CHEMISTRY FORMULAE

Chapter-1. Some Basics Concepts Chemistry

Some Basic concepts of chemistry

Basic S.I Units

Sr.No.	Physical Quantity	Symbol	Unit	Symbol Of Unit
1	Length	l	meter	m
2	Mass	m	kilogram	kg
3	Time	T	second	s
4	Electric current	I	ampere	A
5	Temperature	T	kelvin	K
6	Amount of Substance	N	mole	mol
7	Luminous Intensity	I	candela	cd

Unit	Kilogram	Kelvin	Second	Siemens
Symbol	kg	K	s	S

Derived units: The units of all other physical quantities are derived out of these of the basic physical quantities.

The units thus obtained are called the derived units.

Sr.No.	Physical Quantity	Mathematical Relation	Name of unit	In terms of basic SI Units
1	Volume	Length cube	Cubic meter	m^3
2	Force	Mass x Acceleration	Newton(N)	kg m s^{-2}
3	Pressure	Force/Area	Pascal (Pa)	kg m^{-1} s^{-2}
4	Energy or Work	Force x Distance	joule(J)	kg m^2 s^{-2}
5	Heat Capacity	Quantity of heat per degree rise in temp.	Joule/kelvsin	$JK^{-1}mol^{-1}$ or $m^2kgs^{-2}k^{-1}$

6	Concentration	Mol./vol.	Mol/L	mol dm^{-3} (M)
7	E.C.E.	Eq.wt. /Faraday	Kg/C	kgC^{-1}
8	Area	Length Square	Square meter	m^2
9	Velocity	Distance /Time	meter/sec	ms^{-1}
10	Acceleration	Velocity change/Time	meter per square second	ms^{-2}
11	Power	Energy/Time	Watt(W)	kg m^2 s^{-3} or $J.s^{-1}$
12	Density	Mass/Volume	Kilogram per cubic meter	kg m^{-3}
13	Frequency	Cycles/Second	hertz(Hz)	S^{-1}
14	Electric Charge	Current × Time	coulomb(C)	A.s
15	Potential difference	Force/ Charge (force per unit charges)	volt(V) or ($J.A^{-1}s^{-1}$)	kg m^2 $s^{-3}.A^{-1}$ or (charge)

Some other units in SI system

Physical Quantity	Unit	Relationship with basic SI unit
Length	kilometer (km) meter (m) centimeter (cm) millimeter (mm) micrometer or micron (□m) nanometer (nm) pico meter (pm)	1 km = 1000 meter- 100 cm = 1 meter 1000 mm = 1 meter 10^6 □m = 1 meter 10^9 nm = 1 meter 10^{12} pm = 1 meter
Mass	kilogram (kg)	1 kg = 1000 g

	gram (kg) milligram (mg) microgram (□g) Nanogram (ng)	- 1000 mg = 1 g 10^6 □g = 1 g 10^9 ng = 1 g
Volume	milliter (mL) cubic centimeter (cm^3,mL) microliter(□L)	1000 mL = 1 liter 1000 cm^3 = 1 liter 10^6 □l = 1 liter

Determination of Atomic Mass:

- 1 amu=(1/12)mass of an atom of ^{12}C = 1.66x10^{-24}g=1.66x10^{-27}kg
- Average Atomic Mass =$\frac{(m_1 \times x_1)+(m_2 \times x_2)}{x_1+x_2} = \frac{\%\ of\ element}{Atomic\ mass\ of\ element}$
  Where, m_1& m_2 are atomic masses of isotopes and x_1& x_2 are their fractions present.
- One Gram Atom = 6.023 X 10^{23} atoms
- Masses-Volume relation:
- $\frac{\text{Mass}}{\text{Molar mass}} = \frac{\text{V}(dm^3)}{22.4}$
- n =$\frac{\text{Mass}}{\text{Molar mass}} = \frac{No.of\ particles}{6.022 \text{ X } 10^{23}}$
- **Determination of Molar Mass:**
- One Gram Molecule (one mole) = 6.023 X 10^{23} particles
- One mole = 6.023 X 10^{23} atoms, molecules, electrons etc.,=22.4dm^3 at S.T.P.(for gases)
- Molecular Mass = 2 X Vapour density
- Vapour density = $\frac{\text{Mass of certain volume of a gas or vapour}}{\text{Mass of equal volume of a } H_2 \text{ at same temp.}}$
- STP = Standard temperature & pressure, T = 273.15 K, and P = 1 atm.
- Eq. mass = $\frac{\text{Atomic Mass}}{Valency}$
- Eq. mass of the same element may be different in different compounds if its valency changes:

1) Hydrogen Displacement Method

$$\text{Eq. mass of metal} = \frac{\text{Mass of Metal}}{\text{Mass of } H_2 \text{ displaced}} = \frac{\text{Mass of metal}}{V_0(dm^3)\ X\ 9\ X\ 10^{-2}}$$

2) Oxide Formation method:

$$\text{Eq. mass of metal} = \frac{8\ X\ \text{Mass of metal taken}}{\text{mass of } O_2 \text{combined with metal}}$$

$$= \frac{5.6\ X\ \text{Mass of metal}}{\text{V of } O_2 \text{ combined with metal}}$$

3) Chloride Formation Method:

$$\text{Eq. mass of metal} = \frac{35.5\ X\ \text{mass of metal taken}}{\text{mass of } Cl_2 \text{ combined with metal}}$$

4) Metal Displacement Method:

$$\frac{\text{Mass of metal A}}{\text{mass of metal B}} = \frac{\text{Eq.Mass of metal A}}{\text{Eq.mass of metal B}}$$

5) Electrolysis Method:

$$\frac{\text{Mass of A discharged}}{\text{mass of B discharged}} = \frac{\text{Eq. Mass ofA}}{\text{Eq.mass of B}}$$

CHAPTER 2. STATES OF MATTER (GASEOUS & LIQUID STATES)

Gas laws:

1. **Boyle's law:**

a) PV = constant

b) $\frac{p}{d}$ = constant (at constant T & n), Where d-density of gas

2. **Charle's law:**

a) V/T = constant (at constant P & n),

b) $V_t = V_o + \frac{V_0 t}{273.15} = v_0\left(1 + \frac{t}{273.15}\right)$

3. **Gay Lussac law:**

P/T = constant (at constant P & n)

4. **Avogadro's law:** $V \propto$ Number of molecules (n), \
(at constant P & T) or $\frac{V}{n}$= constant

5. **Kinetic energy:** K.E./Mol.=$\frac{3}{2}$RT

Average K.E. or K.E./Molecule =$\frac{3}{2}\frac{RT}{N}$= $\frac{3}{2}$kT

(K=Boltzman constant)

6. **Van der Waal's equation:**

$\left[P + \frac{a}{V^2}\right][V - b] = RT$ (For 1 mole)

$\left[P + \frac{n^2a}{V^2}\right][V - nb] = nRT$ (For n mole)

a-'a' is vander Waal's constant for attraction between gas molecules.

b-'b'is vander Waal's constant for volume occupied by gas particles.

b=4.N.v (v is volume of one molecule in rest) and $a = P \cdot V^2$

CHAPTER 3. REDOX REACTIONS

3.1. Oxidation: Oxidation or de-electronation is a process which liberates electronsor increase in the oxidation number of oxidized species.

3.2 Reduction: Reduction or electronation is a process which gains electrons or decreases in the oxidation number of reduced species.

Steps involved in balancing of redox equation by oxidation number method:

Step 1. Find out oxidation number of each element and identify the element Which undergoes change in oxidation number.

Step 2. Find out increase and decrease in oxidation number per atom. Multiply the increase or decrease in oxidation number with number of atoms undergoing the change.

Step 3. Multiply the formula with suitable integer to equalize the increase & decrease in oxidation number.

Step 4. Balance atoms other than O & H.

Step 5. To balance O atoms, add H_2O molecules to the side containing less O atoms.

Step 6. In case of ionic reaction:

a) If the reaction is acidic medium, the proper number of H^+ ions are added to the side containing less number of H atoms.

b) If the reaction is basic medium, then proper number of H_2O molecules is added to the side containing less number of H atoms, while an equal o OH^- ions are added to the other side.

or free space.

Step7 Cancel any duplication that is observed on both the sides of equation.

Step 8 Check the equation is balanced for both, the atoms and the charges.

CHAPTER 4. CHEMICAL EQUILIBRIUM

Ostwald's dilution law, pH & pOH

a) $\alpha = \frac{\text{Number of moles ionised}}{\text{Total number of moles}}$

b) Percentage dissociation $= (\% \alpha) = \alpha \times 100$

c) $\alpha = \frac{\% \text{ dissociation}}{100}$

d) For weak electrolyte $\alpha = \sqrt{\frac{K}{C}}$ $\quad \therefore (K = \alpha^2 \times C)$

e) For WA, $\alpha = \sqrt{\frac{K_a}{C}}$ $\quad (K_a = \alpha^2 \times C), \quad \because (\alpha < 0.005)$

f) For WB, $\alpha = \sqrt{\frac{K_b}{C}}$ $\quad (K_b = \alpha^2 \times C), \quad \because (\alpha < 0.005)$

Dissociation constant of an acid HA, $K_a = \frac{[H^+][A^-]}{[HA]}$

Dissociation constant of a base BOH, $K_b = \frac{[B^+][OH^-]}{[BOH]}$

g) For two solutions of an electrolyte $\frac{\alpha_i^2}{\alpha_{ii}^2} = \frac{C_{ii}}{C_i}$

h) $[H^+]$=Basicity x α x C (for WA)

i) $[OH^-]$=Acidity x α x C (for WB)

j) For S.A./S.B.→ α=1

k) pH=-log $[H^+]$

l) pOH=-log $[OH^-]$

m) $[H^+]$=antilog (-pH)

n) $[OH^-]$= antilog (-pOH)

o) pH+ pOH=14(at 298K)

p) $[H^+][OH^-] = K_w = 1X10^{-14}$(at 298K)

q) Alternately $[H^+] = \sqrt{K_a \times C}$

r) $[OH^-] = \sqrt{K_b \times C}$

s) $C = \frac{\text{No.of Moles}}{dm^3}$

t) $n = \frac{\text{Mass}}{\text{Molar Mass}}$

To calculate pH of buffer: (Henderson Hasselbalch equation)

a) for acidic buffer:

$$pH = pK_a + log\frac{[Salt]}{[Acid]} \qquad where, \quad (pK_a = -logk_a)$$

b) For basic buffer: $pOH = pK_b + log\frac{[Salt]}{[Base]}(pK_b = -logk_b)$

1) Salt of strong acid & weak base: $pH = \frac{1}{2}(pK_w - pK_b - \log C)$

2) Salt of weak base & strong acid: $pH = \frac{1}{2}(pK_w + pK_b + \log C)$

3) Salt of weak acid & weak base: $pH = \frac{1}{2}(pK_w + pK_a - pK_b)$

4) Salt of strong acid & strong base: pH=7

Where,$pK_a = -\log K_a$,

$pK_b = -\log K_b$

$pK_w = -\log K_w$

$pK_a + pK_b = pK_w = 14$

CHAPTER 5. SOLID STATE

a) To calculate formula of compound:

1. In a cube three are 8 corners, 6 face centers, 12 edge centers & one body centers.
2. Contribution towards unit cell:
3. Corner=$\frac{1}{8}$, face centre=$\frac{1}{2}$, edge centre=$\frac{1}{4}$, body centre=1

Formula of the compound is same as the ratio of atoms in the unit cell.

b) For cubic crystals of ionic compounds:

$$\rho = \frac{Z \times M}{a^3 \times N_A}\ gcm^{-3}$$

Where Z=Number of formula unit present in one unit cell.

M=Formula mass

c) Relation between distance and edge length:

SCC	BCC	FCC
d=a	$d = \frac{\sqrt{3}a}{2}$	$d = \frac{a}{\sqrt{2}}$

d=distance between nearest neighbors & 'a' edge length of cubic unit cell

CHAPTER 6. SOLUTION AND COLLIGATIVE PROPERTIES

1. **Relation between molarity & molality**:

a) $\text{Molarity} = \frac{\text{molality} \times \text{Mass of solvent in kg}}{\text{volume of solution in dm}^3}$

b)

i) if 'd' of solvent is given then M=m X d (for dilute solution)

ii) If 'd' of solution is given then

$$\text{Molality} = \frac{\text{Molarity} \times 1000}{(\text{d} \times 1000) - (\text{Molarity} \times \text{Molar Mass})}$$

2. **Relation Between Molarity(m) and Mole fraction of solute(X_2) in water is**

$X_2\, X_2 = \frac{\text{m}}{55.56+\text{m}}$ (Where moles of water in 1 $\text{dm}^3$is 55056)

Henry's law

1. $S = K \times P$, $K \rightarrow$ Henry's constant (atm^{-1})
2. $m = K \times P$, $(S \propto M)$
3. $x_{gas} = K \times P, \left(M \propto x_{gas}\right)$
4. If $K \rightarrow$ Henry's constant in atm then $p = K \times x_{gas}$

Osmotic pressure (Π) :

Expression for osmotic pressure: osmotic pressure=h d g

Where, h=height of column, d=density of solution in the column, g=acceleration due to gravity=$9.8 ms^2$

Van't Hoff solution equation:

Determination of molar mass of solute from osmotic pressure:

$$PV = nRT \quad \text{or} \quad P = \frac{W_2 RT}{M_2 V} \quad \text{or} \quad M_2 = \frac{W_2 RT}{\pi V}$$

Units of R, Π & V

Units of R	0.082 litre atm $K^{-1}mol^{-1}$	8.314 J $K^{-1}mol^{-1}$	8.314 J $K^{-1}mol^{-1}$
Units of (Π)	atm	kPa(kNm^{-2})	dm^3
Units of (V)	lit.	Pa(Nm^{-2})	m^3

To calculate van't Hoff factor (i):

I) $i = \frac{CP_{(obs)}}{CP_{(theor)}} = \frac{CP_{(expt)}}{CP_{(normal)}}$

II) $i = \frac{\pi_{(obs)}}{\pi_{(theor)}} = \frac{\Delta P_{(obs)}}{\Delta P_{(theor)}} = \frac{\Delta T_{b(obs)}}{\Delta T_{b(theor)}} = \frac{\Delta T_{f(obs)}}{\Delta T_{f(theor)}}$

III) $i = \frac{\text{theoretical molar mass of solute}}{\text{Observed molar mass of solute}}$

To calculate degree van't Hoff factor (i):

Hoff factor for the substances that undergo dissociation or association:

I) $\pi = iCRT$

II) $\Delta T_b = iK_bm$

III) $\Delta T_f = iK_fm$

CHAPTER 7.CHEMICAL THERMODYNAMICS AND ENERGETICS

A] First law of thermodynamics:

$\Delta U_{(J)} = q_{(J)} + W_{(J)} = q + P\Delta V$

Note:

a) In this statement, q is the heat absorbed and W is the work done on the System. $\Delta U = q + W$

b) In this statement, q is the heat absorbed and W is the work done by the System. $\Delta U = q - W$

Sign convention for q, W, ΔU

1. q=+ve, heat absorbed by system from surrounding &
   q=-ve, heat evolved by system into surrounding.
2. ΔU=+ve ($U_2 > U_1$), I.E. of system increases &
   ΔU=-ve ($U_2 < U_1$), I.E. of system decreases.
3. W=+ve ($V_2 > V_1$), work done on the system by the surrounding &W=-ve($V_2 < V_1$),work done by the system on the surrounding

B] Change in enthalpy: $\Delta H=\Delta U+P\Delta V$

Sign convention of ΔH:

1. If ΔH=-ve, heat is evolved, it is called exothermic reaction.
2. If ΔH=+ve, heat is absorbed, it is called endothermic reaction.
3. $\Delta H=\Sigma \Delta H_{(products)}- \Sigma \Delta H_{(reactants)}$
4. Enthalpy change in reaction=(Sum of enthalpies of formation or (heat of combustion) of products)-(sum of enthalpies of formation of reactants)

Note:

a) Enthalpy of element in their physical state and at standard condition is zero.

b) Enthalpy of diamond is not considered as an elementary state of C hence
Its enthalpy is not zero.

1. $\Delta H=\Delta U +\Delta nRT$
2. $q_p=q_v+ \Delta nRT$

Where,

ΔH=Heat of reaction at a constant pressure in J.

ΔU=Heat of reaction at a constant volume in J.

Δn=Difference between number of moles of gaseous products and number of moles of gaseous reactants.

R=gas constant ($8.314 JK^{-1} mol^{-1}$)

T=Absolute temperature (K)

q_p= ΔH=Heat absorbed at a constant pressure

q_v= ΔU=Heat absorbed at a constant volume

P=Atmospheric volume (Nm^{-2})

V=Volume (m^3)

Hint: generally ΔH & ΔU are given in kJ, convert them in J as R is given ($1kJ=10^3J$)

1. The value of Δn may be zero, positive or negative.
2. For gases:
   a) If $\Delta n=0$ then $\Delta H = \Delta U$
   b) If $\Delta n<0$ then $\Delta H < \Delta U$

c) If $\Delta n>0$ then $\Delta H > \Delta U$

3. For solids and liquids, $\Delta n=0$

D] Hess's law:

1. $\Delta H= \Delta H_1+ \Delta H_2+ \Delta H_3$
2. To solve the examples on Hess's law:

a) First step: write the data in the form of thermo chemical equation.
b) Second step: write the required equation and balance it.
c) Third step: obtain the required equation by adding, subtracting, multiplying or dividing the data equation.
d) Fourth step: carry out the same operation in the sequential manner on the enthalpy values of the equations and obtain the total enthalpy change (ΔH) in the required equation.

3. Note:

a) Subtracting is conveniently done by adding the reversed equation and changing the sign of ΔH while reversing it.
$\Delta H_{\text{direct reaction}}=- \Delta H_{\text{reverse reaction}}$
b) In thermo chemical equation the symbol 'aq' when used alone indicates a very large quantity of water. While multiplying an equation containing 'aq' by any number, the term 'aq' need not be multiplied.

H] Change in entropy:

a) $\Delta S = \frac{q_{rev}}{T}$
b) $\Delta S_{sys} = \frac{q_{sys}}{T}$ and $\Delta S_{surr} = \frac{-q_{surr}}{T}$
c) $\Delta S_{universe} = \Delta S_{total} = \Delta S_{sys} + \Delta S_{surr}$

Standard molar energy (ΔS^0):

$\Delta S^0=\Sigma \Delta S^0_{(products)}- \Sigma\Delta S^0_{(reactants)}$ **or**

$\Delta S^0 = (cS^0C + dS^0D) - (aS^0A + bS^0B)$

ΔG^0 and equilibrium constant (K):

$\Delta G^0 = -2.303RT\log_{10}K_C$ or $\Delta G^0 = -2.303RT \log_{10}K_p$

Where $K_C = \frac{(Products)}{(Reactants)} = \frac{[C]^c[D]^d}{[A]^a[B]^b}$ or $K_p = \frac{(P_c)^c(P_d)^d}{(P_A)^a(P_B)^b}$

C=concentrations & P=Partial pressure

CHAPTER 8 ELECTROCHEMISTRY

a) **To calculate Λ_0 of weak acid**

1. Λ(weak acid)=Λ_0(salt of WA and SB)+Λ_0(SA)-Λ_0(salt of SA and SB) OR

Ex: $\Lambda_0(CH_3COOK)+ \Lambda_0(HBr)- \Lambda_0(HBr)$

b) **Faraday's 1st law:**

a) W(kg)=Z(kg/C) x Q(C)

b) W(kg)=Z(kg/C) x i(amp) x t(sec)

c) E=F x Z

d) E (kg)=96500(C) x Z(kg/C)

Avogadro's law:

1mole=Molar mass=$6.023x10^{23}$molecules=$22.4dm^3$ of a gas at N.T.P.

Form Avogadro's law and faraday we can calculate the volume of different gases liberated by 1 faraday.

1mole gas (mass) = Molar volume = (mass/eq.mass)

number of equivalents= number of Faraday

Relation between quantity and amount of substance deposited:

Quantity of electricity to discharge one mole of ions=n x F

(Where n=charge on the ion)

CHAPTER 8. CHEMICAL KINETICS

A) **To calculate rate constant for first order reaction:**

$$k = \frac{2.303}{t} \log_{10} \frac{[A]_0}{[A]_t}$$

Where, $[A]_0$=Initial concentration of reaction A,

$[A]_t$=concentration of reaction A left after time t.

B) **To calculate rate constant (k) according to Arrhenius equation**:

a) $k=Ae^{-Ea/RT}$

b) $\log_{10}=\log_{10}A - \frac{E_a}{2.303RT}$

Where, A → Frequency factor or pre-exponential factor

E_a →Activation energy, R-Gas constant, T-Absolute temperature

c) $E_a \Rightarrow \frac{E_a}{RT} \Rightarrow \frac{E_a}{RT} \Rightarrow e^{-\frac{E_a}{RT}} \Rightarrow k \Rightarrow$ rate

decreases decreases increases increases increases increases

d)E_a=Threshold energy - Average energy

C) Arrtenius equation and temperature variation or to calculate E_a:

a) $\log_{10}\frac{k_2}{k_1} = \frac{E_a}{2.303R}\left[\frac{T_2-T_1}{T_1 \times T_2}\right]$

k_1→ rate constant at temperature T_1,

k_2→ rate constant at temperature T_2

b) Rate either doubled or tripled for every degree 10^0 rise in the temperature as $\frac{k_T+10}{k_1} = 2$ to 3

Relation between [A] and rate and half life:

a) Time for the completion of 'x' fraction of the reaction may be evaluated by the equation.

$t_x = \frac{2.303}{k_1} log \frac{1}{1-x}$

b) Time taken for the completion of 100% reaction:

$a - x = 0, t_x = \frac{2.303}{k} = log \frac{a}{o} = \infty$

c) Amount left after n half lives:

$[A] = [A]_0\, 2^{-n}$ or $[A]_t = [A]_0\, 2^{-n}$ where $n = \frac{\text{total time}}{t_{0.5}}$

e) From the above equation we can arrive at:

a) For 75% of the reaction; $t_{0.75} = 2x\ t_{0.5}$

b) For 87.5% of the reaction; $t_{0.875} = 2x\ t_{0.5}$

c) For 99.9% of the reaction; $t_{0.999} = 10x\ t_{0.5}$

CHAPTER 9.CO-ORDINATION COMPOUNDS

I) Structural Isomerism:

a) Ionisation Isomerism:

Ion-Ion exchange. Ex.: $[Co(NH_3)_5SO_4]Br$ and $[Co(NH_3)_5Br]SO_4$

b) Linkage Isomerism: Linkage of atoms of linganda.

Ex.:$[Co(NH_3)_5NO_2]Cl_2$ and $[Co(NH_3)_5.ONO]Cl_2$

c) Co-ordination Isomerism:

Exchange of ligands.Ex.: $[Cu(NH_3)_4][PtCl_4]$ and$[Pt(NH_3)_4][CuCl_4]$

d) Hydrated Isomerism:

Number of H_2O molecules inside and outside of coordination sphere.

Ex.:$[Cr(H_2O)_6]Cl_3$, $[Cr(H_2O)_5Cl]Cl_2.H_2O$ and $[Cr(H_2O)_4Cl_2]Cl_2.H_2O$

II) Stereo-Isomerism:

Geometrical Isomerism:

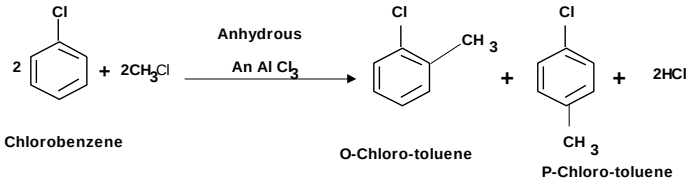
CN=4

a) Tetrahedral geometry: do not show

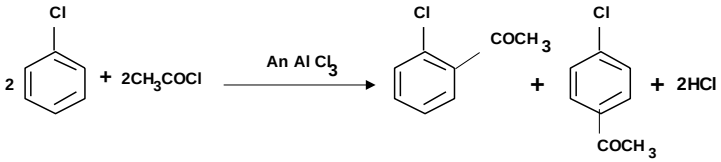
b)Square planner geometry: (Cis-same and trans opposite)

CHAPTER 10.HALOARENES

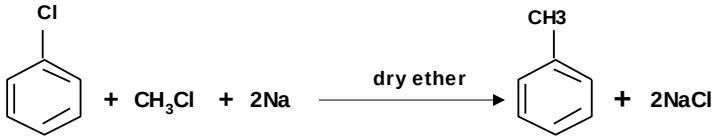
1) Friedel-Craft Alkylation:



2) Friedel-Craft Acetylation:



3) Wurtz – Fitting Reaction:

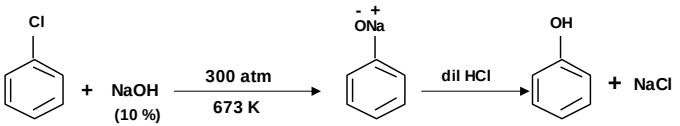


CHAPTER 11 - PHENOL

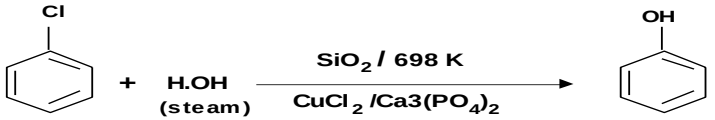
Preparation:

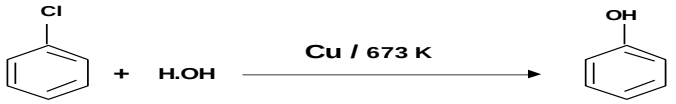
1) From chlorobenzene:

a) Dow's process (1928):

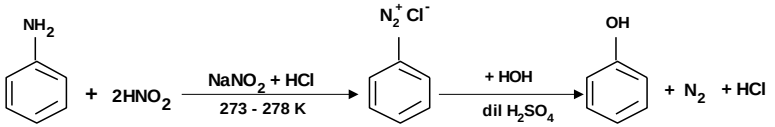


b) Rasching process (Industrial Method 1943) :

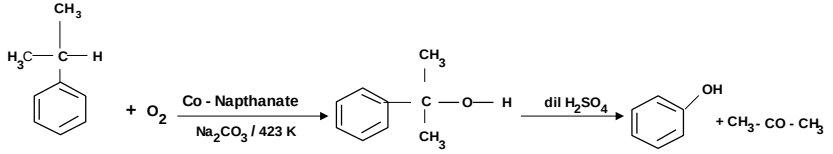




2) From Aniline or aminobenzene (Diazotisation):

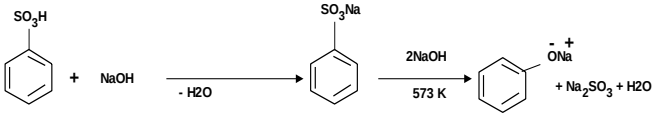


3) From Cumene (Isopropyl Benzene):

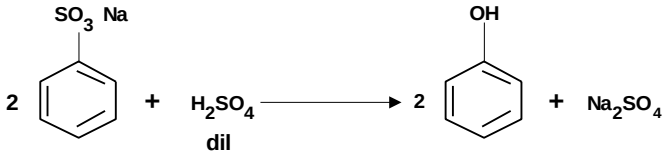


4) From benzene sulphonic acid:

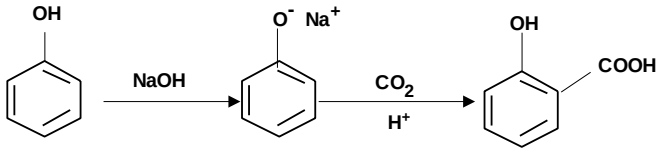
i)



ii)

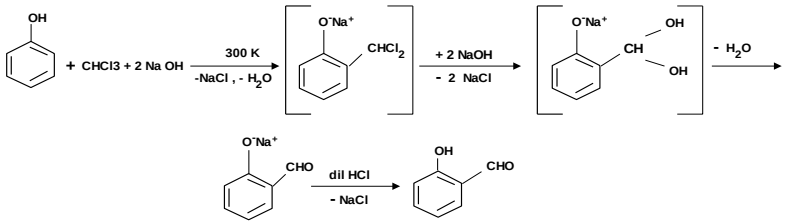


5) Kolbe's Reaction: (Formation of salicylic acid)



Salicylic acid
(2 - Hydroxybenzoic Acid)

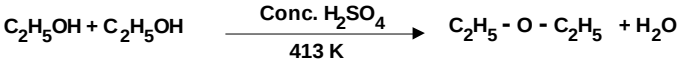
6) Reimer – Tiemann reaction: (formation of salicylaldehyde):



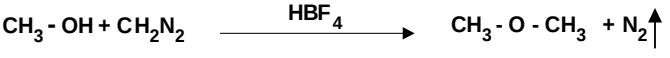
CHAPTER 12 - ETHERS

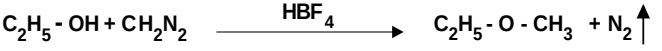
1) Preparation of ether

By intermolecular dehydration of alcohols
(Continuous etherification)

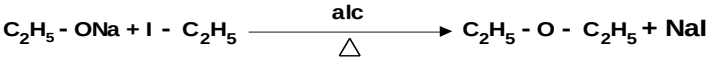


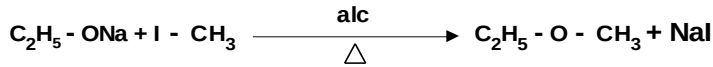
2) By methylation of alcohol: (from diazomethane and alcohol)



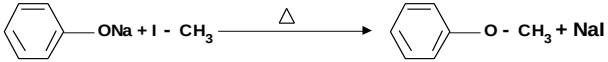


3) By Williamson's synthesis: (from sodium alkoxide and alkyl halide)



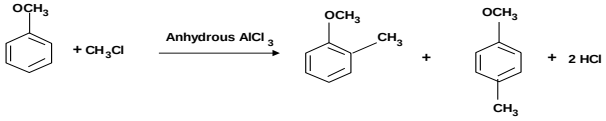


4) By Williamson's synthesis:

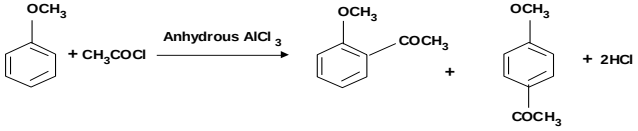


A) Electrophilic substitution reaction

1) Friedel – Craft alkylation:

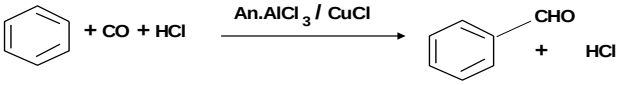


2) Friedel – Craft Acetylation:



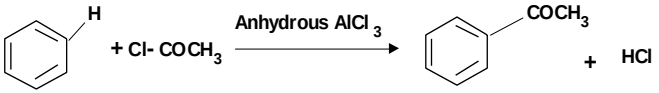
B) Preparation of aromatic aldehydes only:

1) By formylation of benzene (Gattermann – Koch reaction):

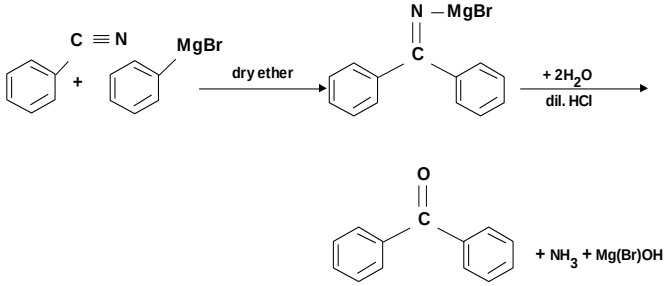


C) Preparation of aromatic ketones only:

Friedel – Craft alkylation:



From GR and phenyl cyanide

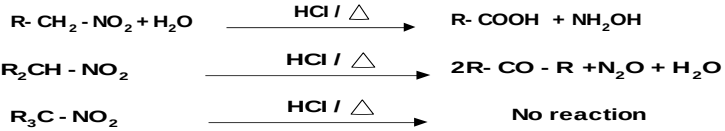


CHAPTER 13. COMPOUND CONTAINING NITROGEN

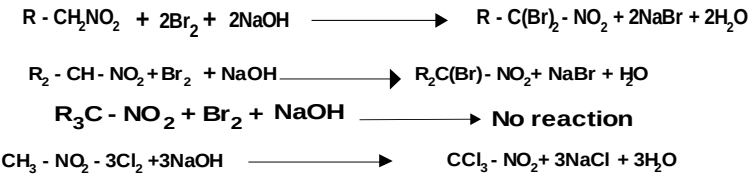
A) Chemical Properties

1) Hydrolysis:

(Distinguishing test between 1^0,2^0, 3^0 nitroalkane)



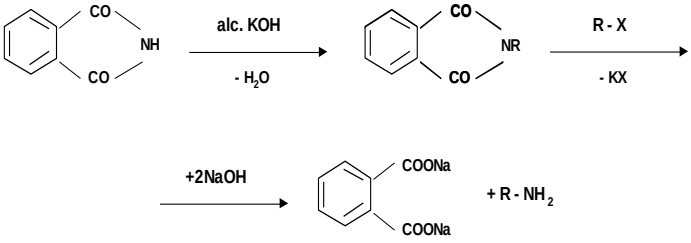
2) Halogenation (Alkaline bromination):



B) Amines

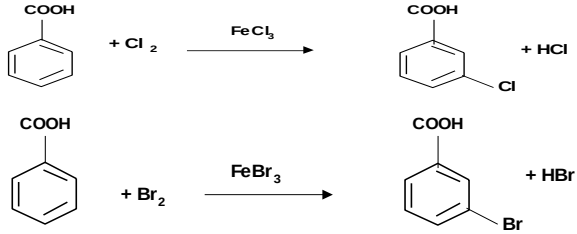
Preperation

1) By alkylation of pthalimide (Gabriel)

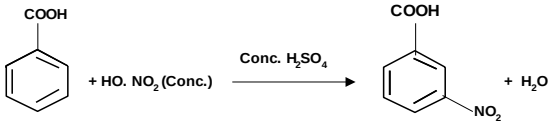


Ring substitution (ESR):

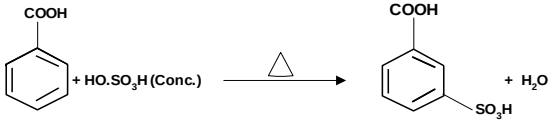
a) Halogenation:



b) Nitration:



c) Sulphonation:



d) Friedel – Craft reaction: Do not given by benzoic acid.

Action of cold (HNO_2 +dil HCL):

a) $2CH_3NH_2 + 2HNO_2 \xrightarrow{\text{Cold}} CH_3 - O - CH_3 + 2N_2 + 3H_2O$ and

$CH_3NH_2 + 2HNO_2 \xrightarrow{\text{Cold}} CH_3 - O - N = O + N_2 + 2H_2O$

b) $C_2H_5NH_2 + HO - NO \xrightarrow{\text{Cold}} C_2H_5 - OH + H_2O + N_2 \uparrow$

c) $C_6H_5NH_2 + NaNO_2 + 2HCl \xrightarrow{\text{Cold}} C_6H_5N_2{}^+Cl^- + NaCl + 2H_2O$

d) $(C_2H_5)_3NH + HO - NO \xrightarrow{\text{Cold}} (C_2H_5)_2N - N = O + H_2O$

e) $(C_2H_5)_3N + HNO_2 \xrightarrow{\text{Cold}} [C_2H_5NH]NO_2$

Haffmann's Carbyl amine test (Isocyanide formation):b

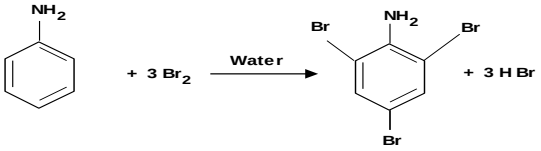
$$R - NH_2 + CHCL_3 + 3KOH \xrightarrow{alc} R - NC + 3KCl + 3H_2O$$

$$C_6H_5NH_2 + CHCL_3 + 3KOH \xrightarrow{alc} C_6H_5NC + 3KCl + 3H_2O$$

A) Aniline:

Electrophilic substitution reaction:

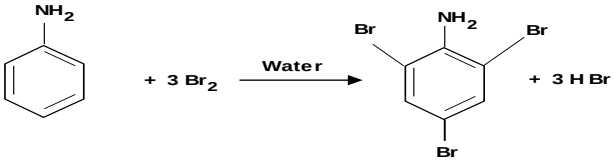
1) Bromiantion



B) Benzene Diazonium Salt

Preparation:

1) By diazotization of aniline:



Chemical Properties

I) Replacement of diazonium group:

Replacement by –H(formation of arenes/ Deamination):

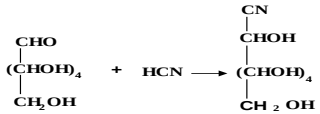
$$Ar - N_2{}^+X^- + H_3PO_2 \xrightarrow{CuCl} Ar - H + N2 \uparrow + H_3PO_3 + HX$$

$$Ar - N_2{}^+X^- + CH_3CH_2OH \xrightarrow{CuCl} Ar - H + N2 \uparrow + CH_3CHO + HX$$

CHAPTER 14 - BIOMOLECULES

Presence of carbonyl group:

Action of HCN:



Vitamins:

Some vitamins, their sources and diseases due to deficiencies

S.N.	Vitamins	Sources	Diseases due to

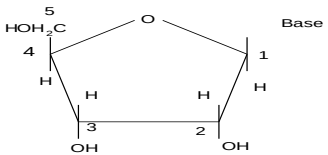
			deficiencies
1	Vita-A (Retinol/ Axerophtohl)	Milk, fish liver, tomatoes, carrot, potatoes	Night blindness, retardation of growth, dryness of skin and hair
2	Vita-B (Thiamine)	Rice, wheat, meat, green vegetable	Beriberi
3	Vit-B_2 or G Riboflavin	Egg yolk, fishes, yeast, liver	Inflammation of tongue, dryness of lips and mouth, cheilosis (retarding the growth and digesion)
4	Vit-B_3 (Panthothermic acid)	Yeast, liver, tomatoes, egg, meat	Dermatities, graying of hair, retard body mental growth, reproductive disability.
5	Vit-B_5 (Nicotinamide)	Barley, maize, wheat, rice	Pigmentation of skin (pellagra), retard body and mental growth, degeneration of spinal cord, mental confusion.
6	Vit-B_6 (Pyriodoxine or Pyridoxal Pyridoxamine)	Milk, liver, maize, wheat, fish, yeast	Convulsion, loss of weight, mental change, derangement of enzymes (which control carbohydrates metabolism)
7	Vit-B_{12} (Cyanocobalamn)	Egg, liver of pig, sheep	Degradation of spinal cord, anaemia
8	Vit-C (Ascorbic acid)	Orange, grapes, lemon, tomatoes, onion, cabbage	Scurvy (bleeding, spongy, swollen) gums
9	Vit-D (Ergocalciferol)	Butter, liver, egg, fish oil, milk, meat, in skin cell	Rickets, Osteomalacia

		in sun	
10	Vit-E (Tocopherol)	Light rice, liver of cattle, seed oils, wheat deposition	Weakness of muscles, abnormal growth and of tissue, decrease reproductive power
11	Vit-H (Biotin)	Yeast, egg, fruits, wheat	Skin lesions, loss of apatite, hair fall, paralysis
12	Vi-K (Phylloquinine)	Green leaf of spinach, fish meat, cauliflower	Increase boold clotting time (hemorrhage), poor coagulation of blood
13	Vit-P	Orange, grapes	Haemorrhagia, decrease in capillary resistance.

Nuclear Acid

Nucleosides= Base + Suga

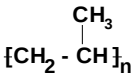
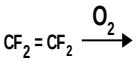
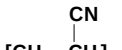
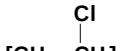
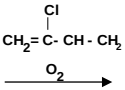
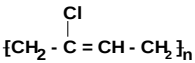
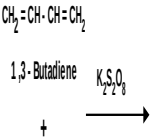
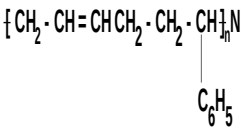
a) Ribonucleosides



CHAPTER 15 - POLYMERS

Chart of Polymers

Name	Monomer	St. of Polymer	Type/Application
Polyethene	$CH_2=CH_2$	a)LDPE Branched 473K/1000 atm: $[CH_2\text{-}CH_2]_n$ b)HDPE Linear 473/6-7 atm $T_iCl_4+C_2H_5)_3Al$	Addition Reaction Homopolymer Insulator for cables

Polypropene	CH_3-CH=CH_2		Addition Reaction homopolymer
Teflon		$[CF_2$-$CF_2]_n$	Addition Reaction homopolymer
(Pan) Polyacryloni trile	CH_2 = CH-CN		Addition Reaction homopolymer
(Orlon) Polyvinyl Chloride	Peroxide CH_2=CHCl		Addition Reaction homopolymer Pipes
Neoprene	 2-chloro-1, 3-butadiene		Addition Reaction homopolymer Making container Converyour belt.
Buna-S(SBR) or (GNR)			Addition Reaction Co-polymer Making Bubble gum

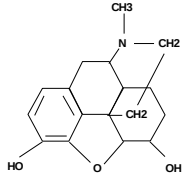
CHAPTER 16 - CHEMICALS IN MEDICINES:

A) Analgesic (Pain killer) :

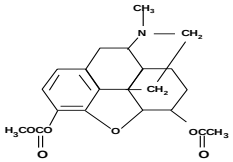
Types of analgesic:

a) Narcotic analgesic: These drugs produce depression on the central nervous system and relive pain instantly.

E.g. (1) Morphine (M.F.: $C_{17}H_{19}NO_3$)



(2) Heroine (M.F. : $C_{21}H_{23}NO_5$)



B) Non – Narcotic analgesic: These drugs when consumed do not produce any significant depression of the central nervous system called non – narcotic analgesic.

E.g. Paracetomol, Aspirin, Ibuprofen, Methyl salicylate, etc.

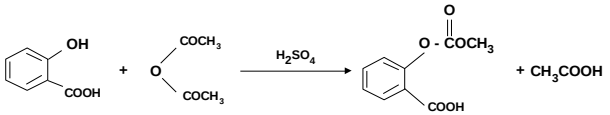
Aspirin:

Acetyl salicylic acid is commercially called aspirin.

Molecular formula: $C_9H_8O_4$, **Common Name**: Acetyl salicylic acid

IUPAC name: 2 – Acetoxybenzoic acid

Preparation: from salicylic acid:



C) Antimicrobials:

The drugs used to kill or prevent the growth of the diseases forming micro-organisms are called antimicrobials. These are Antibiotics Antiseptic, Disinfectants, etc.

1) Antibiotics: The term 'antibiotics' was proposed by Vuillemin in 1889.

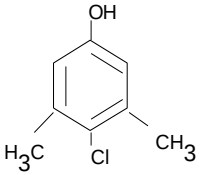
(Anti-against, biotic- life).Chemical substances which are derived from one type of micro-organisms such as bacteria and are used to inhibit the growth and destroy disease forming micro-organisms, which causes infections, are called antibiotics.

2) Antiseptic: The chemical substances that can kill bacteria or prevent the growth of micro-organisms in living tissues are called antiseptics.

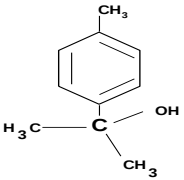
Common antiseptics are:

Chloroxylenol

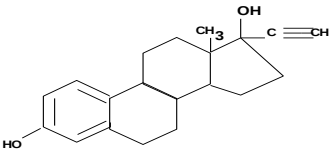
(M.F:C_8H_9OCl)



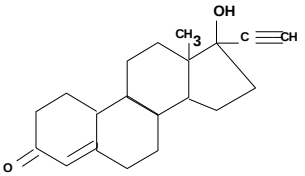
1) Terineol(M.F:$C_{10}H_{18}O$)



1) Disinfectants: Chemicals which are antimicrobial agents that are applied to non-living objects to destroy micro-organism which may cause infections are called disinfectants.
   Ex: (1) Chlorine (Cl_2) water, (2) 1%Phenol (C_6H_5OH) (3) Sulphur dioxide (SO_2)
2) Anti-fertility drugs: The drugs which are used to control the population by family planning
   Ex: (1) Novestrol
   (Ethynylestradiol
   (M.F:$C_{20}H_{24}O_2$)



2) Norethindrone
(M.F: $C_{20}H_{26}O_2$)



5) Antacids and anthistamines:

a) Antacids: The chemicals which are used to neutralize the excess acid (HCI) formedin gastric juice and raise the pH to an appropriate level in stomach is called antacids.
Sweetening agents : The substances which are used for sweetening the food and food material are called sweeteners.

1) Saccharine (M.F: $C_7H_5SNO_3$)