

GYAN-SUTRA SOLUTION : CHEMISTRY

$$\textcircled{1} \quad 1 \text{amu} = 1.66 \times 10^{-24} \text{g}$$

$$\textcircled{2} \text{ (i) moles} = \frac{\text{mass}}{\text{molar mass}}$$

$$\text{(ii) moles} = \frac{\text{no. of molecules}}{N_A}$$

$$\text{(iii) moles} = \frac{\text{volume of gas (L)}}{22.4 \text{ (L)}}$$

$$\textcircled{3} \quad \text{molecules} = \text{no. of moles} \times N_A$$

$$\textcircled{4} \quad \text{atoms} = \text{no. of moles} \times N_A \times \text{no. of particles}$$

⑤ Dulong & Petit's formula:

$$\text{Avg. atomic mass of metal} = \frac{6.4}{\text{specific heat (cal/g}^\circ\text{C)}}$$

$$\textcircled{6} \quad \text{Vapour density} = \frac{\text{Molar mass of gas}}{2}$$

$$\textcircled{7} \quad \% \text{ composition} = \frac{\text{mass of a component}}{\text{total mass}} \times 100$$

$$\textcircled{8} \quad \text{Avg. atomic mass} = \frac{M_1 x_1 + M_2 x_2}{x_1 + x_2} \quad \text{where, } M_1, M_2 = \text{Atomic masses of isotopes}$$

$x_1, x_2 = \% \text{ composition of isotopes}$

$$\textcircled{9} \quad \text{Molarity (M)} = \frac{\text{moles of solute}}{\text{volume of solution (L)}}$$

$$\textcircled{10} \quad \text{Molality (m)} = \frac{\text{moles of solute}}{\text{mass of solvent (kg)}}$$

$$\textcircled{11} \text{ Normality (N)} = \frac{\text{no. of g-Equivalent of solute}}{\text{volume of solution (L)}}$$

$$\therefore \text{where, g-Equivalent} = \frac{\text{given mass}}{\text{Equivalent mass}}$$

$$\textcircled{12} \text{ Mole fraction (x)} = \frac{\text{moles of a component}}{\text{total no. of moles}}$$

$$\textcircled{13} \% \frac{w}{w} = \frac{\text{mass of solute}}{\text{mass of solution}} \times 100$$

EX: 20% aq. HCl by \Rightarrow 20 g HCl in 100 g solution
mass

$$\textcircled{14} \% \frac{v}{v} = \frac{\text{volume of solute}}{\text{volume of solution}} \times 100$$

EX: 20% v/v HCl \Rightarrow 20 ml HCl in 100 ml solution

$$\textcircled{15} \% \frac{w}{v} = \frac{\text{mass of solute}}{\text{volume of solution}} \times 100$$

EX: 20% $\frac{w}{v}$ HCl \Rightarrow 20 g HCl in 100 ml solution

$$\textcircled{16} \text{ ppm} = \frac{\text{mass of solute}}{\text{mass of solution}} \times 10^6$$

$$\textcircled{17} 1 \text{ ppm} = 1 \text{ mg/L}$$

$$\textcircled{18} \text{ strength} = \frac{\text{mass of solute (g)}}{\text{volume of solution (L)}}$$

$$\textcircled{19} \text{ Eq. Mass} = \frac{\text{Molar mass}}{\text{n-factor}}$$

$$(20) \text{ Avg molar mass} = x_1 M_1 + x_2 M_2 + \dots$$

where, $x_1, x_2 \Rightarrow$ mole fractions

$M_1, M_2 \Rightarrow$ Molar masses

$$(21) \frac{1}{m} = \frac{d}{M} - \frac{M_B}{1000}; \quad \text{where: } m = \text{molality}$$

$M = \text{Molarity}$
 $M_B = \text{molar mass of solute}$
 $d = \text{density of solution (g/mL)}$

$$(22) M = \frac{x_B \times d \times 1000}{x_A M_A + x_B M_B}; \quad \text{where: } M = \text{Molarity}$$

$x_B = \text{mole fraction of solute}$
 $x_A = \text{mole fraction of solvent}$
 $M_A, M_B = \text{mol. mass of solvent and solute}$

$$(23) m = \frac{x_B \times 1000}{x_A M_A}; \quad m = \text{molality}$$

$$(24) \text{ Normality} = n\text{-factor} \times \text{Molarity}$$

$$(25) \text{ i) g-Equivalent} = \frac{\text{given mass}}{\text{Eq. mass}}$$

$$\text{ii) g-Equivalent} = \text{moles} \times n\text{-factor}$$

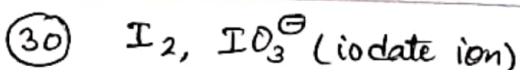
$$\text{iii) g-Equivalent} = \text{Normality} \times V(L) \quad \text{or} \quad n\text{-factor} \times \text{Molarity} \times V(L)$$

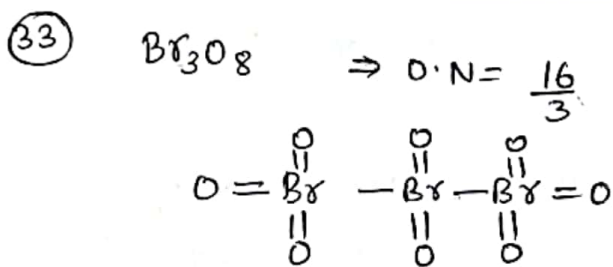
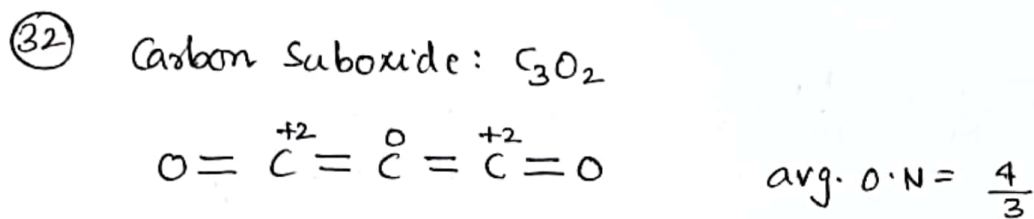
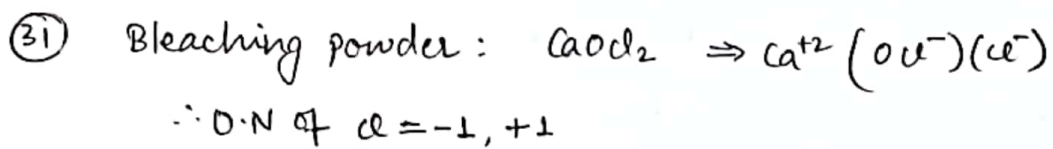
$$(26) 5, 3, 3, 1$$

$$(27) 6$$

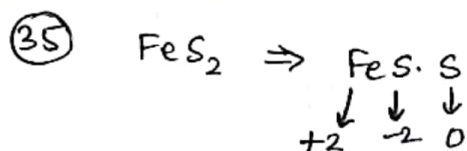
$$(28) 8, 8, 1$$

$$(29) 2$$



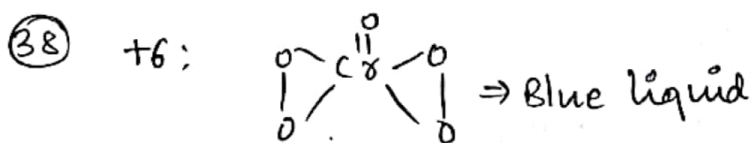


34) starch



36) $\text{KMnO}_4 \rightarrow$ self indicator

37) Diphenyl amine



39) electron = 0.00054 amu \rightarrow J.J Thomson
 proton = 1.00727 amu \rightarrow Goldstein/Rutherford
 neutron = 1.00866 amu \rightarrow James Chadwick.

40) $R = R_0(A)^{\frac{1}{3}}$
 $R =$ Radius of nucleus
 $A =$ Atomic mass
 $R_0 =$ constant = $(1.2 \times 10^{-15} \text{ m})$

$$(41) \quad 100 \text{ nm}$$

$$(42) \quad \text{frequency } (\nu) = \frac{c}{\lambda}$$

$$(43) \quad \text{i) } r = \frac{n^2 h^2}{4\pi^2 m k z e^2}$$

$$\text{ii) } r = 0.529 \frac{n^2}{z} \text{ \AA}$$

n = no. of orbit
 z = atomic no.

$$(44) \quad v = 2.18 \times 10^6 \frac{z}{n} \text{ m/s}$$

$$(45) \quad T.E = -\frac{1}{2} \frac{k z e^2}{r}$$

$$(46) \quad E = -13.6 \frac{z^2}{n^2} \text{ eV}$$

$$E = -2.18 \times 10^{-18} \frac{z^2}{n^2} \text{ J/atom}$$

$$(47) \quad 2$$

$$(48) \quad -2$$

$$(49) \quad -1$$

$$(50) \quad m v r = \frac{n h}{2\pi}$$

$$(51) \quad \bar{v} = 109677 z^2 \left(\frac{1}{n_1^2} - \frac{1}{n_2^2} \right) \text{ cm}^{-1}$$

(52) a) Lyman: UV

b) Balmer: visible

c) Paschen, Pfund, Brackett, Humphrey
→ all are IR

$$(53) \quad \frac{\Delta n (\Delta n + 1)}{2}$$

$$\therefore \Delta n = n_2 - n_1$$

$$(54) \quad \Delta E = 13.6 z^2 \left(\frac{1}{n_1^2} - \frac{1}{n_2^2} \right) \text{ eV}$$

$$\Delta E = 2.18 \times 10^{-18} z^2 \left(\frac{1}{n_1^2} - \frac{1}{n_2^2} \right) \text{ J}$$

(55)

$$\text{photons } (N) = \frac{\text{Power} \times \text{time}}{(hc/\lambda)}$$

$$(56) \quad KE = h\nu - \phi$$

$$\therefore \phi = h\nu_0 = \text{work function}$$

$$(57) \quad \lambda = \frac{h}{p}$$

$$(58) \quad \lambda = \frac{h}{\sqrt{2m KE}}$$

$$(59) \quad \lambda = \frac{h}{\sqrt{2m eV}}$$

$$(60) \quad \lambda_e = \frac{12.27}{\sqrt{V}} \text{ \AA}, \lambda_p = \frac{0.286}{\sqrt{V}} \text{ \AA}$$

$$(61) \quad \lambda_\alpha = \frac{0.101}{\sqrt{V}} \text{ \AA}$$

$$\Delta x \cdot \Delta p \geq \frac{h}{4\pi}$$

$$\Delta x \cdot m \Delta v \geq \frac{h}{4\pi}$$

$$\Delta E \cdot \Delta t \geq \frac{h}{4\pi}$$

$$(62) \quad \frac{d^2\psi}{dx^2} + \frac{d^2\psi}{dy^2} + \frac{d^2\psi}{dz^2} + \frac{8\pi^2 m}{h^2} (E - V) \psi = 0$$

$$\therefore H\psi = E\psi$$

(63) n : Principle quantum no.
 m : Magnetic quantum no.
 l : Azimuthal quantum no.

(64) n : represents size & energy of shell

(65) l : represent subshell & shape of subshell

(66) m : represent orbitals & orientation of orbitals

(67) s : represent axis of rotation of e^-

(68) $\sqrt{l(l+1)} \frac{h}{2\pi}$

(69) $\sqrt{s(s+1)} \frac{h}{2\pi}$

(70) radial node: $n-l-1$
angular node: l
total node: $n-1$

(71) Energy: $1s < 2s = 2p < 3s = 3p = 3d < 4s = 4p \dots$

(72) $\sqrt{n(n+2)} \text{ BM}$
↳ Bohr-magneton

(73) Thermodynamics is the study of amount of energy required to change a system from one equilibrium state to another.

(74) type of boundaries:
Real & imaginary
open (flexible) & rigid
diathermal & adiabatic

(75) open: → Flexible, imaginary & diathermal

closed: Real, Rigid & diathermal boundary

Isolated: Real, rigid, adiabatic

(76) state function: P, T
Path function: Heat, work

(77) Extensive: volume, heat capacity, moles, $\Delta G, \Delta H$ etc

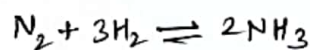
Intensive: P, T , density, molarity, molar heat capacity etc.

(78) $work = - \int P_{ext} \cdot dV$

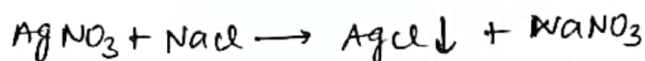
(79) $1 \text{ atm L} = 101.32 \text{ J}$

(80) $1 \text{ cal} > 1 \text{ J} > 1 \text{ erg}$

(81) Reversible:



irreversible: ionic reaction



(82) $\Delta U = Q + W$

Principle: Energy Conservation

(83) Heat Capacity: Amount of energy required to change the temp of a system by 1°C (or) 1K .

$$\text{Heat capacity (C)} = \frac{dQ}{dT}$$

(84) specific heat capacity: Amount of energy required to change the temp of 1g system by 1°C .

(85) molar heat capacity: It is the amount of energy required to change the temp of 1 mole system by 1°C .

$$(86) C_p - C_v = R$$

where C_p & C_v are molar heat capacity.

(87)

Gas	C_p	C_v	γ
Monoatomic	$5R/2$	$3R/2$	$5/3$
Diatomic	$7R/2$	$5R/2$	$7/5$

$$(88) C_{p,mix} = \frac{n_1 C_{p1} + n_2 C_{p2}}{n_1 + n_2}$$

$$C_{v,mix} = \frac{n_1 C_{v1} + n_2 C_{v2}}{n_1 + n_2}$$

$n_1, n_2 \rightarrow$ moles of gases 1 and 2.

$$(89) \Delta H = n C_p \Delta T$$

$$(90) \Delta U = n C_v \Delta T$$

(91)

If R_n is not given:

$$\Delta H = \Delta U + n_g R \Delta T$$

If it is given:

$$\Delta H = \Delta U + \Delta n_g R T$$

where; $\Delta n_g =$ moles of gas product - moles of gas reactant

(92)

Isobaric process:

$$W_{rev} = -P \Delta V$$

$$W_{irr} = -P_{ext} \Delta V$$

Isothermal process

$$W_{rev} = -2.303 nRT \log \frac{V_2}{V_1}$$

$$W_{irr} = -P_{ext} \Delta V$$

Isochoric process:

$$W_{rev} = 0$$

$$W_{irr} = 0$$

Adiabatic process:

$$W_{rev} = \frac{P_2 V_2 - P_1 V_1}{\gamma - 1} \quad (93) n C_v \Delta T$$

$$W_{irr} = -P_{ext} \Delta V$$

(93)

$$P V^\gamma = \text{const}$$

$$T V^{\gamma-1} = \text{const}$$

$$P^{1-\gamma} \cdot T^\gamma = \text{const}$$

(94)

$$\text{slope for isothermal } \left(\frac{dP}{dV}\right) = -\frac{P}{V}$$

$$\text{slope for adiabatic } \left(\frac{dP}{dV}\right) = -\gamma \left(\frac{P}{V}\right)$$

(95) zero

$$(96) \Delta H_r = \left[\sum \text{mole} \times \Delta H_f^\circ \right]_{\text{Product}} - \left[\text{mole} \times \Delta H_f^\circ \right]_{\text{Reactant}}$$

(97) For $SA + SB$:

$$\Delta H_n = -57.23 \text{ KJ/eq}$$

$$\Delta H_n = -13.7 \text{ Kcal/eq}$$

(98) Clausius statement: Energy is always transferred from high temp to low temp.

Kelvin plank statement: Any cyclic engine can't transfer heat into work done completely.

(99) $\Delta S_t > 0$; spontaneous Rn
(also known as mathematical expression for 2nd law of Thermo)
 $\Delta S_t = 0$; Equilibrium (reversible)
 $\Delta S_t < 0$; Non-spontaneous process

(100)

$$\Delta S_g = 2.303 nR \log\left(\frac{V_2}{V_1}\right) + 2.303 nC_v \log\left(\frac{T_2}{T_1}\right)$$

$$\Delta S_g = 2.303 nR \log\left(\frac{P_1}{P_2}\right) + 2.303 nC_p \log\left(\frac{T_2}{T_1}\right)$$

(101) For association: like: $2A \rightarrow A_2$
 $\Delta H = -ve$
 $\Delta S = -ve$

For dissociation like $A_2 \rightarrow 2A$
 $\Delta H = +ve$
 $\Delta S = +ve$

(102)
$$\Delta S_f = \frac{\Delta H_f}{T_m}$$

 T_m : melting point (K)
 ΔH_f = Enthalpy of fusion

(103)
$$\Delta S_{vap} = \frac{\Delta H_{vap}}{T_b}$$

 ΔH_{vap} = enthalpy of vaporisation
 T_b = boiling point

(104)
$$\Delta S_{sub} = \frac{\Delta H_{sub}}{T_s}$$

 ΔH_{sub} = enthalpy of sublimation.

(105) Gibbs free energy: It is the max amount of energy available for work done.
 $\Delta G \rightarrow$ Extensive property & state function.

(106)
$$\Delta G = \Delta H - T\Delta S$$

(107) $\Delta G < 0$; spontaneous
 $\Delta G > 0$: Non spontaneous
 $\Delta G = 0$: Equilibrium

(108) $\Delta G < 0$: spontaneous
 $\Delta G > 0$: Non-spontaneous
 $\Delta G = 0$: Equilibrium

(109)
$$\Delta G = \Delta G^\circ + RT \ln Q$$

(110)
$$\Delta G^\circ = -2.303 RT \log K$$

$$\Delta G^\circ = -RT \ln K$$

(111) • Temp must be constant
 • vessel must be closed

(112) temperature

(113)
$$K_p = K_c \cdot (RT)^{\Delta n_g}$$

(114)
$$\alpha = \frac{M_t - M_0}{M_0}$$

(115) $K_{eq}^m > Q$: Forward
 $K_{eq}^m < Q$: Backward
 $K_{eq}^m = Q$ = Equilibrium.

116) Le-Chatelier principle:

If a reaction at equilibrium is subjected to any physical or chemical change then it's shifted in that direction where it can minimise the effect of that disturbance.

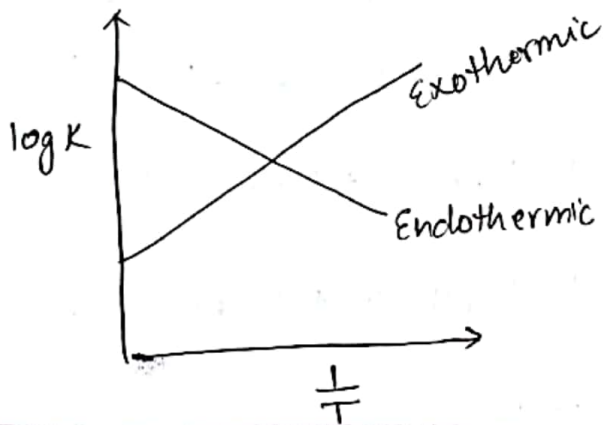
$$(117) \quad K = e^{-\frac{\Delta H}{RT}}$$

for exothermic reaction;

$$K_{eq}^m \propto \frac{1}{T}$$

for endothermic reaction;

$$K_{eq}^m \propto T$$



(118) Clausius-Clapeyron equation:

for; liquid \rightleftharpoons vapour

$$\frac{d \ln P}{dT} = \frac{\Delta H_{vap}}{RT^2}$$

$$(119) \quad K_i = c\alpha^2$$

$$\therefore \alpha = \sqrt{\frac{K_i}{c}}$$

(120) at 90°C, $K_w = 10^{-12}$
at 25°C; $K_w = 10^{-14}$

121) for conjugate acid-base pairs like
HF/F⁻, HCN/CN⁻, etc;

$$K_a \cdot K_b = K_w$$

$$122) \quad pK_a + pK_b = pK_w$$

$$\therefore pK_a + pK_b = 14$$

$$123) \quad pH + pOH = 14$$

$$124) \quad pH \propto \frac{1}{\text{temperature}}$$

125) pH for blood = 7.42
pH for rain water = 5.4-5.6
pH for distilled water = 7

126) pH for strong acid:
 $pH = -\log(\text{Normality})$

for monoprotic acid;

$$pH = -\log c$$

127) pH for weak acid;

$$1) \quad pH = -\log(c \cdot \alpha)$$

$$2) \quad pH = -\frac{1}{2} \log(K_a \cdot c)$$

$$3) \quad pH = \frac{1}{2}(pK_a - \log c)$$

(128)

for strong base;

$$pOH = -\log(c) \quad \therefore pH = 14 - pOH$$

(129)

pOH for weak base:

$$1) \quad pOH = -\log(c\alpha)$$

$$2) \quad pOH = -\frac{1}{2} \log(K_b \cdot c)$$

$$3) \quad pOH = \frac{1}{2}(pK_b - \log c)$$

(130) for strong acid having conc $< 10^{-6}$ M;
pH will be between 6 and 7.
as conc of H^+ is also considered
 $\therefore pH = 6.98$

(131) for strong base having conc $< 10^{-6}$ M;
pH will be between 7 to 8.
 $\therefore pH = 7.02$

(132) for mixing of two strong acids;
$$pH = -\log \left(\frac{M_1 V_1 + M_2 V_2}{V_1 + V_2} \right)$$

(133) for mixing of two strong bases;
$$pOH = -\log \left(\frac{M_1 V_1 + M_2 V_2}{V_1 + V_2} \right)$$

(134) for mixture of two weak acids:

i) $pH = -\log (C_1 \alpha_1 + C_2 \alpha_2)$

ii) $pH = -\log (K_{a1} C_1 + K_{a2} C_2)$

(135) for mixture of two weak bases:

i) $pOH = -\log (C_1 \alpha_1 + C_2 \alpha_2)$

ii) $pOH = -\log (K_{b1} C_1 + K_{b2} C_2)$

(136) Neutral

(137) Acidic

(138) Basic

(139) May be acidic or basic

(140) $K_h = ch^2 \therefore K_h = \frac{K_w}{K_a}$

(141) $K_h = \frac{K_w}{K_b}$

(142) $K_h = \frac{K_w}{K_a \cdot K_b}$

(143) $h = \sqrt{\frac{K_w}{K_a \cdot C}}$

(144) $h = \sqrt{\frac{K_w}{K_b \cdot C}}$

(145) $h = \sqrt{\frac{K_w}{K_a \cdot K_b}}$

(146) $pH = 7$

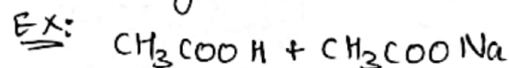
(147) $pH = 7 - \frac{1}{2} pK_a - \frac{1}{2} \log C$

$C = \text{conc. of salt}$

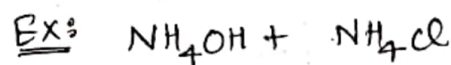
(148) $pH = 7 + \frac{1}{2} pK_b + \frac{1}{2} \log C$

(149) $pH = 7 + \frac{1}{2} (pK_a - pK_b)$

(150) Acidic buffer consists of
a weak acid + salt of weak
acid & strong base.



(151) Basic buffer consists of a
weak base + salt of weak base
& strong acid



(152) $pH = pK_a + \log \frac{[\text{salt}]}{[\text{Acid}]}$

(153) $pOH = pK_b + \log \frac{[\text{salt}]}{[\text{Base}]}$

(154) pK_{a-1} to pK_{a+1}

(155) pK_{b-1} to pK_{b+1}

(156) Buffer capacity @ Buffer index:

$$B.I = \frac{\text{Conc of strong acid @ strong base}}{\text{change in pH}}$$

$$\therefore B.I = \frac{\Delta x}{\Delta pH}$$

Also:

$$B.I = \frac{2.303 ab}{a+b}$$

a: moles of acid @ base

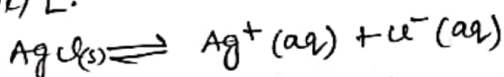
b: moles of salt

(157) $1.8 \times 10^{-10} \text{ mol}^2/\text{L}^2$

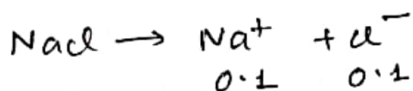
(158) Solubility (s) = $\left(\frac{K_{sp}}{x^x \cdot y^y}\right)^{\frac{1}{x+y}}$

(159) if $Q > K_{sp}$; precipitation of salt occurs.

(160) let; solubility of AgCl is 's' mol/L.



at eq^m, solubility: — s s



Here; common ion = Cl^-

$$\therefore [Cl^-] = s + 0.1 \approx 0.1M$$

Due to common ion Cl^- ; conc of Cl^- increases in the solution due to which rxn shift in

backward direction.

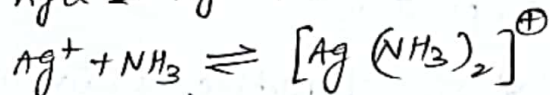
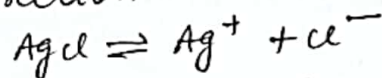
i.e: "In 0.1 M NaCl, solubility of AgCl decreases" due to common ion effect.

$$\therefore K_{sp} = [Ag^+][Cl^-]$$

$$= s(0.1)$$

$$s = \frac{K_{sp}}{0.1}$$

(161) In presence of NH_3 "solubility of AgCl increases as Ag^+ immediately forms $[Ag(NH_3)_2]^+$ and reaction shift in forward direction.



(162)

let; solubility of AgCl = s_1 mol/L

solubility of AgBr = s_2 mol/L

$$\therefore [Ag^+] = s_1 + s_2$$

$$[Ag^+] = \frac{K_{sp1} + K_{sp2}}{\sqrt{K_{sp1} + K_{sp2}}}$$

$$\therefore [Ag^+] = \sqrt{K_{sp1} + K_{sp2}}$$

(163)

$$pH = \frac{pK_{a1} + pK_{a2}}{2}$$

(164)

$$K_{a1} \gg K_{a2}$$

\therefore pH for diprotic acid like H_2A is:

$$pH = -\frac{1}{2} \log(K_{a1} \cdot c)$$

(165) for an Indicator; HIn
$$pH = pK_{In} + \log \frac{[In^-]}{[HIn]}$$

(166)

1. Solid in solid = Metal alloys
2. Liquid in solid = Na(Hg)
3. Gas in solid = $H_2(g)$ in Pd
4. Solid in liquid = NaCl in water
5. Liquid in liquid = alcohol in water
6. Gas in liquid = CO_2 in water
7. Solid in gas = Camphor in N_2
8. Liquid in gas = chloroform in N_2
9. Gas in gas = $O_2 + N_2$

(167) Solubility is defined as amount of solute dissolved in a given solvent at a particular temperature.

(168) size of particle, nature of solute and solvent, Temp, pressure

(169) Henry's Law: Solubility (mole fraction) of a gas in liquid phase is directly proportional to its partial pressure.

$$\text{solubility}(x) \propto p$$

$$\therefore \boxed{p = K_H \cdot x}$$

K_H = Henry's constant

p = partial pressure of gas.

(170) Oxygen = 32.1 %

He = 11.7 %

N_2 = 57.2 %

(171) $K_H \propto \text{temp}$

\therefore Increases

(172) Raoult's law states that, in a binary liquid solution, partial pressure of a component is directly proportional to its mole fraction in liquid phase.

$$i.e. P_A \propto x_A$$

$$P_A = P_A^0 \cdot x_A$$

(173) Force of attraction = 0

$$2) \Delta H_{mix} = 0 (\Delta H_1 + \Delta H_2 + \Delta H_3 = 0)$$

$$3) \Delta V_{mix} = 0$$

4) Ex: Benzene + Toluene
hexane + heptane

(174) 1) solute-solute and solvent-solvent interactions are stronger than solute-solvent interaction

$$2) \Delta H_{mix} > 0$$

$$3) \Delta V_{mix} > 0$$

$$4) P_{observed} > P_{calculated}$$

(175) 1) solute-solute and solvent-solvent interaction is weaker than solute-solvent interaction

$$2) \Delta H_{mix} < 0$$

$$3) \Delta V_{mix} < 0$$

$$4) P_{observed} < P_{calculated}$$

(176) Ideal Solution

a) hexane + heptane

b) ethyl chloride + ethyl bromide

c) Benzene + toluene

d) CCl_4 + CCl_3Br

True deviation:

1) hexane + water

2) ethanol + water

3) Benzene + CCl_4

4) Toluene + CCl_4

-ve deviation

HCl + water
acetone + water
phenol + pyridine
HNO₃ + water

(177)

Minimum boiling azeotrope shows +ve deviation.

Ex: Ethanol + water
(95%) (5%)

Maximum boiling azeotrope shows -ve deviation:

Ex: nitric acid + water
(68%) (32%)

(178)

- Relative lowering in vapour pressure
- Elevation in boiling point
- Depression in FP
- Osmotic pressure

(179)

$$\frac{P_A^0 - P_A}{P_A^0} = x_B \cdot i$$

x_B = mole fraction of non-volatile solute

P_A^0 = VP of pure solvent

P_A = VP of solution

(180) $\Delta T_b = K_b \times m \times i$
 $\therefore (\Delta T_b = T_b - T_b^0)$

(181) $\Delta T_f = K_f \times m \times i$
 $\therefore \Delta T_f = T_f^0 - T_f$

(182) $\Pi = CRT \times i$
 C = concentration of solution
 Π = Osmotic pressure

(183)

Osmosis is defined as flow of solvent from lower concentration of solution to higher concentration through semi-permeable membrane.
• In osmosis solvent molecules can flow from both side of membrane with unequal flow rates.

Osmotic pressure (Π) is defined as extra pressure applied to prevent the osmosis.

$$\Pi = CRT$$

(184)

Natural SPM: Animal bladder
Synthetic SPM: Cellophane
(Cellulose acetate)

(185)

unit of $K_b = ^\circ C / \text{molal}$
② $^\circ C \cdot \text{kg/mol}$

(186)

$$K_b = \frac{R(T_b^0)^2 \cdot M_A}{1000 \cdot \Delta H_{\text{vap}}}$$

$$K_f = \frac{R(T_f^0)^2 \cdot M_A}{1000 \cdot \Delta H_f}$$

T_f^0, T_b^0 = FP & BP of pure solvent

M_A = molar mass of solvent

ΔH_{vap} = Enthalpy of vapourisation

ΔH_f = Enthalpy of fusion.

(187)

$i = \frac{\text{observed colligative property}}{\text{theoretical colligative property}}$
 $i = \frac{\text{Normal (theoretical) molar mass}}{\text{Abnormal (observed) molar mass}}$

(188)

Isotonic solution: They have same osmotic pressure.

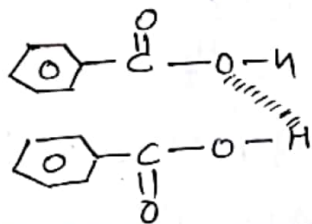
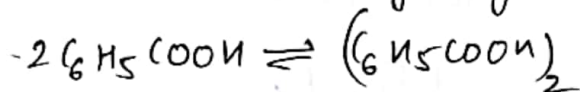
$$i.e. \pi_1 = \pi_2$$

• Blood cells are isotonic with solution having 0.9% w/v NaCl (0.16 M)

Hypotonic solution: They have conc. of NaCl less than 0.9% w/v due to which a cell placed in this solution swells up due to osmosis of water inside the cell, also known as EDEMA.

Hypertonic solution: They have conc. of NaCl more than 0.9% w/v due to which a cell placed in this solution loses water through osmosis and shrinks.

(189) Because benzoic acid undergoes dimerisation in benzene due to intermolecular hydrogen bonding.



(190) Berkeley & Hestley's

(191) osmotic pressure

(192) It converts spontaneous chemical energy into electrical energy.

(193) Salt Bridge:

- 1) It connects the circuit internally.
- 2) It prevent polarisation of electrodes
- 3) It consists of a gel made up of agar-agar solution and strong electrolyte like KNO_3 in which K^+ and NO_3^- have same speed.

(194) EMF is the potential of a cell when net current flow from the circuit is zero.

$$EMF \Rightarrow E_{cell}^{(0)} = E_{cell}$$

(195) Primary reference electrode is SHE (standard hydrogen electrode)

(196) Secondary reference electrode is calomel (Hg_2Cl_2)

(197) F_2

(198) Li^+

$$(199) \Delta G = -nF E_{cell}$$

$$\Delta G = -nF E_{cell}$$

(200) $1F = 964787 C$

which is defined as charge of one mole electrons

$$(201) E_{cell} = E_{cell} - \frac{RT}{nF} \log Q$$

at 298K

$$\therefore E_{cell} = E_{cell} - \frac{0.059}{n} \log Q$$

$$(202) \Delta G^\circ = -2.303 RT \log K_{eq}^m$$

$$\therefore \log K_{eq}^m = \frac{n}{0.059} E_{cell}^\circ$$

$$(203) E_{cell}^\circ = SRP_{cathode} - SRP_{anode}$$

$$\therefore E_{cell}^\circ = E_{cathode}^\circ - E_{anode}^\circ$$

$$(204) E_3^\circ = \frac{n_1 E_1^\circ + n_2 E_2^\circ}{n_3}$$

$$(205) \eta = \left| \frac{\Delta G}{\Delta H} \right| \times 100$$

$$(206) \frac{dE_{cell}}{dT} \text{ (or) } \frac{\Delta E_{cell}}{\Delta T}$$

(207) It's electrode is made up of same material.
 $E_{cell}^\circ = 0$

(208) Electrolytic cell converts electrical energy to non-spontaneous chemical energy

(209) It states that 'the amount of substance deposited (w) is directly proportional to the amount of charge transfer.'
 $w \propto Q$

$$(210) w = z \cdot i t$$

$$\therefore \left(\frac{w}{E} \right) = \frac{i t}{96500}$$

↳ g-equivalent

(211) Electrochemical equivalence (z):

It is the amount of substance deposited when $\pm e$ of charge is passed through solution.

$$z = \frac{\text{molar mass}}{n \times F}$$

(212) If cells are connected in series then gram equivalent of substance deposited will be equal at each cell.

$$\frac{W_1}{E_1} = \frac{W_2}{E_2}$$

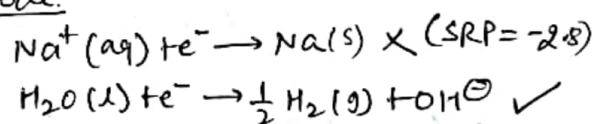
(213) SRP, nature of electrodes, concentration of electrolyte, kinetics (speed) of reaction

(214)

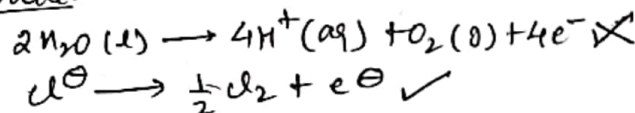
Ans: Cathode: $H_2(g)$
 Anode: $Cl_2(g)$

Rxn:

Cathode:



Anode:

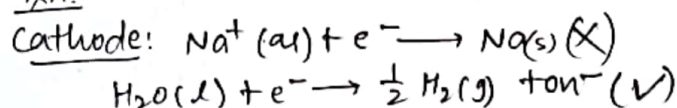


Rxn of Cl^\ominus is feasible at anode due to overvoltage which increases the speed of Cl^\ominus

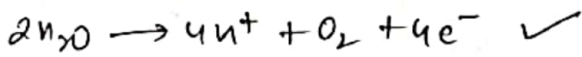
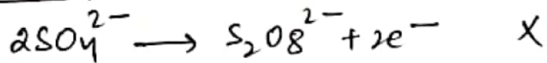
(215)

Ans: Cathode: $H_2(g)$
 Anode: $O_2(g)$

Rxn:



Anode:



\therefore as solution is aq; so deposited of H_2O at anode will be feasible.

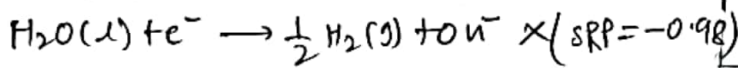
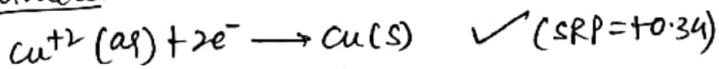
(216)

Ans: Cathode: $\text{Cu}(s)$

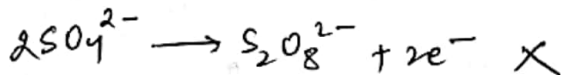
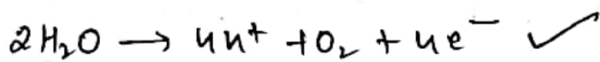
Anode: $\text{O}_2(g)$

Rn:

Cathode:



Anode:



(217) Ag, Au

(218) Resistance (R) = $\rho \frac{l}{A}$

where: ρ = resistivity

⊙ specific resistance

$$\text{Conductance (G)} = \frac{1}{R}$$

$$\therefore G = \kappa \cdot \frac{A}{l}$$

κ = conductivity ⊙ specific conductance.

(219)

S.I unit of Conductance = Ω^{-1} ⊙ mho

⊙ S (Siemen)

S.I unit of Resistance = Ω

⊙ $\text{kg} \cdot \text{m}^2 / \text{s}^2 \cdot \text{A}^2$

(220)

Electrolytic conductivity depends on:

a) concentration of electrolyte
b) viscosity

c) no. of ions

d) degree of solvation

e) Temp (Conductivity \propto Temp)

Metallic conductivity depends on:

a) no. of free electrons

b) nature of metal

c) Temp (conductivity $\propto \frac{1}{\text{Temp}}$)

(221) They have ∞ conductivity

⊙ zero resistivity at 0 Kelvin.

(222) specific conductance ⊙

conductivity (κ) is defined as the conductivity due to all the ions present in $\pm \text{cm}^3$ volume.

(223) Molar conductance (Λ_m)

$$\text{a) } \Lambda_m (\text{S cm}^2/\text{mol}) = \frac{\kappa (\text{S/cm})}{C (\text{mol/L})}$$

$$\text{b) } \Lambda_m (\text{S cm}^2/\text{mol}) = \frac{\kappa (\text{S/cm}) \times 1000}{C (\text{mol/L})}$$

$$\text{c) } \Lambda_m (\text{S m}^2/\text{mol}) = \frac{\kappa (\text{S/m})}{C (\frac{\text{mol}}{\text{L}}) \times 1000}$$

(224) Cell constant (G^*)

$$G^* = \frac{l}{A}$$

$$G^* = R \cdot \kappa$$

$\therefore R$ = resistance

κ = conductivity

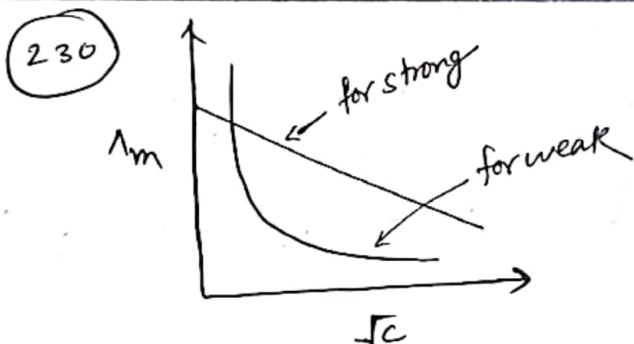
(225) Conductance \rightarrow Increases
 molar conductance \rightarrow Increases
 Conductivity \rightarrow decreases

(226)
 • Molar conductivity increases on dilution due to decrease in force of attraction (for strong electrolyte)
 • Molar conductivity increases on dilution due to increase in degree of dissociation, α (for weak electrolyte)

(227) $\Lambda_m = \Lambda_m^\infty - A\sqrt{c}$
 Λ_m = molar conductivity
 Λ_m^∞ = limiting molar conductivity
 A = Kohlrausch constant
 c = concentration of electrolyte

(228) At infinite dilution, the limiting equivalent conductivity of an electrolyte is summation of limiting conductivity of cations and anions, independent of the nature of electrolyte -

(229) $\Lambda_{eq}^\infty = \frac{\Lambda_m^\infty}{n\text{-factor}}$



(231) $\alpha = \frac{\Lambda_m}{\Lambda_m^\infty} \approx \frac{\Lambda_{eq}}{\Lambda_{eq}^\infty}$

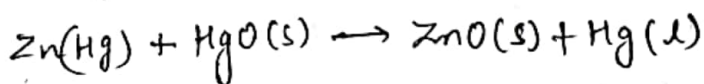
$K_a = \frac{c\alpha^2}{1-\alpha}$ \therefore
 $K_a = \frac{c \cdot \Lambda_m^2}{\Lambda_m^\infty (\Lambda_m^\infty - \Lambda_m)}$

(232) Primary Battery:
 \rightarrow Dry cell $\text{\textcircled{D}}$ Leclanche cell
 \rightarrow Mercury cell

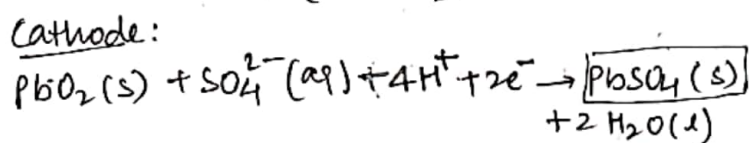
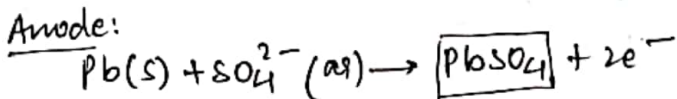
Secondary Battery:
 \rightarrow Ni-Cd Battery
 \rightarrow Lead storage battery

(233)
 Dry cell \Rightarrow 1.5V (variable)
 Mercury cell \Rightarrow 1.35V (constant)

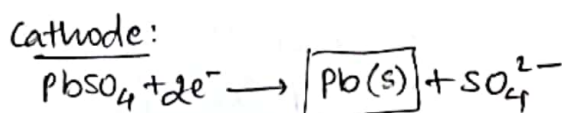
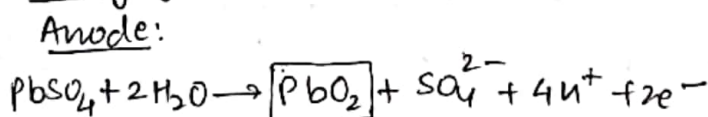
(234) As net reaction do not involve any ions.



(235) discharging:



charging:



(236)

Fuel cell: converts combustion energy into electrical energy
efficiency: 70%.

(237)

Deterioration of metals (oxidation of metals) due to action of moisture and air is called corrosion.

(238)

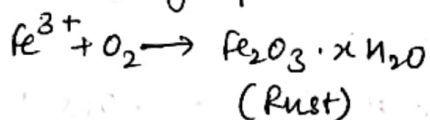
Bisphenol

(239)

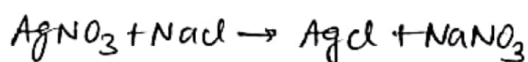
providing a sacrificial anode of metals like Zn, Sn, Mg which prevent the oxidation of original metal is called Galvanization.

(240)

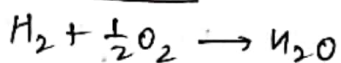
slow: Rusting of iron



fast: ionic rxn:



Moderate rxn:



(241)

mol/L·sec

(242)

conc, temp, pressure, surface area, catalyst

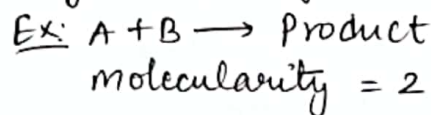
(243)

$(\text{conc})^{1-n} (\text{time})^{-1}$

(244)

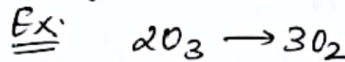
molecularity is the no. of reactants participating in

any elementary reaction.



• order is defined as sum of power of conc. of reactant in any rate equation.

Ex:



$$\text{rate} = k [O_3]^2 [O_2]^{-1}$$

$$\text{order} = 1$$

(245)

for zero order rxn:

• $\text{Rate} = k$ (rate constant)

• $C_A = C_{A0} - k \cdot t$

C_A = final concentration

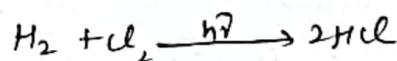
C_{A0} = initial concentration

k = rate constant

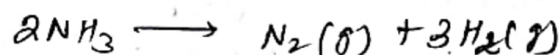
t = time (seconds)

(246)

i) photochemical reaction:



ii) decomposition of NH_3 :



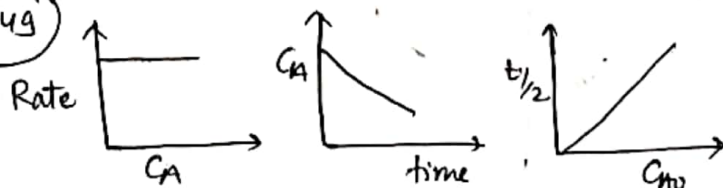
(247)

$$t_{1/2} = \frac{C_{A0}}{2k}$$

(248)

$$t_{1/2} \propto C_{A0}$$

(249)



$$(250) \text{ mol L}^{-1} \text{ sec}^{-1}$$

$$(251) t_{75} = \frac{3}{2} t_{50}$$

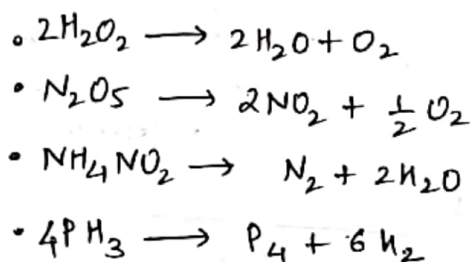
$$(252) C_A = C_{A0} e^{-Kt}$$

$$K = \frac{2.303}{t} \log \frac{C_{A0}}{C_A}$$

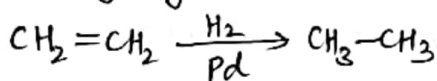
(253)

a) Radioactive decay

b) Decomposition rxns;



c) Hydrogenation rxn



(254)

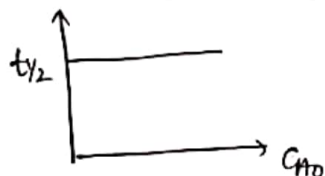
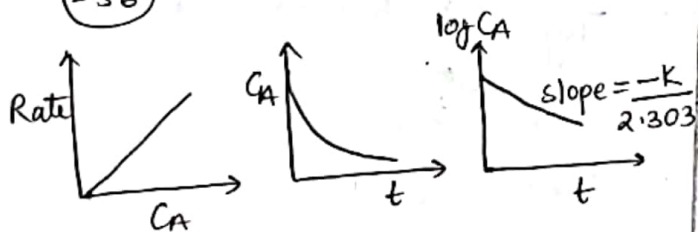
$$t_{1/2} = \frac{\ln 2}{K}$$

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

(255)

$t_{1/2}$ is independent of initial concentration (C_{A0})

(256)



$$(257) \text{ sec}^{-1} \text{ @ } \text{min}^{-1} \text{ @ } \text{hr}^{-1}$$

(258)

$$t_{75} = 2 \cdot t_{50}$$

(259)

$$t_{99.9} = 10 \cdot t_{1/2}$$

(260)

Conc after n -half lives:

$$= \frac{C_{A0}}{2^n}$$

(261)

$$\frac{1}{C_A} - \frac{1}{C_{A0}} = Kt$$

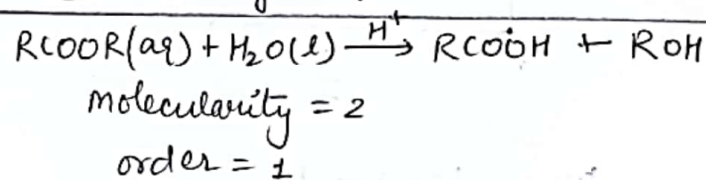
(262)

$$\text{mol}^{-1} \text{ L sec}^{-1}$$

(263)

$$t_{1/2} = \frac{1}{K \cdot C_{A0}}$$

(264) Hydrolysis of Ester:



(265)

$$\text{unit} = \text{sec}^{-1}$$

$$\text{molecularity} = 2$$

(266)

a) temperature

b) concentration of reactant which is present in excess.

(267)

$$\text{order}(n) = 1 + \left(\frac{\log (T_2/T_1)}{\log (C_1/C_2)} \right)$$

(268)

$$K = A \cdot e^{-E_a/RT}$$

(269)

$$\frac{k_2}{k_1} = \left(Q \right)^{\frac{\Delta T}{10}}$$

Q = temp coefficient which generally lie b/w 2 to 3.

(270)

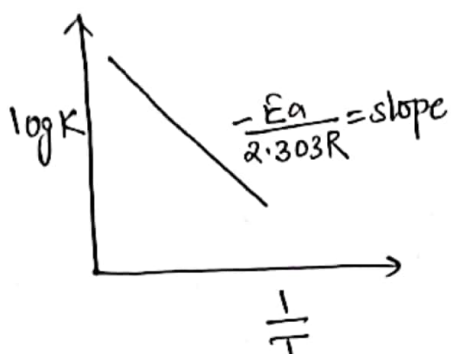
T.E = Activation Energy + P.E of reactant

(271)

Activation energy (E_a): It is the minimum extra energy required for reactant particles to reach transition state

Threshold Energy (TE): It is the min. amount of energy required for reactant molecules to form transition state.

(272)



$$\log K = \log A - \frac{E_a}{2.303RT}$$

(273)

1) It is based on KTG and applicable for bimolecular 1st order reaction.

2) Acc. to collision theory, products are formed by effective collision between reactant particles

3) No. of effective collision depends on two factors:

- Threshold energy (TE)
- Orientation factor (P)

(274)

a) Threshold energy
 $f = e^{-E_a/RT}$

b) orientation factor (P)

(275)

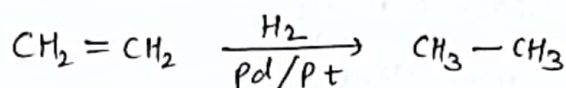
$$K = Z_{AB} \cdot P \cdot e^{-\frac{E_a}{RT}}$$

Z_{AB} : collision frequency.

(276) Catalyst increases the rate of reaction by decreasing activation energy.

ORGANIC CHEMISTRY

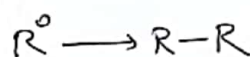
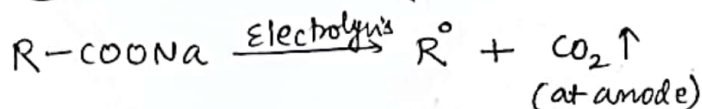
(277) Sabatier - Sanderson Reaction



a) Heat of hydrogenation \propto no. of π bond
 $\propto \frac{1}{\text{stability}}$

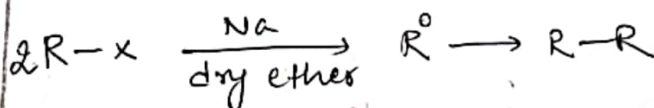
b) rate $\propto \frac{1}{\text{stability of alkene}}$

(278) Kolbe electrolysis



- Best method for symmetrical alkane
- CH_4 can't be produced by this method
- free radical mechanism.

(279) Wurtz Reaction



- Best method for symmetrical alkanes.
- CH_4 can't be produced
- ether is used because it is polar aprotic solvent.

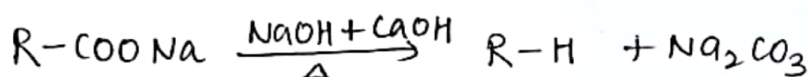
(280) Fittig Reaction:



(281) Wurtz-Fittig reaction

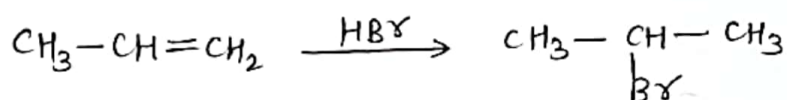


(282) Decarboxylation (i) soda-lime test

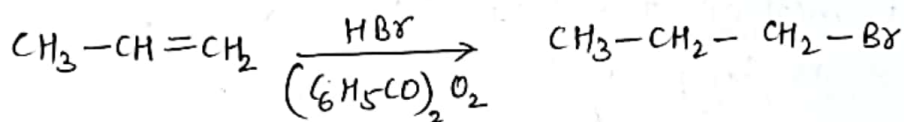


- Ratio of NaOH + CaO \Rightarrow 3:1
- Rate of rxn \propto stability of carbenion
- CH_4 can be prepared.

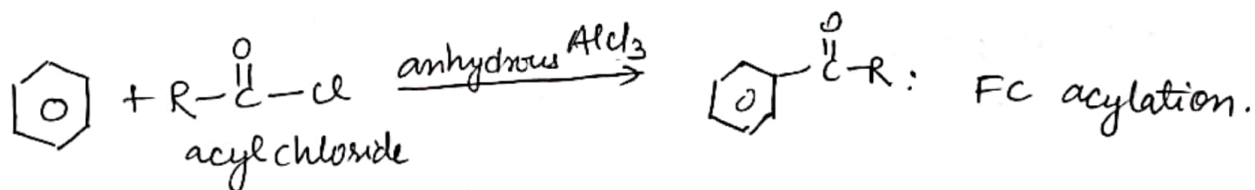
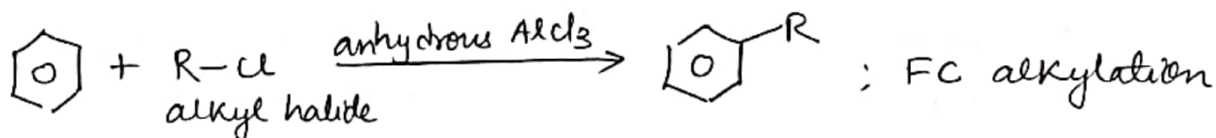
(283) Markovnikov's addition:



Anti-Markovnikov's Rule (free radical mechanism)

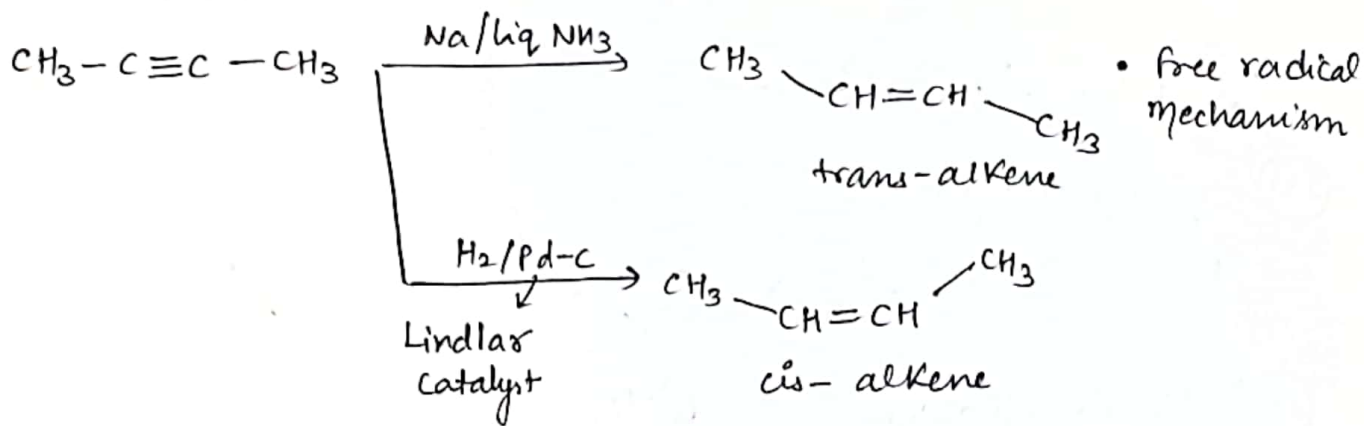


(284) Friedel-Craft Reaction

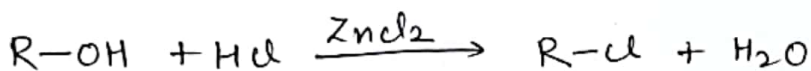


- In acylation; carbocation may rearrange into stable form.
- Acyl halide can't be used as reagent in alkylation.
- Any Lewis acid along with AlCl_3 can be used as a catalyst.

(285) Birch reduction:

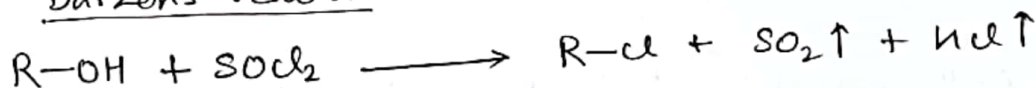


(286) Groove's Method



- $\text{HCl} + \text{ZnCl}_2$ is called Lucas reagent
- Above reaction takes place via carbocation formation.
- 1° and 2° alcohol requires ZnCl_2 (as a catalyst) for the reaction.
- Reactivity of alcohol: $3^\circ > 2^\circ > 1^\circ$
- Rate of HX : $\text{HI} > \text{HBr} > \text{HCl}$

(287) Darzen's reaction

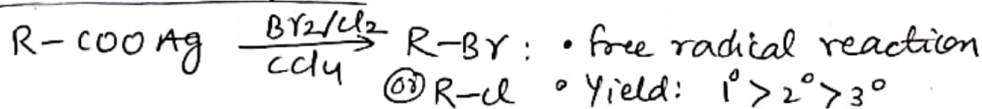


- It is best method for preparation of alkyl chloride from alcohol as by-products are gaseous.

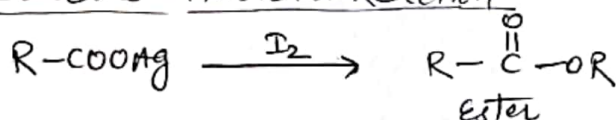
(288) Lucas test:

- 3° alcohol Lucas reagent → white turbidity (immediately)
- 2° alcohol Lucas reagent → white turbidity (10-15 min)
- 1° alcohol Lucas reagent → No-turbidity

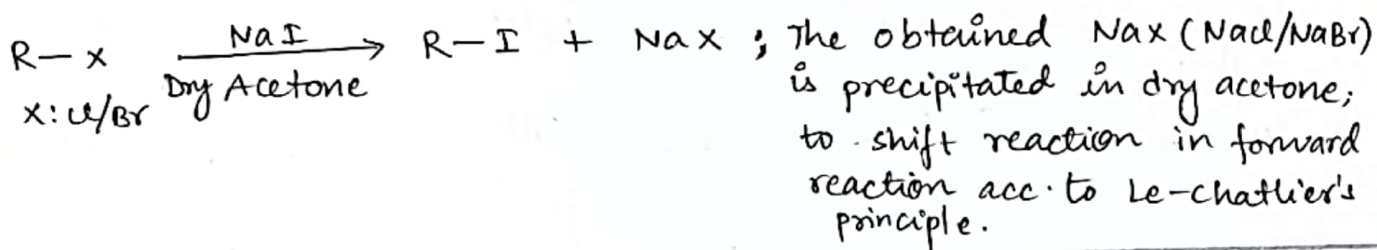
(289) Hunsdiecker Reaction



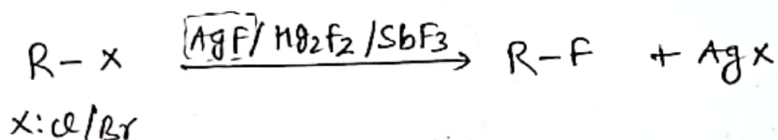
Borodine-Simonini Reaction



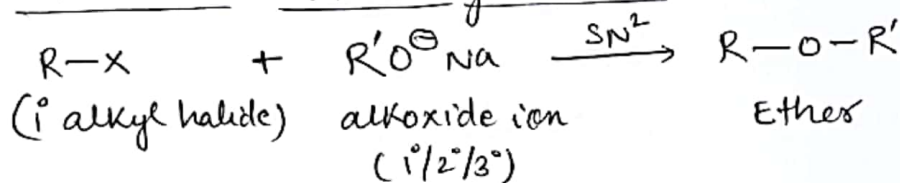
(290) Finkelstein Reaction



(291) Swarts Reaction

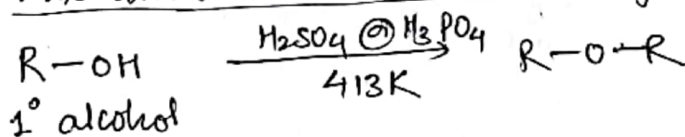


(292) Williamson Ether synthesis



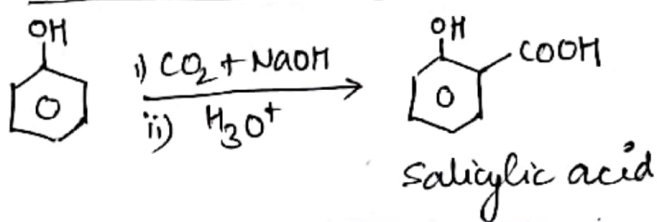
if alkyl halide is 2° or 3° then alkene will form via E₂.

(293) Williamson continuous ether synthesis:

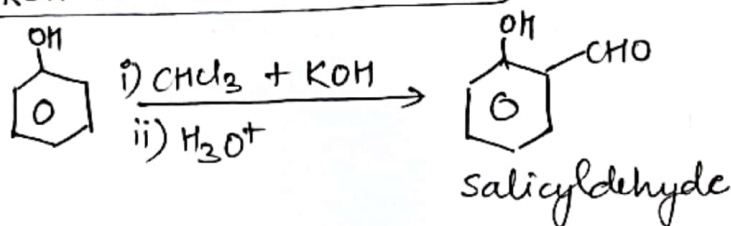


if alcohol is 2°/3° then alkene will form at 443K via E₁

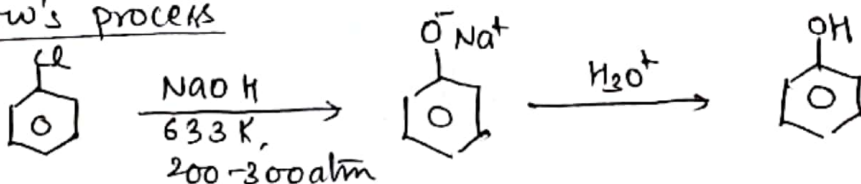
(294) Kolbe Reaction or Kolbe-Schmidt reaction



(295) Reimer-Tiemann reaction

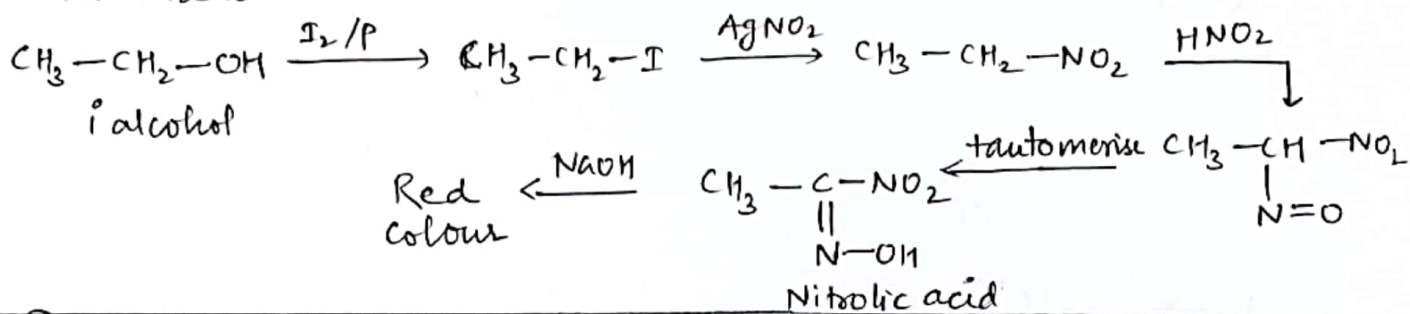


(296) Dow's process



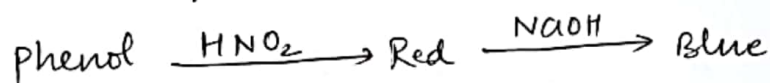
297) Victor-Mayer test

- It is a differentiation test for alcohols.
- 1°, 2° and 3° alcohols gives Red, violet and colorless solution in this reaction.



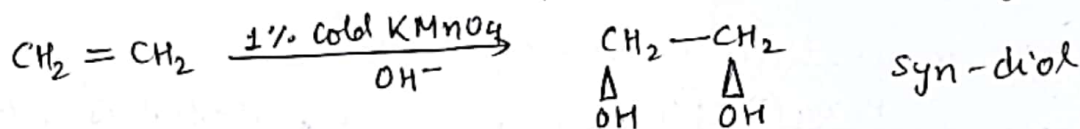
298) Lieberman-Nitroso test

It is a differentiation test for phenols from alcohols.

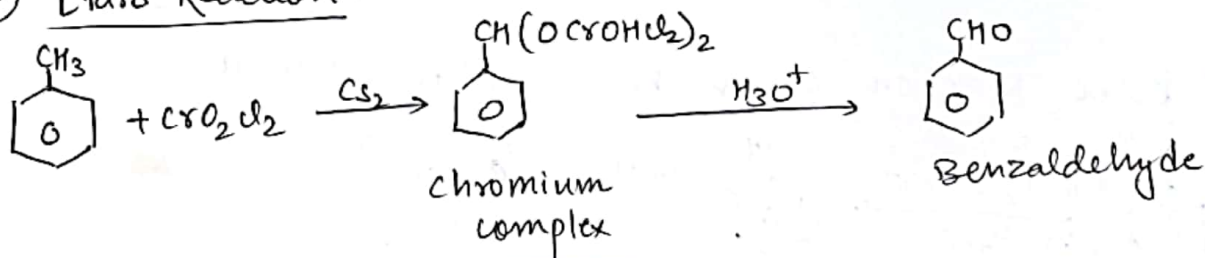


299) Baeyer's hydroxylation (Partial oxidation of alkene)

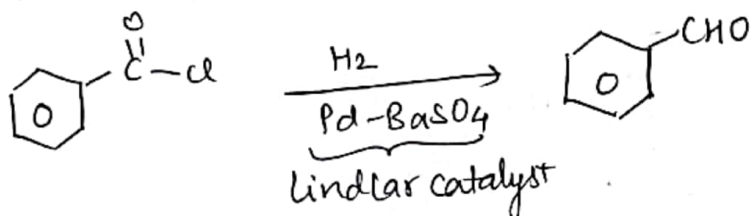
- 1% cold alkaline KMnO_4 .
- It is used for detection of double bonds in organic compounds.



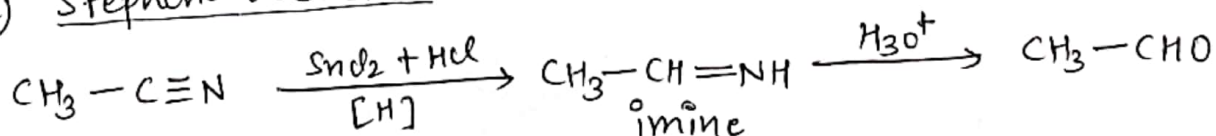
300) Etard Reaction



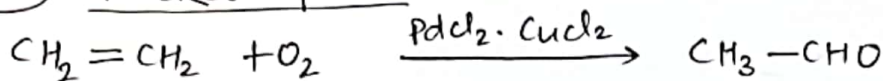
301) Rosenmund Reduction



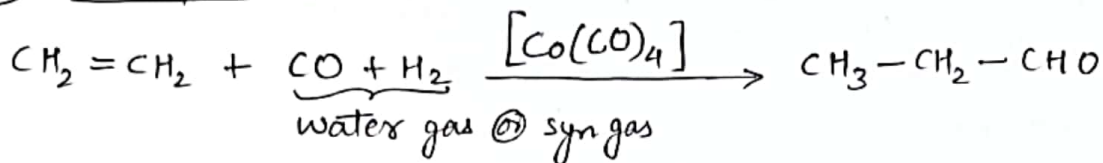
302) Stephen's reduction



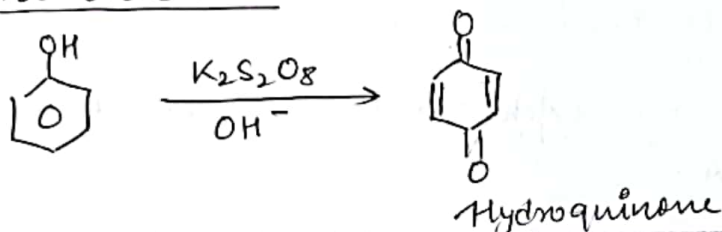
303 Wacker's process



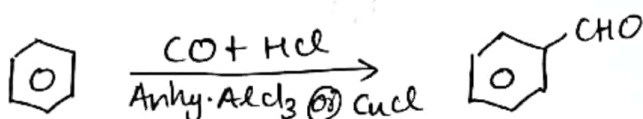
304 Oxo process



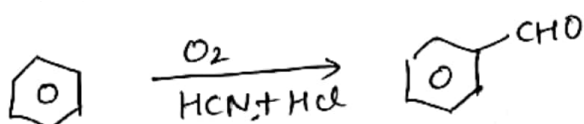
305 Elbe oxidation



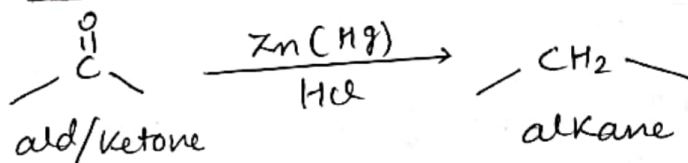
306 Gatterman-Koch reaction



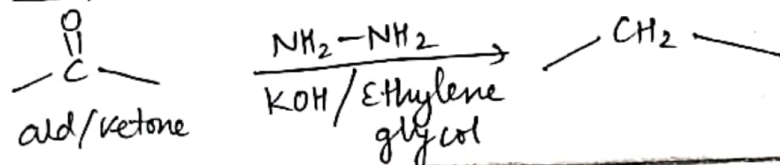
307 Gatterman Aldehyde Reaction



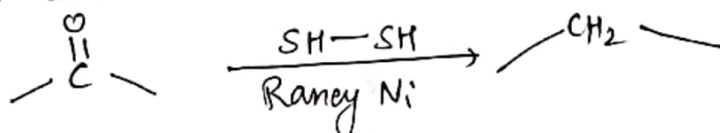
308 Clemmensen's reduction



309 Wolff-Kishner Reduction

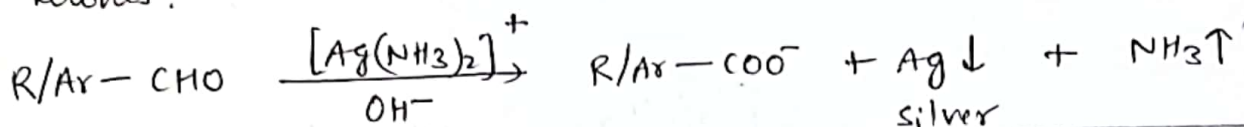


310 Mozingo Reduction



311) Tollen's oxidation:

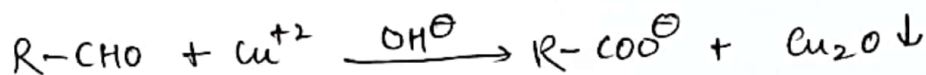
- This test is given by aldehydes, terminal alkynes and α -hydroxy ketones.



312) Fehling test:

- Fehling reagent contains two solution. F.S-A : $CuSO_4$ and F.S-B : Rochelle's salt (sodium potassium tartarate)

- This test is given by aliphatic aldehydes and some α -hydroxy ketones. with F.S-A.



→ Rochelle's salt prevents Cu^{+2} to get precipitated as $Cu(OH)_2$

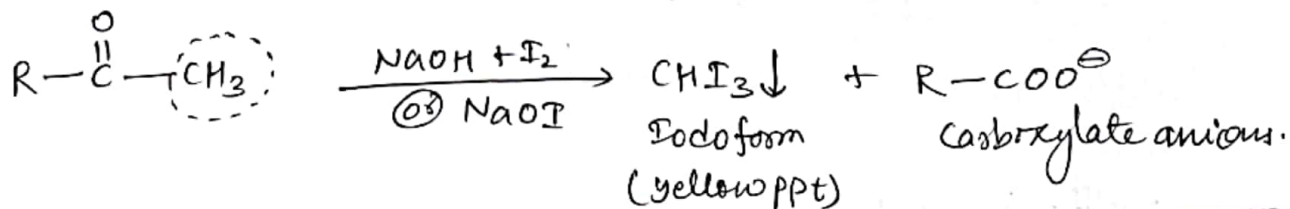
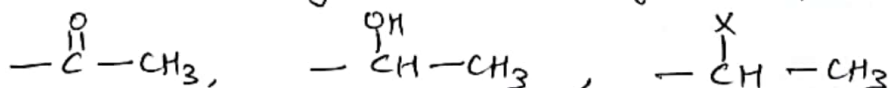
Red-brown ppt

313) Benedict Test:

- It is similar to Fehling test. It also contains two solution, i.e. $CuSO_4$ and sodium citrate

314) Haloform test

- This test is given by aldehydes, ketones, alkyl halides and alcohols having active methyl group ($-CH_3$) as:

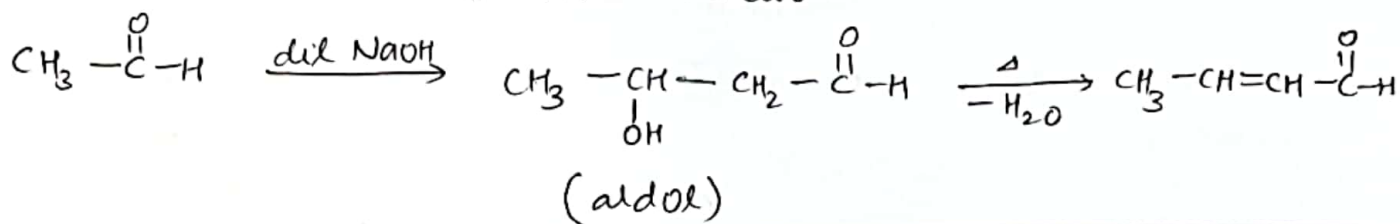


315) Aldol condensation:

- Aldol condensation reaction is given by aldehydes and ketones which have alpha hydrogen

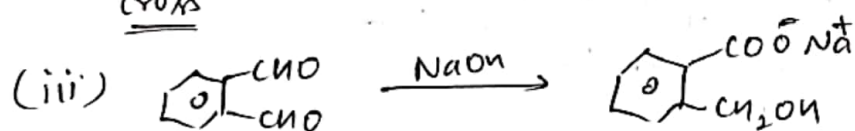
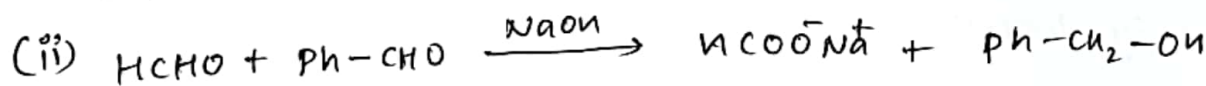
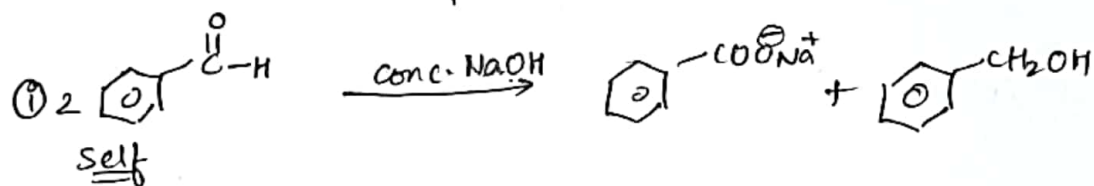
- Aldehydes having αH forms aldol (aldehyde + alcohol) on reaction with dil NaOH as a catalyst which further released water to form product.

- When two same aldehydes molecules react, it is called 'self aldol reaction' while reaction between two different aldehyde molecules is called cross aldol reaction

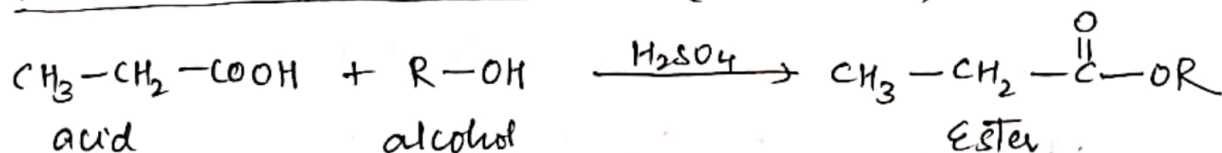


316) Cannizzaro reaction:

- Aldehyde molecules which do not have any α -hydrogen undergoes disproportionation (self oxidation to acid and self reduction to alcohol) in presence of conc. NaOH or KOH as a base.
- It is also of three types: (a) self Cannizzaro rxn (b) cross-Cannizzaro reaction (c) Intramolecular Cannizzaro reaction
- In RDS step of this reaction, H^- (hydride) transfer takes place.

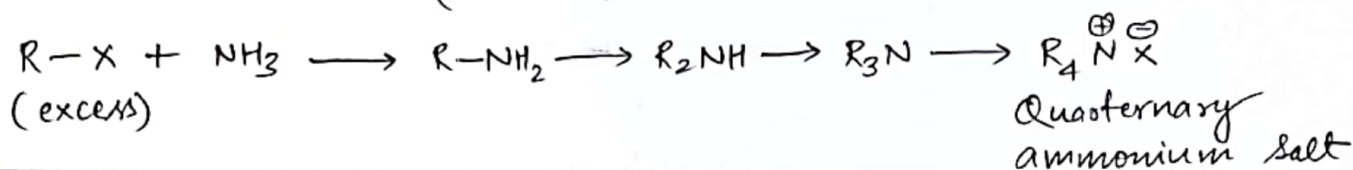
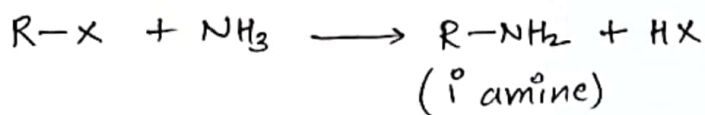


317) Fisher-Esterification reaction (Ester test)

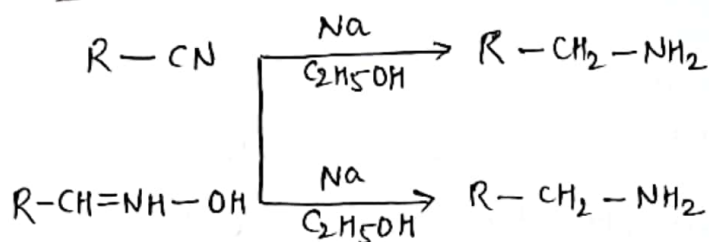


- Reactivity: 1° alcohol > 2° alcohol > 3° alcohol
- Above esterification can also take place by reaction of alcohol with acid anhydride in presence of H_2SO_4 and by acid chloride in presence of Et_3N .

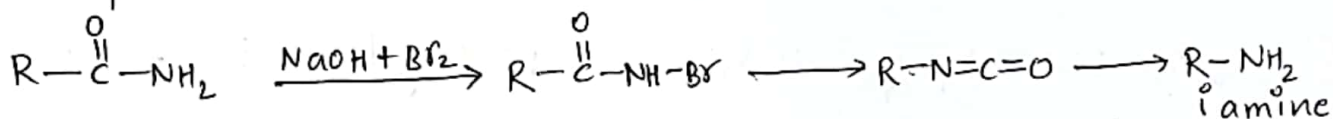
319) Hoffmann's Ammonolysis reaction



320) Mendius reaction

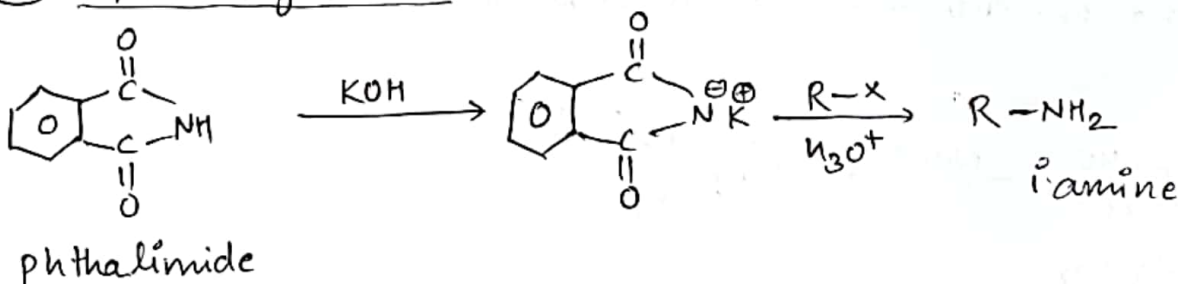


321) Hoffmann's Bromamide degradation reaction:



• This method is used for preparation of 1° amine.

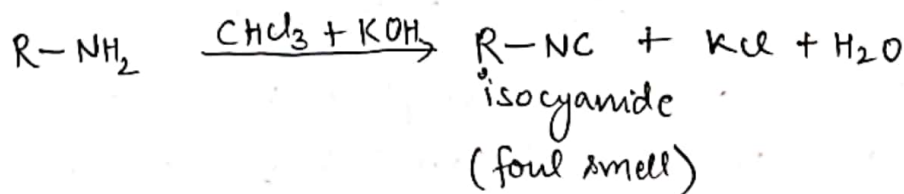
322) Gabriel synthesis:



→ Aromatic amines can't be prepared by this method.

323) Carbylamine test (or) Isocyanide test

→ It is a confirmatory test for 1° amine.



324) Hinsberg reagent's reaction

• Hinsberg reagent is aryl sulfonyl chloride: c1ccccc1S(=O)(=O)Cl

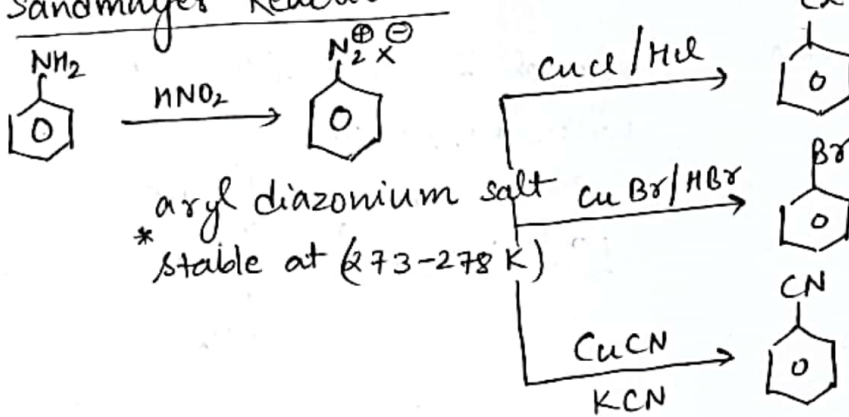
• This test is used for differentiation of 1°, 2° and 3° amine

a) 1° amine $\xrightarrow{H \cdot R}$ N-Substituted Sulfonyl amide \xrightarrow{NaOH} Soluble

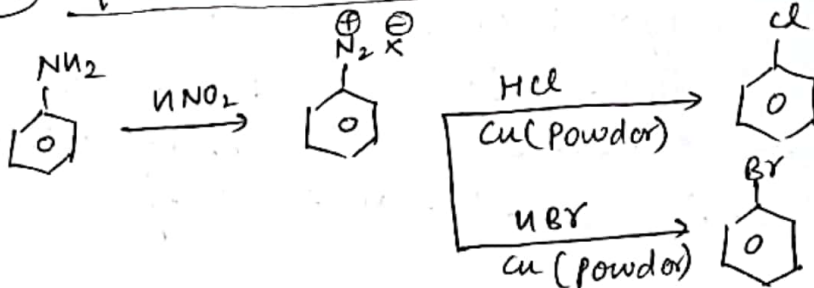
b) 2° amine \xrightarrow{HR} N,N-disubstituted Sulfonyl amide \xrightarrow{NaOH} Insoluble

c) 3° amine $\xrightarrow{H \cdot R}$ X

325) Sandmeyer Reaction

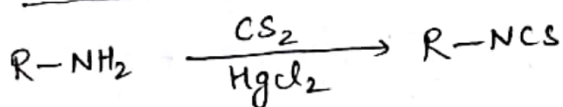


326) Gatterman Reaction:

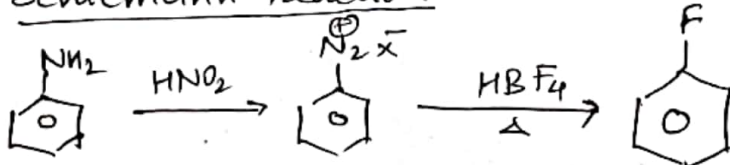


∴ Yield of halobenzene: Sandmeyer > Gatterman rxn.

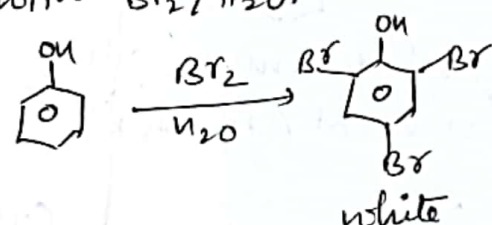
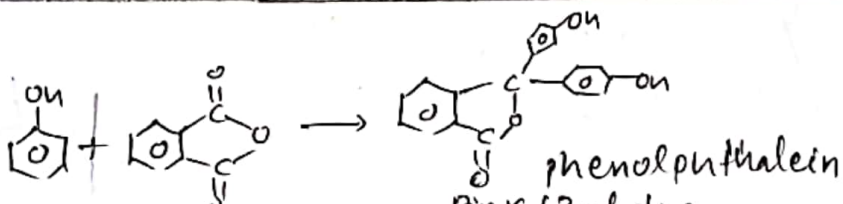
327) Mustard oil reaction:

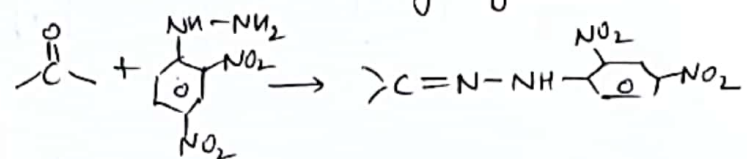


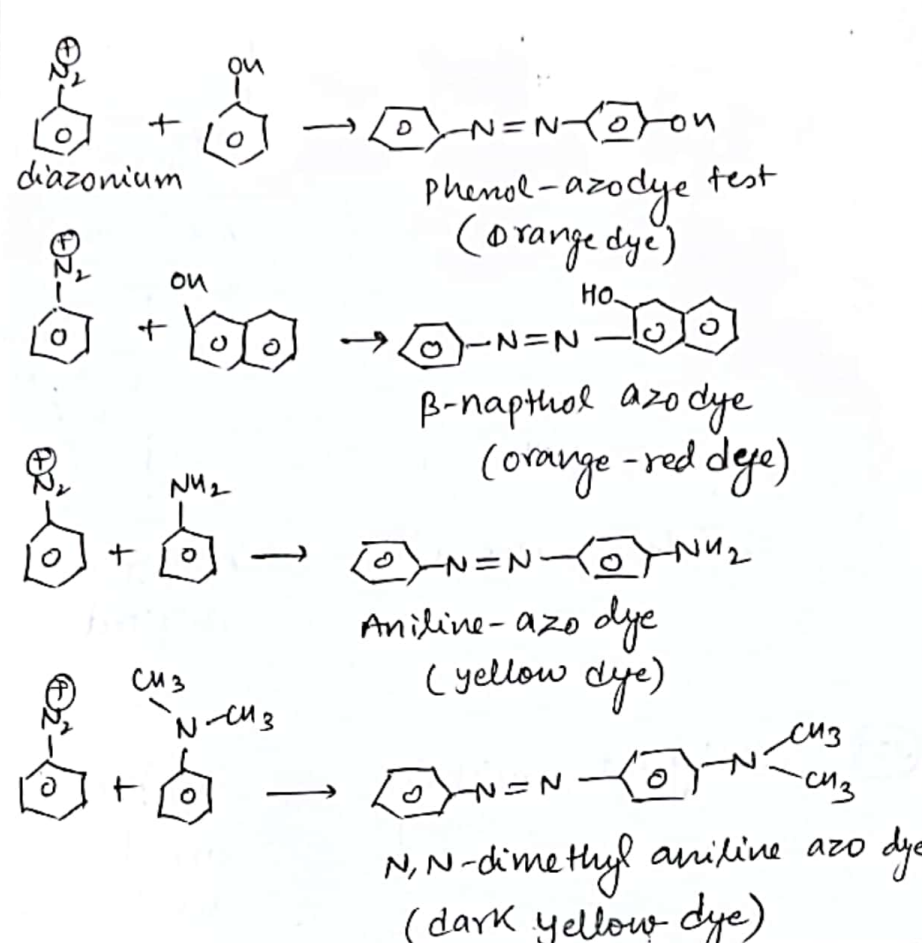
328) Schiemann reaction



IMPORTANT TESTS for FUNCTIONAL GROUPS

S.No	Test Name	Functional Group	Reaction & Important points
329	unsaturation test	alkene	$\text{CH}_2=\text{CH}_2 \xrightarrow[\text{CCl}_4]{\text{Br}_2} \begin{array}{c} \text{CH}_2-\text{CH}_2 \\ \quad \\ \text{Br} \quad \text{Br} \end{array}$ <ul style="list-style-type: none"> In presence of a π bond, Red-brown of Br_2 get decolorised
330	Baeyer's test	alkene	$\text{CH}_2=\text{CH}_2 \xrightarrow[\text{OH}^-]{1\% \text{ cold KMnO}_4} \begin{array}{c} \text{CH}_2-\text{CH}_2 \\ \Delta \text{OH} \quad \Delta \text{OH} \end{array}$ <p style="text-align: center;">Syn diol</p>
331	Bromine water test	phenol	<p>phenol forms white ppt on reaction with $\text{Br}_2/\text{H}_2\text{O}$.</p> 
332	Lucas test	Alcohols	<ul style="list-style-type: none"> It is a differentiation test for alcohols with Lucas reagent ($\text{HCl} + \text{ZnCl}_2$) 3° alcohol $\xrightarrow{\text{LR}}$ Immediate white turbidity 2° alcohol $\xrightarrow{\text{LR}}$ white turbidity (after 15 mins) 1° alcohol $\xrightarrow{\text{LR}}$ No turbidity
333	Ceric ammonium test (CAN)	alcohol	alcohol forms red colour with ceric ammonium nitrate.
334	Iodoform test	ald/ketones alcohols alkyl halide	$\text{R}-\overset{\text{O}}{\parallel}{\text{C}}-\text{CH}_3 \xrightarrow[\text{I}_2]{\text{NaOH}} \text{R}-\text{COO}^- + \text{CHI}_3 \downarrow$ <p style="text-align: right;">yellow</p>
335	phthalein dy test	phenol	 <p style="text-align: center;">phenolphthalein Pink/Red dye</p>

336	Neutral FeCl_3 test	phenol	phenol forms violet color with neutral FeCl_3 . $\text{Ph-OH} + \text{FeCl}_3 \rightarrow (\text{PhO})_3\text{Fe}$
337	2,4 DNP test	Ald/ketones	Ald/ketone forms orange-red precipitate with 2,4 Dinitro phenyl hydrazine $\text{>C=O} + \text{NH-NH}_2 \rightarrow \text{>C=N-NH-}$ 
338	Schiff test	Aldehydes	Aldehydes restores the pink colour of Schiff reagent, (rosaniline hydrochloride)
339	Fehling test	Aliphatic aldehyde	aliphatic aldehydes forms carboxylic acid and forms red-brown ppt of Cu_2O on reaction with fehling's reagent (CuSO_4)
340	Benedict test	Aliphatic aldehyde	It is similar to Fehling test and given by aliphatic aldehydes.
341	Tollen's test	Aldehydes	Aliphatic and aromatic aldehydes forms silver coloured ppt on reaction with Tollen's reagent ($[\text{Ag}(\text{NH}_3)_2]^+$)
342	Litmus test	Carboxylic acid	Acid turns blue litmus into red.
343	NaHCO_3 test	Carboxylic acid	Carboxylic acid gives effervescence of CO_2 gas with NaHCO_3 . $\text{RCOOH} + \text{NaHCO}_3 \rightarrow \text{CO}_2 \uparrow$
344	Ester test	Carboxylic acid	carboxylic acid on reaction with ethanol gives fruity smell of ester in presence of H_2SO_4 .
345	Carbylamine test	Amines (1°)	1° amines gives foul smell of isocyanide with $\text{CHCl}_3 + \text{KOH}$.

346	Azodye test	<p>a) phenol</p> <p>b) β-naphthol</p> <p>c) Aniline</p> <p>d) N,N-dimethyl aniline</p>	 <p>phenol-azodye test (orange dye)</p> <p>β-naphthol azodye (orange-red dye)</p> <p>Aniline-azo dye (yellow dye)</p> <p>N,N-dimethyl aniline azo dye (dark yellow dye)</p>
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347	Hinsberg test	$1^\circ/2^\circ/3^\circ$ amines	<p>Hinsberg test is used to differentiate $1^\circ/2^\circ/3^\circ$ amines. 1° amine forms alkali soluble product on reaction with Hinsberg reagent.</p> <p>2° amine forms alkali insoluble product with Hinsberg reagent.</p> <p>3° amine doesn't react with Hinsberg reagent.</p>
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348	Distillation	354	Partition chromatography
349	steam-distillation	355	$R_f = \frac{\text{distance moved by substance (x)}}{\text{distance moved by solvent (y)}}$ <p>↳ in thin-layer chromatography</p>
350	Distillation under reduced pressure.	356	CuO
351	fractional distillation	357	N ₂
352	Liquids which are steam volatile	358	NH ₃
353	<p>a) thin-layer chromatography</p> <p>b) column chromatography</p>	359	$\%C = \frac{12}{44} \times \frac{\text{mass of CO}_2}{\text{mass of O.C}} \times 100$

$$\% H = \frac{2}{18} \times \frac{\text{mass of } H_2O}{\text{mass of O.C}} \times 100$$

(360) In Duma's method:

$$\% N = \frac{P_{N_2} \cdot V}{RT} \times 28 \times 100$$

—————
mass of O.C

$$\therefore \% N = \frac{28 \cdot P_{N_2} \cdot V}{RT \times \text{mass of O.C}} \times 100$$

(361) In Kjeldahl's method:

$$\% N = \frac{2.8 \times M \left(V - \frac{V_1}{2} \right)}{\text{mass of O.C}}$$

M = molarity of H_2SO_4

$\left(V - \frac{V_1}{2} \right)$ = Volume of H_2SO_4 which neutralizes NH_3 (in ml)

V = volume of H_2SO_4 (in ml)

V_1 = volume of NaOH (in ml)

$$(362) \% S = \frac{32}{233} \times \frac{\text{mass of } BaSO_4}{\text{mass of O.C}} \times 100$$

$$(363) \text{ a) } \% P = \frac{31}{1877} \times \frac{\text{mass of ammonium phosphomolybdate}}{\text{mass of O.C}} \times 100$$

$$\text{ b) } \% P = \frac{62}{222} \times \frac{\text{mass of } Mg_2P_2O_7}{\text{mass of O.C}} \times 100$$

$$(364) \% Cl = \frac{35.5}{143.5} \times \frac{\text{mass of } AgCl}{\text{mass of O.C}} \times 100$$

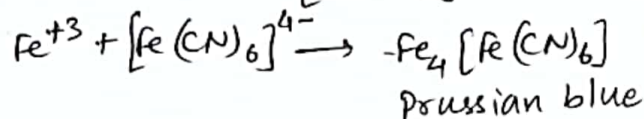
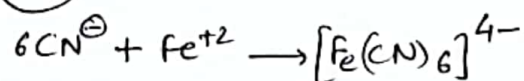
$$\% Br = \frac{80}{188} \times \frac{\text{mass of } AgBr}{\text{mass of O.C}} \times 100$$

$$\% I = \frac{127}{235} \times \frac{\text{mass of } AgI}{\text{mass of O.C}} \times 100$$

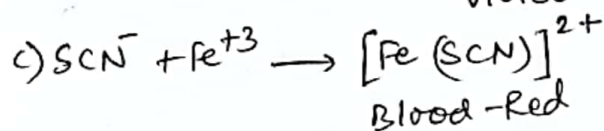
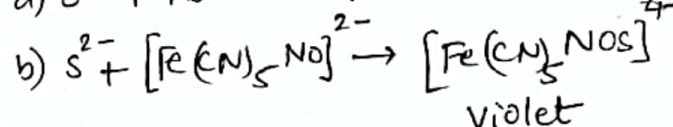
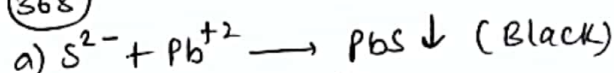
$$(365) \% O = \frac{32}{88} \times \frac{\text{mass of } CO_2}{\text{mass of O.C}} \times 100$$

(366) a) Azo compounds b) Nitro compound
c) N present in ring

(367)



(368)

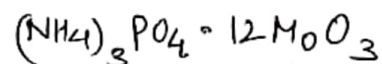
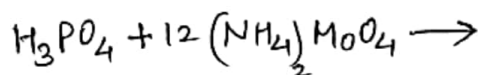
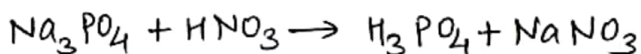
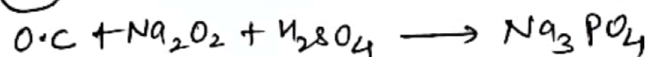


(369) $AgCl \rightarrow$ white (soluble in NH_4OH)

$AgBr:$ (yellow \rightarrow partially soluble in NH_4OH)

AgI (dark yellow \rightarrow insoluble in NH_4OH)

(370)



Ammonium phosphomolybdate (yellow)

(371) Amino acids