1 \quad T_2}\right]$

Activation energy : The additional energy supplied to the reactant molecules for an effective collision. Activation energy = Threshold energy - Average energy of reactant molecules.

Effect of catalyst on rate of reaction: The function of a catalyst is to provide an alternate path of reaction with lower activation energy.

5. SURFACE CHEMISTRY

Adsorption : The process in which molecules, atomic or ionic species of one substance get accumulated at the surface of another.

Adsorption is a surface phenomenon.	**Absorption** is a bulk phenomenon.
Eg. Coal adsorb gas.	Sponge absorbs water.

Adsorption is classified into two.

Physical adsorption	Chemical adsorption
Not very specific in nature	Highly specific in nature
Adsorbent and adsorbate are	Adsorbent and adsorbate are
held together by weak forces.	held together by chemical bonds
It is reversible.	It is irreversible

Freundlich adsorption isotherm: The extent of adsorption (x/m) with pressure (p) is expressed by the equation $x/m = kp^{1/n}$ is called Freundlich adsorption isotherm. k and n are constants. *Drawback* - It fails at high temperature. *Application of adsorption* : (i) activated charcoal is used in gas masks (ii) ferric hydroxide sol is used against arsenic poisoning.

Catalysis : Types of catalysis

Homogeneous catalysis	Heterogeneous catalysis
Reactants and catalyst are I same phase. Eg. $2\ SO_2+O_2 \rightarrow 2\ SO_3$(Nitric oxide catalyst is gas)	Reactant and catalyst are in different phases. eg :$2\ SO_2 + O_2 \rightarrow 2\ SO_3$ (V_2O_5 catalyst is solid)

Nature of solid catalysts :	
Activity	**selectivity**
Ability to speed up a chemical reaction.	Ability to direct a reaction to yield a particular product. $CO + H_2 \rightarrow CH_4 + H_2O$ (Ni catalyst) ; $CO + H_2 \rightarrow HCHO$ (Cu catalyst)

Shape selective catalyst : The catalytic action that depends upon the pore structure of the catalyst and the size of the reactant and product molecule is called shape selective catalysis. eg. zeolite.

Enzymes are biological catalysts. Eg. invertase, maltase, pepsin etc.

Characterestics of enzymes.

i) enzymes are specific in action. ii) The optimum temperature for enzymatic action is 30^0 to 60^0C. iii) They show maximum activity near pH 7.

Lock and key mechanism of enzymatic action:

Enzyme + substrate → enzyme substrate complex → enzyme product complex → product + enzyme.

Enzyme catalysed reactions : i) protein to amino acid by pepsin ii) starch to glucose by amylase

Colloids : ***Types of colloids***

Name of colloid	Dispersed phase	Dispersed medium	Example
Sol	Solid	Liquid	Paint, muddy water
Gel	Liquid	Solid	Cheese, butter
Emulsion	Liquid	Liquid	Milk, hair cream

Lyophilic colloid	**Lyophobic colloid**
Reversible	Irreversible
More stable	Less stable
Can be easily prepared	Cannot be easily prepared
Eg. starchy water, milk	Gold sol, platinum sol

Multi molecular colloid	**Macro molecular colloids**	**Associated colloid**
Aggregate of atom or molecules	Particles are of big size	Behaves as electrolyte at lower concentration and colloid at higher concentration
Eg. gold sol, sulphur sol	Sols of starch, protein	Soap, detergent

Micelles : The particles in associated colloid are called micelles.

Preparation of colloids:

Peptization : The method of converting a precipitate into a colloid by adding a suitable electrolyte .

Bredig's arc method : Gold, silver sols are prepared by this method. The metal is vapourised by the arc and the vapour condenses and solidifies into particles of colloidal size.

Purification of colloids : I) ***Dialysis :*** The process of removing the impurities from a sol by means of diffusion through a semi permeable membrane is called dialysis. Ii) ***Electro dialysis :*** The movement of ions across the membrane can be enhanced by applying an electric field.

Properties of colloids :

i)**Tyndall effect** :

The phenomenon of scattering of light by colloidal particles is called Tyndall effect.

Application - in the construction of ultra microscope, blue colour of sky etc.

ii) **Brownian movement** : the zig zag movement of colloidal particles is called Brownian movement.

iii**) Electrophoresis**: The movement of colloidal particles towards cathode or anode under the influence of an electric field. Movement towards cathode is cataphoresis and towards anode is anaphoresis.

Coagulation or flocculation : The phenomenon of causing precipitation of colloidal particles by the addition of electrolyte.

Hardy Schulze rule : It states that higher the valency of the flocculating ion greater will be its precipitating power. Eg. In the coagulation of –ve sol, the precipitating power is $Al^{3+} > Mg^{2+} > Na^{+}$. In the coagulation of +ve sol the precipitating power is $PO_4^{3-} > SO_4^{2-} > Cl^-$.

Emulsion : A colloid in which both the dispersed phase and dispersion medium are liquid. Eg milk.

Water in oil type emulsion	**Oil in water type emulsion**
Dispersed phase is water	Dispersed phase is oil
Dispersion medium is oil	Dispersion medium is water
Eg. Butter, cod liver oil	Eg. milk

Uses of colloids : i) Colloidal medicines are more effective because they have large surface area and therefore easily assimilated. ii) Cottrell precipitator : When smoke is passed through charged plates fitted in a precipitator, coagulation takes place and carbon particles get precipitated. iii) Artificial rain is produced by spraying oppositely charged ions over cloud. iv) Deltas are formed when muddy water (colloid) reaches sea water (electrolyte).

Protective colloid : The stable lyophilic colloid used to stabilize unstable lyophobic colloid is called protective colloid. The protective power is expressed in gold number,.

Notes:

6. GENERAL PRINCIPLES AND ISOLATION OF ELEMENTS

Minerals - Compounds of elements found in earths crust
Ore - Mineral from which metal can be extracted

Metal	Ore	Composition
iron	Haematite	Fc_2O_3
copper	Malachite	$CuCO_3.Cu(OH)_2$
Aluminium	Bauxite	$Al_2O_3.2H_2O$
ZincCalamine	$ZnCO_3$	

Concentration of ore

1. **Magnetic Separation:** Either ore or impurity must be magnetic. The powdered ore is dropped over a belt moving around two rollers one of which is magnetic. The magnetic part will collect near the magnetic roller.
2. **Froth floatation :** For sulphide ores
   Principle : The ore is wetted by oil and impurity by water. The powered ore is mixed with water, collectors (pine oil) and stabilizers (cresols) and agitated. Froath is formed and ore particles move up to the surface along with the froath.
3. **Leaching :** Chemical method eg:- Alumina (Bauxite) - powered alumina is treated with con NaOH. Sodium aluminate is formed. Impurities are filtered off. CO_2 is passed through the fitrate. Hydrated alumina gets precipitated. It is filtered and ignited to get pure alumina.

   Calcination: Ore is heated in limited supply of air. Oxyge is not used up
   $ZnCO_3 \rightarrow ZnO + CO_2$
   Roasting : ore is heated in excess oxygen
   Oxygen is used up
   $2ZnS + 2O_2 \rightarrow 2ZnO + 2SO_2$

Ellingham Diagram : A graph showing the variation of $\triangle G^0$ for formation of oxide against temperature. This is used to find the reducing agent and temperature for a metallurgical reduction

Refining of crude metal

Distillation	Eg:- Zn, Hg	metals with low b.p
Liquation	Pb, Sn	metals with low m.p.
Electrolyticre fining	Cu	impure metal anode pure metal cathod
Zone refining	Ge, Ga, Si	impurities are more soluble in the melt
Van-Arkel Method	Ti, Zr, Th	$Zr + 2I_2 \rightarrow ZnI_4(g)$ $ZnI_4(g) \rightarrow Zn + 2I_2$
Mond process	N1	$Ni + 4CO \rightarrow Ni(CO)_4(g)$ $Ni(CO)_{4(g)} \rightarrow Ni + CO$

Extraction of Fe

ore - Haematite Fe_2O_3
Reducing agent - coke
Flux - lime stone

ore, coke and lime stone is introduced to blast furnance

Combustion Zone $C + O_2 \rightarrow CO_2$
Fusion Zone $CO_2 + C \rightarrow 2CO$
Middle Zone $CaO + SiO_2 \rightarrow CaSiO_3$
reduction Zone $Fc_2O_3 + CO_2FeO + CO_2$
$FeO + CO \rightarrow Fe + CO_2$

Pig iron : impure iron obtained from blast furnance containing 4% C, and other impurities like S, Si, P, Mn etc.

Cast iron : Pig iron is melted with scrap iron and coke. It is hard and brittle. Contains 3% carbon.

Wrought iron : Purest form of iron. Cast iron is heated with haematite to obtain wrought iron.

Extraction of Aluminium - Hall Herault process

Alumina is fused with cryolite and CaF_2 and electrolysed using carbon anode. Carbon lining of the tank acts as cathode. Al is obtained at the cathode.

Cryolite and CaF_2 - To lower m.p and icrease conductivity.

7. P-BLOCK ELEMENTS

Anomalous property of first element - due to small size, high electronegativity high ionisation enthalpy and absence of d orbitals.

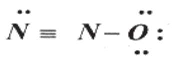
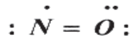
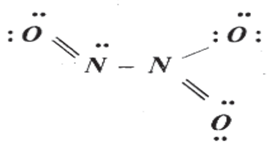
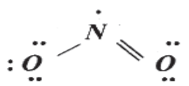
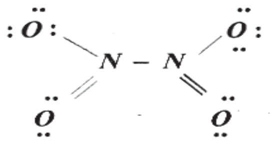
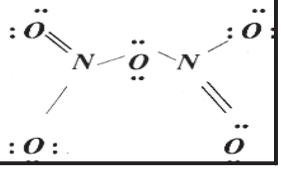
- N can not form pentahalide due to the absence of d orbitals.
- N is less reactive due to high bond dissociation enthalpy
- Manufacture of Ammonia - Haber process.

  $N_{2(g)} + 3H_{2(g)} \leftrightarrows 2NH_{3(g)}$ $\triangle = {}^{-}46.1\ kjmol^{-1}$

  200 atm pressure, 700k and iron/iron oxide catalyst

Uses of Ammonia (1) Manufacture of fertilizers, HNO_3
(2) Refrigerent and Laboratory reagent

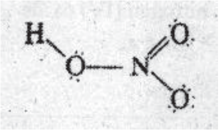
Oxides of N

	Name of oxide	Formula	Oxidation state of nitrogen	Preparation	Structure
1.	Nitrous oxide or nitrogen (I) oxide	N_2O	+1	$NH_4NO_3 \longrightarrow N_2O + 2H_2O$	
2.	Nitrogen monoxide or nitrogen (II) oxide	NO	+2	$2NaNO_2 + 2FeSO_4 + 3H_2SO_4 \longrightarrow Fe_2(SO_4)_3 + 2NaHSO_4 + 2H_2O + 2NO$	
3.	Dinitrogen trioxide or nitrogen (III) oxide	N_2O_3	+3	$2NO + N_2O_4 \xrightarrow{250K} 2N_2O_3$	
4.	Nitrogen dioxide or nitrogen (IV) oxide	NO_2	+4	$2Pb(NO_3)_2 \xrightarrow{673K} 2PbO + 4NO_2 + O_2$	
5.	Dinitrogen tetroxide or nitrogen (IV) oxide:	N_2O_4	+4	$\underset{brown}{2NO_2} \underset{Heat}{\overset{cool}{\rightleftharpoons}} \underset{colourless}{N_2O_4}$	
6.	Dinitrogen pentoxide or nitrogen (V) oxide:	N_2O_5	+5	$4HNO_3 + P_4O_{10} \longrightarrow N_2O_5 + 4HPO_3$	

preparation of HNO_3 - ostwald process

Mixture of NH_3 and O_2 is passed over pt gauze at 500k and 9 bar pressure. No is formed. It is oxidised NO_2 and dissolved in water to form HNO_3.

Structure



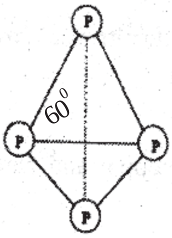
Nitric acid containing dissolved NO_2 is called fumingnitric acid

Uses of HNO_3

1. Manufacture of fertilizers
2. Manufacture of explossives like nitroglyerine, trinitrotoluene (TNT)
3. 1:3 con HNO_3 and con HCI is called acquaregia which is used to dissolve gold

Phosphorous

White phosphorous - highly reactive, less stable, readily catchesfire in air. Because bond angle (p-p-p) is 60^0 and hass greater angular strain. To avoid contact with air it is kept in water

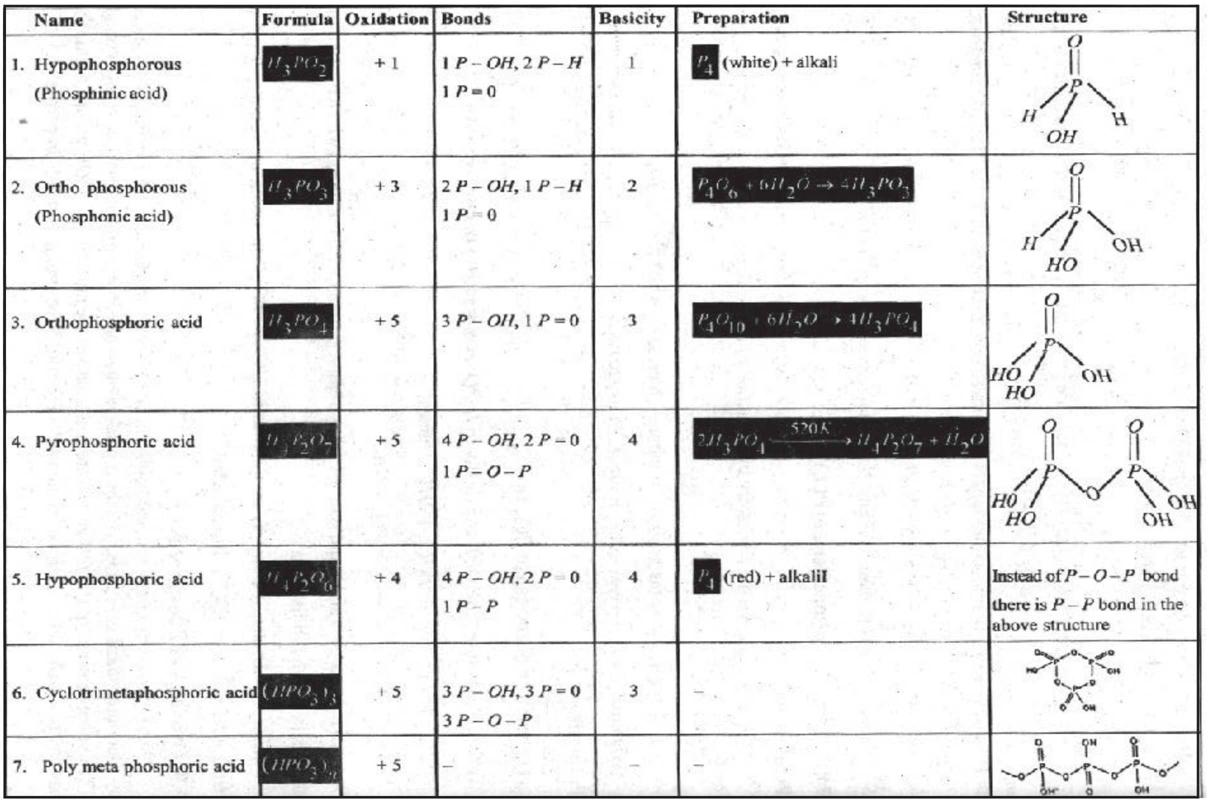


Phosphine (PH_3)

It is prepared by the action of NaOH with white phosphorous

Uses: a. To produce Holmes signal b. In smoke screens

PCl_5 sp^3d hybridisation, trigonal bipyramidal bond angles 120^0 and 90^0.
axial bonds are longer than equitorial bonds. So it is very reactive



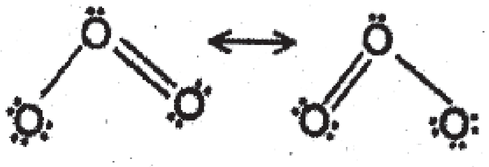
Name	Formula	Oxidation	Bonds	Basicity	Preparation	Structure
1. Hypophosphorous (Phosphinic acid)	H_3PO_2	+ 1	$1\ P-OH, 2\ P-H$ $1\ P=0$	1	P_4 (white) + alkali	
2. Ortho phosphorous (Phosphonic acid)	H_3PO_3	+ 3	$2\ P-OH, 1\ P-H$ $1\ P=0$	2	$P_4O_6+6H_2O \rightarrow 4H_3PO_3$	
3. Orthophosphoric acid	H_3PO_4	+ 5	$3\ P-OH, 1\ P=0$	3	$P_4O_{10}+6H_2O \rightarrow 4H_3PO_4$	
4. Pyrophosphoric acid	$H_4P_2O_7$	+ 5	$4\ P-OH, 2\ P=0$ $1\ P-O-P$	4	$2H_3PO_4 \xrightarrow{520K} H_4P_2O_7+H_2O$	
5. Hypophosphoric acid	$H_4P_2O_6$	+ 4	$4\ P-OH, 2\ P=0$ $1\ P-P$	4	P_4 (red) + alkalil	Instead of $P-O-P$ bond there is $P-P$ bond in the above structure
6. Cyclotrimetaphosphoric acid	$(HPO_3)_3$	+ 5	$3\ P-OH, 3\ P=0$ $3\ P-O-P$	3	–	
7. Poly meta phosphoric acid	$(HPO_3)_n$	+ 5	–	–	–	

Oxygen Family

H_2O is aliquid while H_2S is a gas due to hydrogen bonding in water

Ozone: Ozone is prepared by passing silent electric discharge through oxygen

$3O_2 \rightarrow 2O_3$

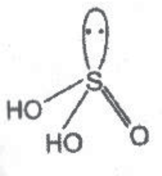


Ozone oxidises iodide to Iodine. The liberated I_2 can be titrated against sodium thiosulphate. Hence ozone is estimated.

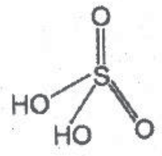
uses of ozone a. germicide and disinfectant
b. bleaching vegetable colouring matter
c. Oxidising agent

Oxoacids of sulpher (Bascity -2)

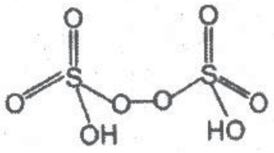
Sulphurous acid : H_2SO_3
Sulphuric acid : H_2SO_4
Peroxodis sulphuric acid : $H_2S_2O_8$
Oleum : $H_2S_2O_7$



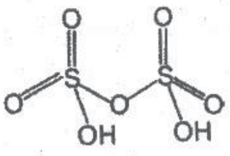
H_2SO_3



H_2SO_4



Peroxodisulphuric acid ($H_2S_2O_8$)



Oleum ($H_2S_2O_7$)

Manufacture of sulphuric acid -contact process

a) Sulpher is oxidised to SO_2
b) SO_2 is oxidised to SO_3 at 720k, 2 bar pressure and V_2O_5 catalyst is used.
c) SO_3 is absorbed in H_2SO_4 to form oleum
d) Olecum is diluted with H_2O to get sulphuric acid

$S + O_2 \rightarrow SO_2$

$2SO_2 + O_2 \rightarrow 2SO_3$

$SO_3 + H_2SO_4 \rightarrow H_2S_2O_7$ (oleum)

$H_2S_2O_7 + H_2O \rightarrow 2H_2SO_4$

Halogen family

Fluorine is the strongest oxidising agent

The strength of hydrohalic acids increases in the order HF < HCI < HBr < HI because bond length increases

inter halogen compounds:

a) compounds formed between two different halegens
b) formula XX^1, XX^1_3, XX^1_5, XX^1_7
c) Eg. C1F, BrF_3, IF_5, IF_7
d) More reactive than halogens because bond dissociation enthalpy is less than halogens.
e) They are all covalent compounds

Noble gases - Less reactive due to stable octet

Xenon ompounds

Noble gases – Less reactive due to stable octet.

Xenon compounds.

XeF_2	$Xe_{(g)} + F_{2(g)} \xrightarrow[1 bar.]{673K} XeF_{2(s)}$.	sp^3d	linear.
XeF_4	$Xe_{(g)} + 2F_{2(g)} \xrightarrow[7 bar]{873K} XeF_4$	sp^3d^2	squareplanar
XeF_6	$Xe(g) + 3F_{2(g)} \xrightarrow[60-70 bar]{573K} XeF_6$	sp^3d^3	distorted octahedral
$XeOF_4$	$XeF_6 + H_2O \longrightarrow XeOF_4 + 2HF$	sp^3d^2	Squire pyramidal
XeO_3	$XeF_6 + 3H_2O \longrightarrow XeO_3 + 6HF$	$sp3$	pyramidal

8. d and f block elements

General electronic configuration of d block elements (n-1) d^{1-10} ns $^{1-2}$

Properties of d block elements

1. variable oxidation states

   Electrons in the (n-1) d and ns orbitals will take part in bonding

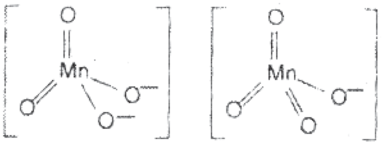
2. Magnetic properties - Due to the presence of unpaired electrons d block elements and their compounds are paramagnetic

   Magnetic moment, M = $\sqrt{n(n+2)}$ where n is the no of unpaired eletrons.

3. Formation of coloured ions-due to d-d electronic transition.
4. Formation of complexes-due to the presence vacant d orbitals
5. catalytic properties - due to variable oxidaion states and ability to form complexes

KM_nO_4 -preparation

Finally powdered pyrolusite mineral is fused with KOH in presence of air. Potassium manganate is formed which on electrolysis gives $KMnO_4$



Manganate ion (green colour) | Permanganae ion (purple colour)

Both the ions are tetrahedral

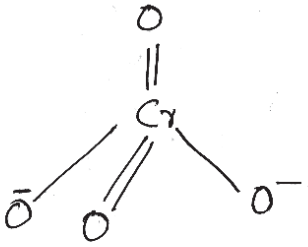
$KMnO_4$ is a powerful oxidising agent

it oxidises (a) iodides to Iodine

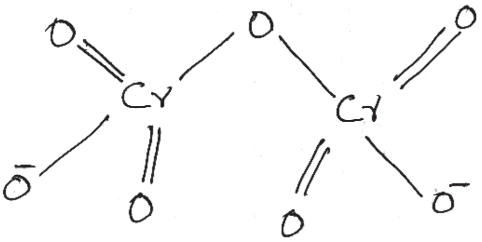
(b) Ferrous to Ferric

$K_2Cr_2O_7$ - Preparation

Finely powdered chromite ore is fused with sodium carbonate. Sodium chromate is formed. It is extracted with water. It is filtered and fitrate is acidified with H_2SO_4 to form sodium dichromate. It is treated with KCI to form potassium dichromate.



Chromate ion (Yellow)



dichromate ion (Orange)

$K_2Cr_2O_7$ is a powerful oxidising agent
It oxidises (a) H_2S to Sulphur
(b) Iodide to Iodine
(c) Ferrous to ferric

f-block elements

1. general electronic configuration of lanthanides
   (Xe) $4f^{1-14}$ $5d^{0-1}$ $6S^2$
2. Most common oxidation state of lanthanides +3
3. Lanthanide contraction

   The steady decrease in the size of atoms of lanthanides with increase in atomic number is called lanthanide contraction. This is due to poor shielding effect of f electrons. Due to lanthanide contraction lanthanides have similar chemical properties, theu occur together in nature and dificult to separate. 4d and 5d series of elements have similar size Zr and Hf have same atomic radic and similar chemical properties. Among hydroxide $La(OH)_3$ is most basic and basicity decreases to $Lu(OH)_3$.
4. use of Lanthanides

   Production of alloys. Eg. Misch metal it is used for making shells. Oxides of lanthanids are catalysts in petroleum cracking.

9. COORDINATION COMPOUNDS

Eg.$[Co(NH_3)_6]Cl_3$
Central metal ion - Co^3+
Ligands - NH_3
Coordination no - 6 - (Secondary valency)
Couter ions - $C1^-$
Primary Valency - 3

Ligands - neutral molecules or ions that are atached to the central metal.
unidentate ligands - ligands which binds to the central metal with a single donor atom
Eg.NH_3, H_2O, CO, CN^-, $C1^-$, OH^-, NO_3^- etc.
bidentate ligands - which have two donour atoms
Eg. CH_2-NH_2 COO^-
$^1CH_2$-NH_2 $^1COO^-$
(ethylene diamine), (oxalate)
Poly dentate ligands -ligand which contains mere than two donour atoms
Eg: EDTA
Chelating ligands - ligands which can form ring structure with the metal
Eg.EDTA, ethylene diamine, oxalate etc.
eg: $[Cu(Cn)_2]^{2+}$

ambidentate ligands -Monodentate ligands which can link through two different donor atoms

Eg: CN^- and NC^-

NO^-_2 and ONO^-

Homoleptic heteroleptic complexes - Complexes having only one type of ligands are homoleptic complexes. Complexes having more than one type of ligands are heteroleptic.

Isomersm in complexes

A. Structural isomerism

(Same formula but different structural arrangement)

1. Ionisaion isomersim

   Same formula but give different ions in solution

   $[Co(NH_3)_5Br] So_4$ $[Co(NH_3)_5So_4]Br$
2. Hydrate isomerism

   Differ in no of water molecules inside and outside the sphere

   Eg:-$[Cr(H_2O)_6 Cl_3$ and $[Cr(H_2O)_5Cl]Cl_2H_2O$
3. Linkage isomerism - due to the presence of ambideatate ligands

   $[Co(NH_3)_3(CN)_3]$ and $[Co(NH_3)_3(NC)_3]$
4. Coordination isomersim

   Due to inter change ligands between anion and cation

   $[Cu ((NH_3)_4] [PtCl_4]$ and $[Pt (NH_3)_4] [CuCl_4]$

B. Stereo isomerism

(Same formula but different spatial arrangement)

1. Geometrical isomersim
2. Optical isomersim

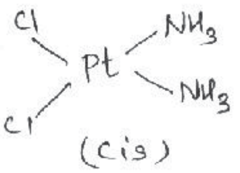
Geometrical isomerism - cistrans isomerism

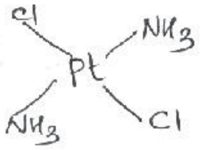
identical ligands occupy adjacet position

- cis isomer

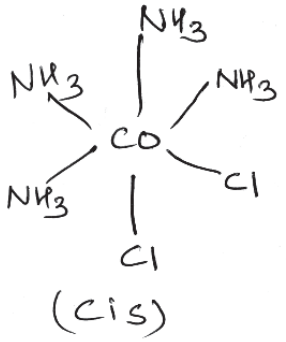
identical ligands occupy opposite position

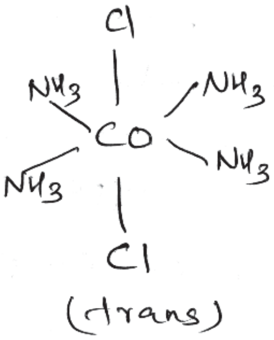
- trans isomer





(trans)



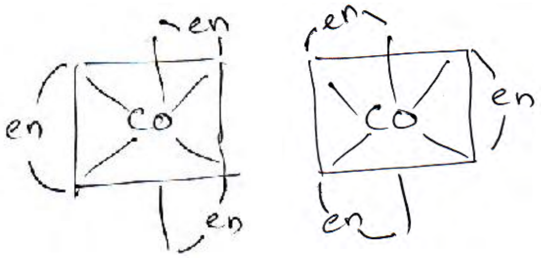


Optical isomerism

Compound differ in optical rotation

Compound rotates plane of polarised light to right dextro compound rotates plane of polarised light to left - leavo

Eg:-$[CO(en)_3]^{3+}$



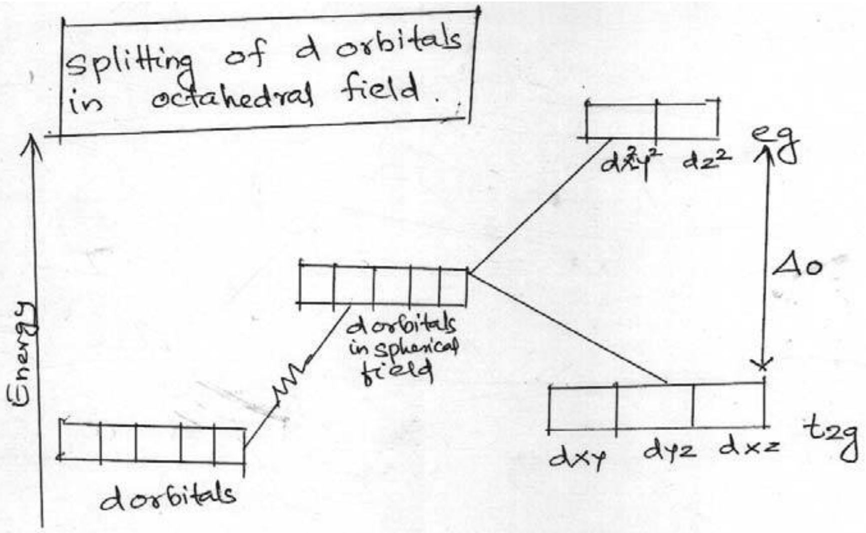
d and l isomers are non-super imposible mirror images and are called enantiomers.

Werner's Theory

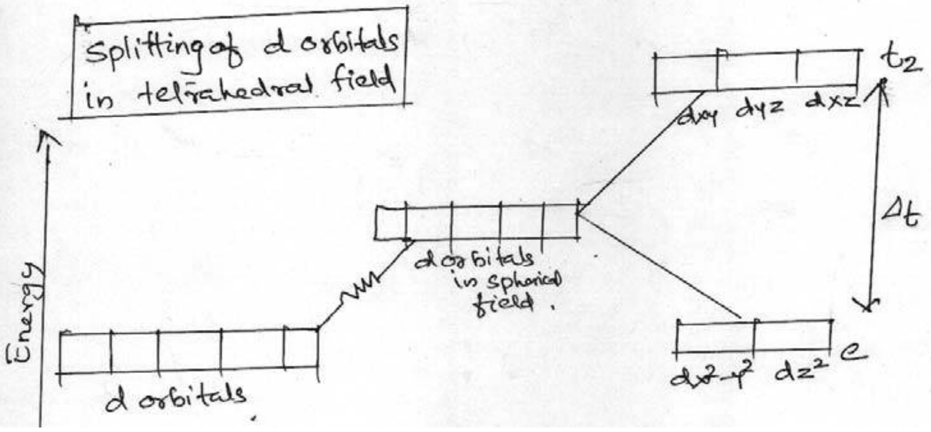
1. Metals have two types of valence primary and secondary
2. Primary valency ionisable Secondary valence non ionisable
3. Secondary valency is coordination no

VALENCE BOND THEORY V.B.T			
$[Co(NH_3)_6]^{3+}$	d^2sp^3	Octahedral	inner orbital complex diamagnetic
$[Fe(CN)_6]^{3-}$	d^2sp^3	Octahedral	inner orbital Complex Paramagnetic
$[CoF_6]^{3-}$	sp^3d^2	Octahedral	Outer orbital Complex diamagnetic
$[Ni (CN)_4]^{2-}$	dsp^2	Squire planar	inner orbital complex diamagnetic
$[Ni(Co)_4]$	sp^3	Tetra hedral	diamagnetic
$[NiCl_4)]^{2+}$	sp^3	Tetrahedral	Paramagnetic

Crystal Field Theory



t_{2g}



Application of Complexes

1.	Chlorophyll	-	Complex of Mg
	Haemoglobin	-	Complex of Fe
	Vitamin B_{12}	-	Complex of Co

2. Chelating ligands are used for the treatment of metal poisoning
3. Cisplatin is used to inhibit the growth of tumours cis $[PtCl_2(NH_3)_2]$

10. HALOALKANES AND HALOARENES

1. Finkelstein reaction

   Alkyl halide + NaI → alkyl iodide + Nax

2. Swarts reaction

   Alkyl chloride / Alkylbromide + AgF → Alkyl fluoride

3.

SN^2 Mechanism	SN^1 Mechanism
a. Substitution nudeophilic bimolecular	a. Substitution nudeophilic unimolecular
b. Single step	b. Two steps
c. Second order reaction	c. First order reaction
d. The orde of reactivity	d. order of reactivity
$1^0 > 2^0 > 3^0$	$3^0 > 2^0 > 1^0$
e. inversion of configuraion	e. Racemisation of configuration

4. Wurtz reaction

   Alkyl halide react with sodium metal to form alkanes

   $2R\text{-}Cl + 2Na \xrightarrow{ether} R\text{-}R + 2\,NaCl$

5. Wurtx fitting reaction

   Mixture of alkylhalide and arylhalide react with sodium to form alkyl substituted aromatic compounds

   $C_6H_5\text{-}Cl + 2Na + CH_3\text{-}Cl\ C_6H_5\text{-}CH_3 + 2Nacl$

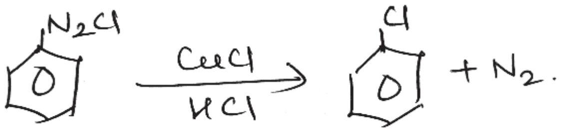
6. Fitting reaction

   Aryl halide react with sodium metal to form biaryl compounds

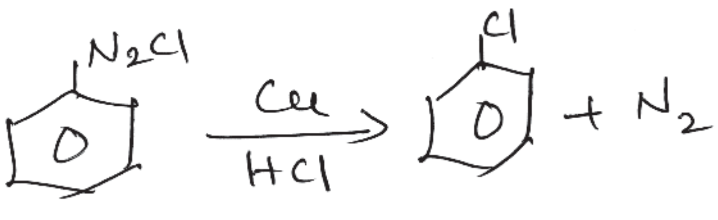
   $2C_6H_5\text{-}Cl + 2Na \xrightarrow{ether} C_6H_5 - C_6H_5 + 2Nacl$

7. Sandmeyer's reaction

   Benzenediazonium chloride when treated with cuprous halide in hydrogenhalide aryl halide is formed



8. Gatter mann reaction

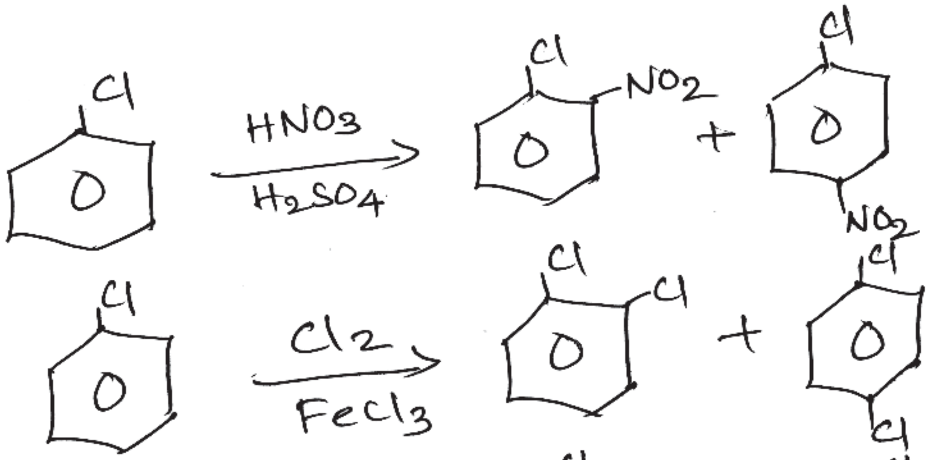


9. Aryl halides are less reactive than alkyhalides because

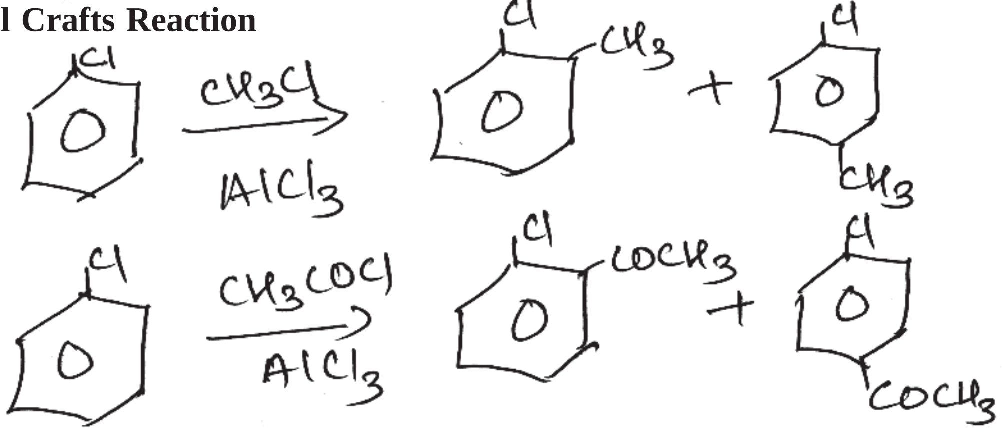
   a. C - CI bond gets double bond characer due to resonence

   b. Sp^2 hybridised carbon is more electronegative

10. Electrophilie substitution



Friedel Crafts Reaction



11. Chloroform ($CHCl_3$) is kept in brown bottles and filled to the brim. Because on exposure to air and light it oxidises to carbonyl chloride or phosgene which is poisonous.

12. Freon - 12 $CCI_2 F_2$

dichlorodifluoromethane used as a refrigerent

11. ALCOHOLS, PHENOLS & ETHERS

- Lucas Test- distinction between primary, secondary and Tertiary alcohols. Lucas Reagent is a mixture of concentrated hydrochloric Acid and anhudrous Zinc chloride.

  Primary alcohols $\xrightarrow{\text{Lucas Reagent}}$ No Reaction
  Secondary alcohols Lucas reagent Turbidity appears within 5 seconds
  Tertiary alcohols Lucas Reagent Turbidity appears immediately.

- Iodoform Test- distinction between methanol and Ethanol

  This test is carried out using Iodine and NaOH
  Methanol I_2 / NaOH No reaction
  Ethanol I_2/ NaOH yellow precipitate of iodoform.

- Neutral Ferric chloride Test- distinction between phenol and ethanol

  Alcohol Neutral $Fecl_3$ No reaction
  Phenol Neutral $Fecl_3$ Violet Colour

Preparation of phenol

- **Dow's process**

  Chlorobenzene is heated with NaoH at 623 K temperature and 300 atm pressure, forms sodium phenoxide which on acidification gives phenol.

- Benzene diazonium chloride warm water phenol

Chemical Reqaction of Phenol

Phenol Conc HNO3 2,4,6 trinitrophenol
Conc H2So4 (Picric Acid)
Phenol dil HNO3 Orthonitrophenol and paranitro phenol
Phenol Br_2/H_2O 2, 4, 6 tribromophenol (White ppt)
Phenol Br_2/CS_2 Ortho bromophenol and parabromophenol

- **Reimer- Teimann Reaction**

  Phenol is treated with Chloroform and sodium hydroxide to form salilcylaldehyde

- **Kolbe's reaction**

  Sodium phenoxide is heated with CO_2 under high pressure form salicylic Acid

- Phenol Zinc dust Benzene
- Reason for acidity of phenol

  The acidic charater of phenol is due to the greater resonance stabilisation of phenoxide ion.

Methanol

Methanol is manufactured by destructive distillation of wood. It is also known as wood spirit

Ethanol

Ethanol is manufactured by the fermentation of molasses
Rectified spirit- 95% ethyl alcohol
Methylated spirit- Rectified spirit made poisonous by adding methyl alcohol
Absolute alcohol- 100% ethyl alcohol

- **Williamson's synthesis**

This method is used for the preparation of ethers. In this method, alkyl halide is treated with sodium alkoxide to form ethers.

- Reaction of anisole with hydrogen lodide

  Anisole+H1 $^{\text{heat}}$ Phenol+Methyl Iodide

12. ALDEHYDES, KETONES & CARBOXYLIC ACIDS

PREPARATION OF ALDEHYDES AND KETONES

- **Stephen Reaction**

  Nitriles (cyanides) are reduced with stannous chloride and HCl to form aldehydes

- **Etard Reaction**

  Toluene can be oxidised with cyromylchloride to form benzaldehyde

  $C_6H_5CH_3$ (i) CrO_2Cl_2 C_6H_5CHO
  (ii) H_2O

- **Gattermann- Koch Reaction**

  When benzene is treated with carbon monoxide and hydrogen chloride in presence of anhydrous aluminium chloride, benzaldehyde is produced.

- **Rosenmund's Reduction**

  Acid chloride when treated with hydrogen in presence of palladiam supported on Barium sulphate give aldehydes.

- **Friedel- Crafts Acylation**

  Aromatic ketones can be prepared by treating benzene with acid chlorides in presence of anhydrous Aluminium chloride

- Aldhydes are more reactive than Ketone towards nucleophilic addition reactions due to (i) inductive effect (ii) sterric effect

REACTIONS OF ALDEHYDES AND KETNOES

- **Clemmensen Reduction**

  Aldehydes and Ketones are reduced to hydrocarbons by heating with Zinc Amalgum and Conc. HCl

  CH_3- CHO Zn-Hg CH_3-CH_3
  Conc. HCl

- **Wolf Kishmer Reduction**

  Aldehydes and ketones are reduced to hydrocarbons by treating with hydrazine and KOH in ethylene glycol

  CH_3-CHO hydrazine +KOH
  Ethylene glycol CH_3- CH_3

- Tollen's test (Silver mirror test)- distinction between aldehydes and ketones. Tollen's reagent is ammoniacal solution of silver nitrate Aldehydes give silver mirror with tollen's reagent Ketones will not answer this test

- Fehlings Test- distinction between aldehydes and Ketones Fehlings Reagent is a mixture of $CuSo_4$ and Sodium potassium tartarate Aliphatic aldehydes give red precipitate of cuprous oxide with Fehlings reagent. Ketones and aromatic aldehydes will not answer this test.
- **Aldol Condensation**

  Aldehydes and Ketones with alpha hydrogen undergo self condensation in presence of dilute NaOH to form aldol.
- **Cannizzaro Reaction**

  Aldehydes and ketones which do not contain alpha hydrogen undergo self oxidation and reduction in presence of concentrated NaOH to form an alcohol and an acid.

COMPARISON OF ACIDITY OF CARBOXYLIC ACIDS

- Monochloro accetic acid is stronger than aetic acid because presence of electron withdrawing substituents increases the acidity
- Trichloro acetic acid is stronger than dichloro acetic acid which is stronger than monochloro acetic acid because acidity increases with increase in the number of electron withdrawing substituents
- Acetic acid is weaker than formic acid because electron releasing substituents decreases the acidity
- Benzoic Acid is stronger than acetic acid due to the electron withdrawing nature of phenyl group.
- Fluroacetic acid is stronger than chloro acetic acid which is stronger than bromoacetic acid because acidity increases with increase in the electron withdrawing capacity of the substituent.
- Hell-Volhard- Zelinsky reaction (HVZ Reaction) Aliphatic carboxylic acids containing $\propto$ hydrogen react with chlorine or bromine in presence of red phosphorous to form $\propto$ chloro or $\propto$ bromo acid.

13. AMINES

- Hoffmann bromamide reaction Acidamides on reaction with bromine and alkali give primary amines with one carbon atom less than the parent amide
- Gabriel- phthalimide Reaction Phthalimide is first treated with ethanolic KOH to form potassium phthalimide. This on treating with an alkylhalide followed by hydrolysis gives primary amine.

COMPARISON OF BASICITY OF AMINES

- Aliphatic Amines are more basic than ammonia due to electron releasing inductive effect (+I effect) of alkyl groups.
- Basicity of aliphatic amines are in the order, Secondary > primary> Tertiary. Tertiary amines have less basicity due to sterric effect caused due to the presence of three alkyl groups.
- Aromatic amines are less basic than ammonia due to delocalisation of lone pair electrons on nitrogen with the aromatic ring.
- Action with nitrous acid-distinction between aliphatic and aromatic primary amines.

  Aromatic primary amine Nitrous Acid Diazonium salt
  5^0C

  Aliphatic primary amine Nitrous Acid Alcohol + Nitrogen gas
  5^0C

- **Carbylamine Reaction- Test for primary amines**

  Primary amines when warmed with chloroform and alcohole KOH produce foulsmelling isocyanides or carbylamines secondary and Tertiary amines do not answer this test.

- Hinsberg test- distinction between 1^0, 2^0 and 3^0 amines. Hinsberg Reagent is benzene sulphonyl chloride.

  Primary amine Hinsberg Reagent Alkyl benzene sulphonamide
  (soluble in alkali)

  Secondary amine Hinsberg Reagent Dialkyl benzene sulphonamide
  (insoluble in alkali)

  Tertiary amine Hinsberg Reagent No reaction

- **Diazotisation**

  Aniline is treated with nitrous acid below 5^0C to form benzene diazonium chloride.

- **Coupling Reaction**

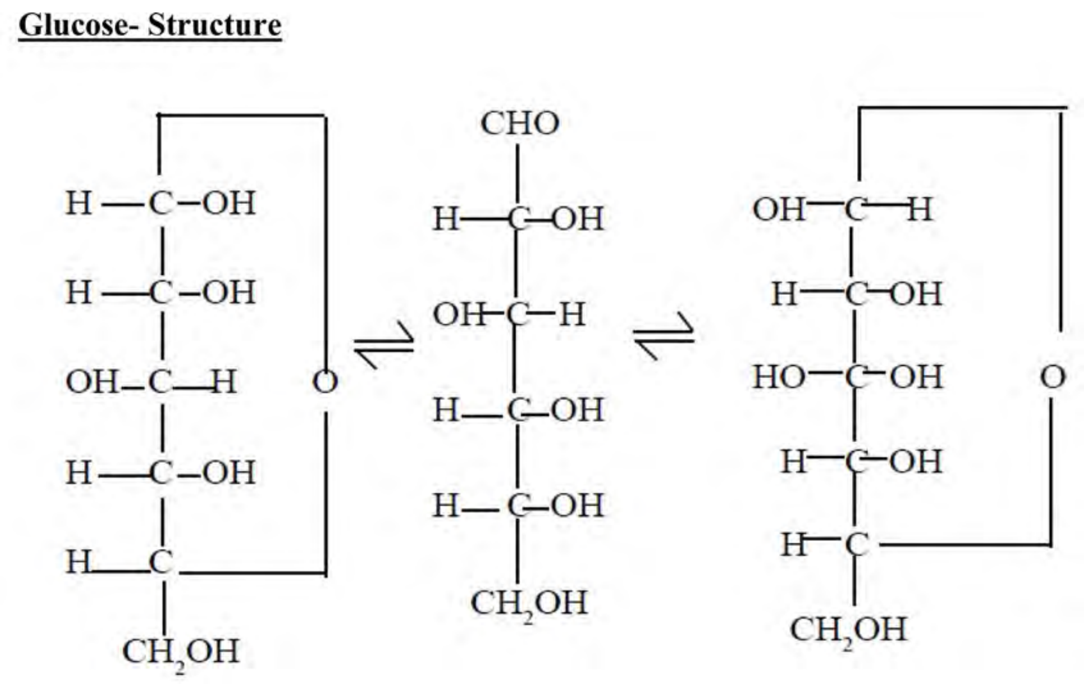
  Arene diazonium salts react with aromatic compounds like amines and phenols to form coloured azo compounds.

14. BIOMOLECULES

Classification of carbohydrates

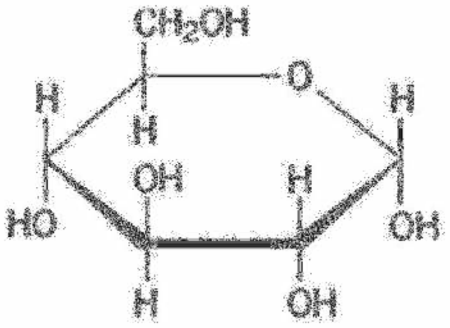
Monosacharides	Oligosacharides	Polysacharides
Cannot be hydrolysed further Eg:- Glucose, Fructose, ribose	On hydrolysis give two to ten monosacharides Eg:- Sucrose, Maltose	On hydrolysis give more than ten monosacharides Eg:- starch, cellulose, glycogen

Glucose- Structure

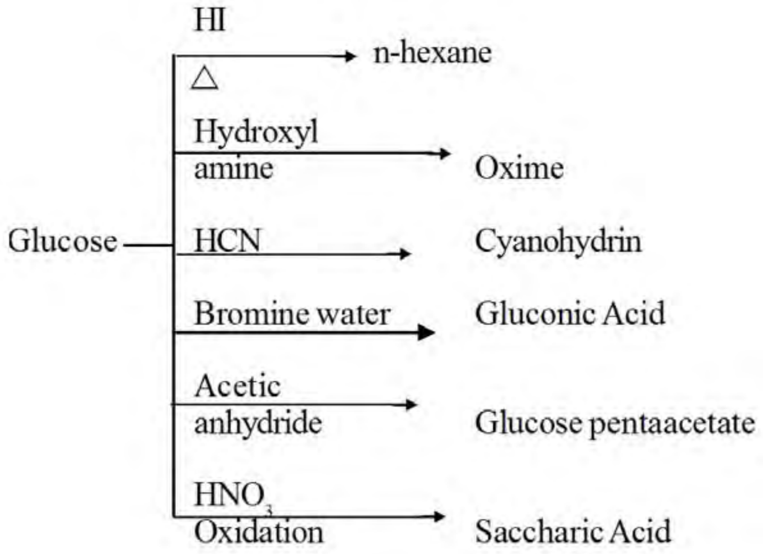


α - D(+) - glucose Open structure β - D (+) glucose

Cyclic structure of glucose



- **Reactions of glucose**



Biomolecule	Monomer	Linkage
Sucrose	Glucose & Fructose	Glycosidic Linkage
Maltose	Glucose	Glycosidic Linkage
Lactose	Galactose and glucose	Glycosidic linkage
Proteins	Amino Acids	Peptide Linkage
Nucleic Acids	Nuelcotides	Phosphodiester Linkage

- **Inversion of cane sugar**

  Sucrose undergo a change in the sign of specific rotation from dextro to laevo, on hydrolysis. This is called inversion of cane sugar and the product is called invert sugar.

Amino Acids

- **Essential and Non essential amino acids**

  Amino acids which cannot be synthesized in the body are called essential amino acids. They must be supplied through diet. Eg:- Leucine, Lysine

  Amino Acids which can be synthesised in the body are called non- essential amino acids. *Eg:-* glycine, alanine

- **Zwitter ion formation of amino acids**

  Amino acids contain both acidic and basic groups and they neutralize each other to form Zwitter ion.

CHEMISTRY

Proteins

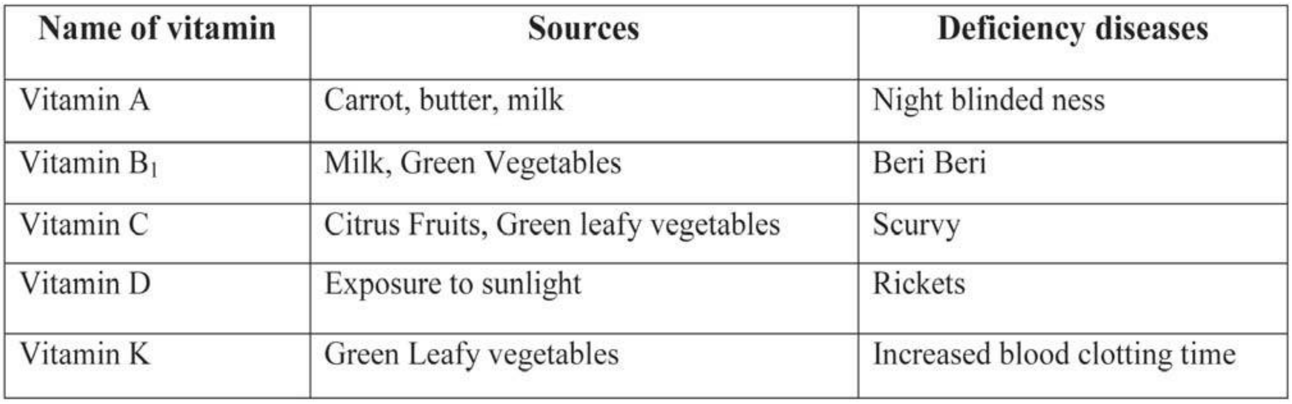
- **Structure of proteins**
    1. Primary structure : The sequence in which amino acids are arranged in proteins
    2. Secondary structure : The manner in which polypeptide chains are folded
    3. Tertiary structure: This gives overall shape of proteins
    4. Quarternary structure: The spatial arrangement of two or more peptide chains
- **Denaturation of proteins**

  Proteins undergo changes in physical and biological properties without affecting chemical composition under the effect of heat or chemicals is called denaturation *Eg:*- boiling of egg
- **Globular and Fibrous proteins**

  In globular proteins, the polypeptide chains coil around to give spherical shape Eg:- Insulin, albumin. In fibrous proteins, the polypeptide chains lie side by side to form fibre- like structures. Eg:- Keratin (hair & wool), myosin (muscles)

Vitamins

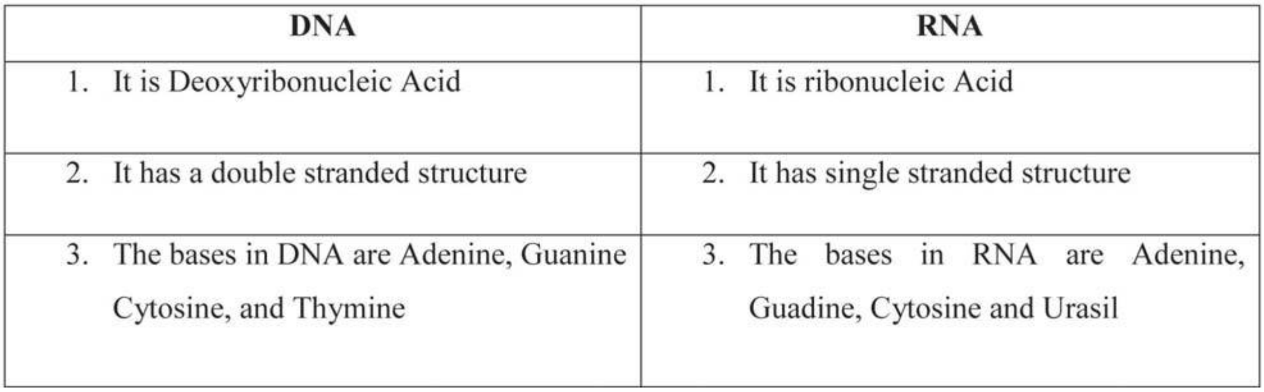
- Fat soluble vitamins Eg: vitamins A,D E and K
- Water soluble vitamins Eg:- vitamins B,C
- Water soluble vitamins must be regularly provided in the diet because they cannot be stored in our body



Name of vitamin	Sources	Deficiency diseases
Vitamin A	Carrot, butter, milk	Night blinded ness
Vitamin B_1	Milk, Green Vegetables	Beri Beri
Vitamin C	Citrus Fruits, Green leafy vegetables	Scurvy
Vitamin D	Exposure to sunlight	Rickets
Vitamin K	Green Leafy vegetables	Increased blood clotting time

Nuleic Acids

Difference between RNA and DNA



DNA	RNA
1. It is Deoxyribonucleic Acid	1. It is ribonucleic Acid
2. It has a double stranded structure	2. It has single stranded structure
3. The bases in DNA are Adenine, Guanine Cytosine, and Thymine	3. The bases in RNA are Adenine, Guadine, Cytosine and Urasil

15. POLYMERS

- **Addition polymerization or chain growth polymerization**
  This type of polymerization takes place by the repeated addition of monomer units having double or triple bonds *Example* for addition polymers: Polythene, polyvinyl/ chloride
- **Condensation polymerization or step growth polymerization**
  This type of polymerization takes place by condensation reactions between molecules having two or more functional groups. *Example* for condensation polymers : Nylon 6,6, Nylon 6
- **Homopolymers and copolymers**

  Polymers formed by the polymerization of only one type of monomers are known as homo polymers *Example* Polyethene, Polyvinyl Chloride
  Polymers formed by the polymerisaation of two or more different monomers are called copolymers *Example* Nylon 6,6, Terylene

- **CLASSIFICATION OF POLYMERS BASED ON INTERMOLECULAR FORCES**

1) **Elastomer**

   Here, the polymer chains are held together by weak intermolecular forces and they possess elasticity *Eg:-* Buna-S, Buna-N, Neoprene

2) **Fibres**

   These are thread forming polymers with strong inter molecular forces *Eg:-* Nylon, Silk

3) **Thermoplastic polymers**

   These have intermolecular forces in between that of elastomers and fibres. They can be remoulded. *Eg:-* polythene, polystyrene

4) **Thermosetting polymers**

   These are polymers which become infusible and hard on heating and cannot be remoulded *Eg:-* Bakelite, melamine formaldehyde resin

- **Vulcanization of rubber**
  The process of heating natural rubber with sulphur to improve its properties is called vulcanization. Vulcanized rubber has more elasticity and resistant to oxidation

Some polymers and their monomers

POLYMER	MONOMER
Polythene	Ethene
Teflon	Tetra fluro ethane
Polyacrylonitrile	Acrylonilrile
Nylon 6,6	Hexamethylene diamine and adipic acid
Nylon 6	Caprolactum
Bakelife	Phenol and formaladehyde
Buna-S	1,3 butadiene and styrene
Buna-N	1,3 butadiene and Acrylonitrile

16. CHEMISTRY IN EVERYDAY LIFE

- **Antacids**

  Substances which remove excess acid in the stomach are known as antacids *Eg:-* sodium hydrogen carbonate, aluminium hydroxide, Magnesium hydroxide
- **Antihistamines**

  Antiallergic medicines are called antihistamines *Eg:-* bromphrniramine, terfenadine
- **Tranquilisers**

  Drugs used for the treatment of stress and mental diseases are called tranquilizers *Eg:-* luminal, seconal
- **Analgesics**

  Medicines used for getting relief from pain are called analgesics. *Eg:-* Aspirin, paracetamol
- **Antibiotics**

  Chemical substances used to destroy or inhibit the growth of micro organisms are called Antibiotics. *Eg:-* penicillin, tetracycline
- **Antiseptics**

  Chemicals which either kill or prevent the growth of microorganisms. They can be applied to the living tissues. *Eg:-* Dettol, 0.2% phenol.
- Bithional is an antiseptic used in soaps.
- Boric acid is an antiseptic used for eyes.
- Dettol is a mixture of chloroxylenol and terpinol.
- **Disinfectants**

  These are chemicals which kill the microorganisms and are harmful to the living tissues. *Eg:-* 1%phenal, Cl_2, SO_2
- **Anifertility drugs**

  These are chemicals used for birth control *Eg:-* Norethindrone, Novestrol
- **Artificial sweeteners**

  These are chemicals which give sweetening effect to the food. *Eg:-* aspartame, saccharin, sucrolose and alitame
- **Food preservatives**

  These are chemicals that prevent food from spoilage due to microbial growth. *Eg:-* table salt, sugar, sodium benzoate
- **Synthetic detergents**

  Synthetic detergents are cleaning agents which have all the properties of soaps, but actually do not contain any soap. They can be used in soft and hard water.

They are of three types:-

- Anionic detergents- contain anionic hydrophilic group. *Eg:-* sodium lauryl sulphate
- Cationic detergents- contain cationic hydrophilic group. Eg:- cetyl trimethyl ammonium bromide
- Non-ionic detergents This type of detergents do not contain ions. They are widely used in dishwashing detergents. Eg:-The ester formed from polyethylene glycol and stearic acid.

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ലഹരി വസ്തുക്കൾ ഉപയോഗിക്കരുതേ...
ജീവിതം ലഹരിയാക്കൂ...

പ്ലാസ്റ്റിക് ഉപേക്ഷിക്കാം
ഭൂമിയെ ഹരിതാഭമാക്കാം