1. Order of a chemical reaction is the sum of powers of concentrations of the reactants as given in the rate law expression.

$R = K[A]^x [B]^y$; order $= x+y$.

2. The total number of atoms per unit cell in a fcc crystal structure is four (4).

3. Nitrogen is more electronegative and smaller than Phosphorous. The atomic orbitals of N are sp^3 hybridized whereas in P sp^3 hybridization is less distinct and has almost pure 'p' orbitals. ∴ bond angle in PH_3 is less than that in NH_3.

4. Chemisorption has higher enthalpy of adsorption as here the absorbate molecules are held by strong chemical bonds to the absorbent unlike the weak vander waal forces in physisorption.

6. $CH_3-O-CH_2-\overset{2}{C}H(\overset{1}{C}H_3)-\overset{3}{C}H_2-\overset{4}{C}H_3$

IUPAC name: 1-Methoxy-2-methylbutane.

7. $C_6H_5NH_2 \xrightarrow[0-5^\circ C]{NaNO_2+HCl} [C_6H_5N_2^+Cl^-] + KI \longrightarrow C_6H_5I + KCl + N_2$

Benzene diazonium chloride

8. 'Poly' means many & 'mer' means unit or part.
Polymerisation is the process of synthesis of polymers (macromolecules of molecular mass 10^3-10^7 u) from the repective monomers by linking these repeated units in a large scale either by addition rxn or condensation rxn.

9. The factors that influence the rate of a chemical reaction are
* Concentration of the reactants
* Temperature

* Pressure
* Presence of a catalyst.
* Surface area
* Proper orientation & effective collisions of reactants.

10. Henry's law states that partial pressure of the gas above the solution is directly proportional to its solubility in that liquid.

$p \propto x$

$\boxed{p = K_H x}$ where x - molefraction of the gas in soln.

K_H - Henrys constant.

Application:

Soda bottles and soft drinks are sealed at a high pressure to ensure more solubility of CO_2 in them.

11. $t = 40$ min

30% decomposition $\Rightarrow$ remaining $[R] = 70\%$

CH-04

$$K = \frac{2.303}{t} \log \frac{R_o}{R}$$

$$K = \frac{2.303}{40} \log \frac{100}{70.}$$

$$= \frac{2.303}{40} \log 1.429$$

$$= \frac{2.303}{40.} (0.1550)$$

$$= 8.923 \times 10^{-3} \text{ min}^{-1}$$

$$t_{1/2} = \frac{0.693}{K} = \frac{0.693}{8.923 \times 10^{-3}} = \frac{693}{8.923}$$

$$= 77.66 \text{ min.}$$

12) i) $C_6H_5N_2Cl + KI \rightarrow C_6H_5I + KCl + N_2$

Iodobenzene

Nr: ① 0.3623 + 1.1903 = 1.5526 or 1.6021 = 3.9505

1.4285

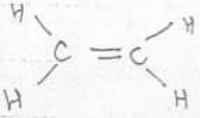
8913 → 8.923×10^{-3}

0.1550

Nr: 2.8407 or: 0.9505 = 1.8902

7762 → 7.766×10^{1}

1504 1505

(ii)  + Br_2 $\xrightarrow{CCl_4}$ $H_2C(Br)-CH_2(Br)$ (vic-di ethyl dibromide)

13) (i) Haloarenes are less reactive than haloalkanes towards nucleophilic substitution as C–X bond in haloarenes acquire partial double bond character due to resonance and is difficult to cleave than C–X bond in haloalkanes. In C–X in haloarenes C is sp^2 hybridised & thus more electronegative than sp^3 hybridized 'c' in haloalkanes. Due to instability of phenyl cation & possible repulsion of e^- rich ring, they are less reactive.

(ii)  undergoes S_N1 faster as carbocation so generated during the rate determining step is secondary and is more stable than primary carbocation in  .

14) i) ClO^- is isoelectronic with ClF.

tendency to gain 2 electrons and become Bi^{3+} which is more stable than Sb^{3+}
Due to completely filled d and/or f orbitals in Bi, shielding effect will be poor due to which it does not allow ns^2 e^- to take in bonding (inert pair effect) than in Sb which is smaller than Bi.

15)(i) $6Fe^{2+} \longrightarrow 6Fe^{3+} + 6e^-$ (oxdn)

$Cr_2O_7^{2-} + 14H^+ + 6e^- \longrightarrow 2Cr^{3+} + 7H_2O$ (redn)

Overall: $6Fe^{2+} + Cr_2O_7^{2-} + 14H^+ \longrightarrow 6Fe^{3+} + 2Cr^{3+} + 7H_2O$

$12^+ \quad +6$

$S_2O_3^{2-} \quad SO_4^{2-}$

$2-8=-6$

$2x-6=-2 \quad x=6$

$2a=4$

$a=2$

$-12 \quad -4-8$

ii) $(S_2O_3^{2-} + 5H_2O + 10(OH^-) \longrightarrow 2SO_4^{2-} + 10H_2O + 8e^-)3$

$(MnO_4^- + 4H_2O + 3e^- \longrightarrow MnO_2 + 2H_2O + 4OH^-)8$

Oxdn: $3S_2O_3^{2-} + 15H_2O + 30(OH^-) \longrightarrow 6SO_4^{2-} + 30H_2O + 24e^-$

Redn: $8MnO_4^- + 24H_2O + 24e^- \longrightarrow 8MnO_2 + 16H_2O + 32OH^-$

Overall:

$8MnO_4^- + 3S_2O_3^{2-} + H_2O \rightarrow 6SO_4^{2-} + 8MnO_2 + 8OH^-$

16. Vitamins are classified based on the <u>solubility in fat or wates</u>:

<u>Fat soluble vitamins</u>: Those which are soluble in fats, stored in adipose tissues.

Ex: Vitamin A, D, E, K.

<u>Water soluble vitamins</u>: Those which are soluble in water, ex: Vitamin B & C.

Vitamin B has subunits (B_1, B_2, B_6 & B_{12})

<u>chief sources</u> (i) Vit A – Carrot, fish liver oil, pumpkin, milk.

(ii) Vit C – amla, citrus fruits, green leafy vegetables.

17. (i) Primary structure of the protein is that structure which gives the unity <u>sequence of amino acids</u> present in the <u>peptides</u> which are the monomers of protein. If the sequence is changed the peptide will ...

ii) Denaturation is the process in which a native protein when subjected to physical change (like temperature) or chemical changes (like in pH) loses its biological activity as its H-bonds are disturbed globules unfold and helix uncoils.

Ex: Curdling of milk by lactic acid bacteria in curd.

18

18. Thermoplastic polymers are those polymers which can be softened and hardened on repeated heating & cooling respectively. They are long chain polymers with a few branchings and have intermolecular forces in the intermediate of elastomers and fibres.

Ex: polythene, PVC.

Thermosetting polymers are those cross-linked & heavily branched polymers which undergoes extensive branching on heating and becomes infusible, rigid & insoluble solid.

Ex: Bakelite.

19. 1- Solvent, 2- Solute.
(C_2H_5O C_2H_5)

$w_2 = 8\ g$; $w_1 = 100\ g$; $T_f = 36.86^\circ C$, $T_f^\circ = 35.60^\circ C$

$M_2 = ?$

$\boxed{\Delta T_b = K_b m.}$

$\Delta T_b = 36.86 - 35.60$

$1.26\ ^\circ C. = 1.26\ K$

$\therefore 1.26 = 2.02 \left(\frac{w_2 \times 1000}{M \times w_1} \right)$

$= 2.02 \left(\frac{8}{M} \times \frac{1000}{100} \right)$

$1.26 = \frac{20.2 \times 8}{M}$

101
80
808

8917
My 3.9874
Dx 1.7993
2.1081

126
252

1.282×10^2
128.2

Molecular mass of solute = 128.2 g/mol.

20. fcc $Z = 4$.

$a = 4.077 \times 10^{-8}$ cm

$d = 10.5$ g/cm^3

$M = ?$

$$d = \frac{ZM}{a^3 \times N_A}$$

$$M = \frac{d \times a^3 \times N_A}{Z} = \frac{10.5 \times 4.077 \times 4.077 \times 4.077 \times 10^{-24} \times 6.02 \times 10^{23}}{4}$$

$$= 1071 \times 10^{-1} = 107.1 \text{ g/mol}.$$

21. Multimolecular colloids:

* On dissolution of a substance, large no. of atoms or molecules come

towards each other and aggregate to form substances in the colloidal range (1 - 1000 nm).

* Gold sol consists of a large no. of particles of varying sizes. Sulphur sol consists of thousands of S_8 molecules together forming colloid.

Macromolecular colloids:

* Contain macromolecules dissolve in a suitable solvent to form the particles in colloidal range. They are stable & resemble true solutions
* Ex: Natural - Rubbers, starch, cellulose, enzyme in H_2O.
  Synthetic - polystyrene, nylon.

Associated colloids are those colloids in which certain substances at low concentration behave like normal electrolytes but when the concentration exceeds critical miscelle concentration (cmc) and temperature exceeds kraft temperature they aggregate to form miscelle (colloids) which on dilution gives back the substance.
Ex: Soaps

22. (i) Transition metals due to their incompletely filled 'd' orbitals possess a no. of unpaired electrons which on absorption of light of particular wavelength undergoes d-d transition and thus exhibit colours.

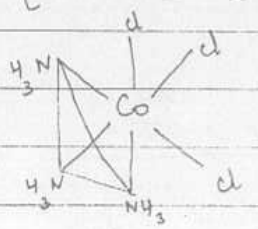
(ii) Cr^{2+} is unstable with $3d^4$ configuration ∴ loses one e^- to attain $3d^3$ state which is highly stable due to half-filled t_{2g} orbital (t_{2g}^3, extra stable) ∴ it is a reducing agent.

Mn^{3+} is unstable with $3d^4$ state ∴ gains one e^- to attain $3d^5$ state which is stable due to half-filled d orbital. ∴ it is oxidising agent.

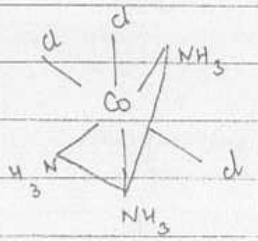
(iii) Actinoids exhibit a large no. of oxidation states (+3 to +7) due to very little energy difference between 7s, 6d + 5f orbitals than the energy difference between 6s 5d & 4f orbitals in lanthanoids. Moreover, in actinoids 'f' orbitals are not that much penetrated and inactive as those present in lanthanoids.

Q3) a) Spectro-chemical series is the arrangement of ligands in the increasing order of their field strength and is based upon the emission of colour by them when light was passed through their aqueous solution.

b) (i) $[Co(NH_3)_3Cl_3]$

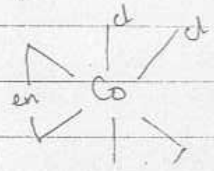


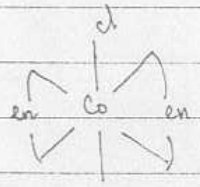
facial

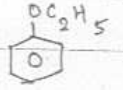


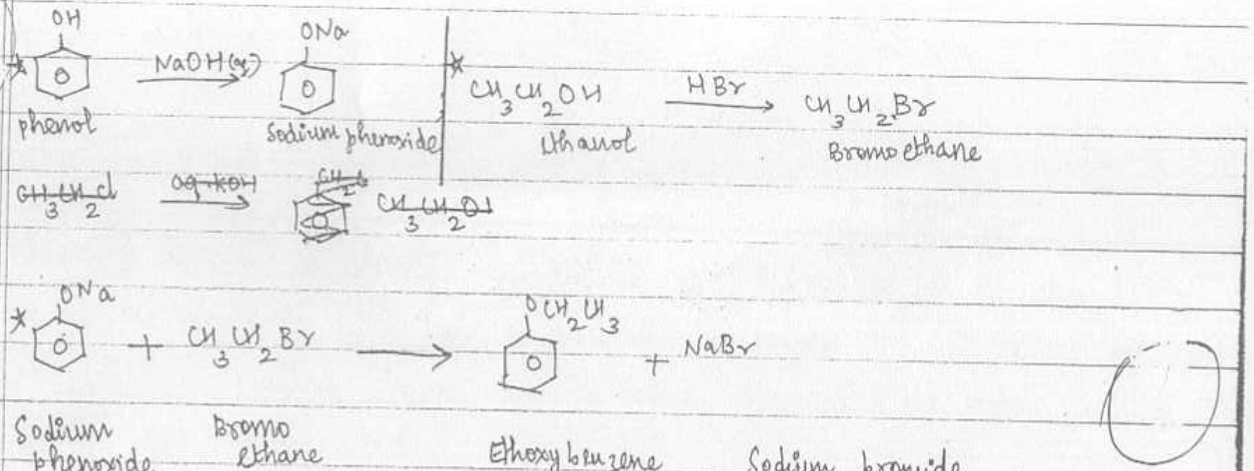
meridional

(ii) $[CoCl_2(en)_2]^+$

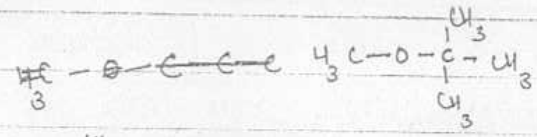


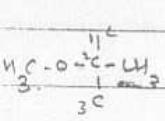


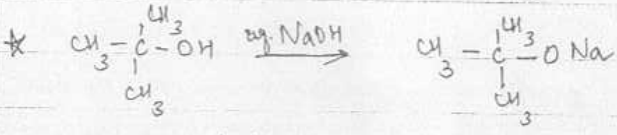
24) a)(i) 



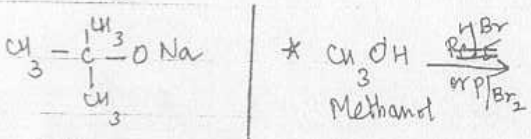
Sodium phenoxide — Bromo ethane — Ethoxybenzene — Sodium bromide.

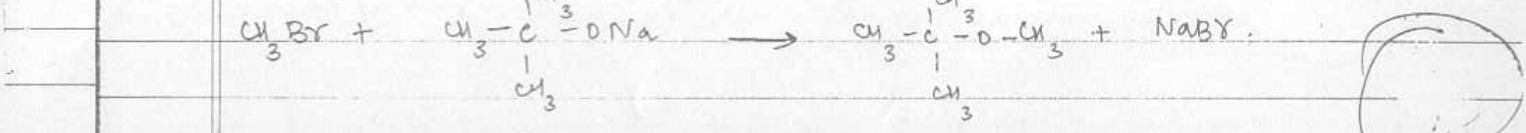
(ii) 





tert butyl alcohol. & ~~tert~~





2-Methyl-2-methoxypropane.

(b) In phenols, -OH gp is directly attached to sp^2 hybridized / more electronegative carbon of the ring. So lone pair of electron on oxygen is withdrawn for resonance and it gains a positive charge due to which it repels the proton (H^+). ∴ It'd not undergo protonation easily.

25. For the reduction of a metal from its oxide ore, the reducing agent should be chosen such that ΔG (Gibbs energy change) for the formation of its oxide is more negative than for the formation of the metal oxide.

* According to pyrometallurgy & thermodynamical principles, the reaction is spontaneous only if ΔG is negative.

$\Delta G = \Delta G_{P} - \Delta G_{rea}$ should be -ve.

* Acc. to Ellingham diagram, only those can act as a reducing agent if its

temperature, its oxide is more stable than metal oxide.
for ex: for Fe_2O_3, C can act as reducing agent as

$$Fe_2O_3 + 3C \xrightarrow{(coke)} 2Fe + 3CO \; ; \; \Delta G \text{ is } -ve.$$

* $Al_2O_3 + 3Mg \rightarrow 3MgO + 2Al$ only under certain conditions.

for Al_2O_3 Mg can act as reducing agent only below 1350°C.
Mostly, Al_2O_3 is reduced electrolytically as Al is more reactive to be reduced by chemical methods.

26. (i)  ; $CH_3 \rightarrow \ddot{N}H_2$

In aniline, $-NH_2$ is directly attatched to the benzene ring which withdraws lone pair of electrons of N for resonance and thus, reducing the e^- density on N. $C_6H_5\ddot{N}H_2$ has only 2 resonance structures compared to $C_6H_5NH_2$ which has 5 resonance structures. So, it is less basic & high pK_b.
In CH_3-NH_2, $-CH_3$ is an electron donating group and due to +I

effect, the e^- density on N increases and thus can easily donate e^- and acts a stronger base.

(ii) $CH_3\ddot{N}H_2$ is a lewis base and thus reacts with $FeCl_3$ (lewis acid) which is electron deficient to precipitate $Fe(OH)_3$.

$$CH_3\ddot{N}H_2 + H_2O \rightleftharpoons CH_3NH_3^+OH^-$$

$$6CH_3NH_3^+OH^- + 2FeCl_3 \rightarrow 6CH_3NH_3^+Cl^- + 2Fe(OH)_3 \downarrow$$

(iii) In friedal craft rxn, anh. $AlCl_3$ which is an e^- deficient species and lewis acid used as a catalyst. It uses the lone pair of e^- on 'N' of $\overset{\text{Ani}}{C_6H_5}NH_2$ and forms salt. Thus, 'N' gain a +ve charge & is acts as a deactiving gp for electrophilic substitution of alkyl/acyl group.

27. (i) Ranitidine – It is an antihistamine which acts as an antacid intere

inhibits the secretion of acid & pepsin.

ii) Paracetamol - It is a non-narcotic analgesic which reduces or abolishes pain and thus fever without causing impairment to consciousness physical incoordination. It is a neurotypically active drug which affects the message transfer from nerve to receptor.

iii) Tincture of iodine - It is applied on wounds & cuts as it acts as an antiseptic and inhibits the microbial action.

Q 8)

I = 1.5 A

mass of Ag = 1.45 g t = ? mass of Cu & Zn = ?

—x—

96,487 coloumb deposits one equivalent gram of any substance

Charged passed Q = It

= 1.5 x t

96,487 C of charge $\xrightarrow{\text{deposits}}$ 108 g of Ag.

(1.5 × t) C of charge $\xrightarrow{\text{deposits}}$ $\frac{1.5 \times t \times 108}{96,487}$ g of Ag

But,

$$\frac{1.5 \times t \times 108}{96,487} = 1.45 \text{ g}$$

$$t = \frac{96,487 \times 1.45}{108 \times 1.5} = 863.8 \text{ seconds.}$$

Acc. to Fardays 2nd law,

Mass of Zn = ? x g

$$\frac{108}{1.45} = \frac{65.4}{2 \times x} \quad 32.7$$

$$x = \frac{1.45 \times 32.7}{} = .439 \text{ g of Zn.}$$

NI:
0.1614
1.5145
1.6759.
Dr: 2.0334
T.6425

9841
1
1 ①
NI: 4.9845
0.1614
5.1459
①
Dr: 2.0334
0.1761
2.2095

4 11 315
5.1459
2.2095
2.9364

8.638×10^{-2}

1-2
1
1385

mass of Cu = y gm.

$$\frac{108}{1.45} = \frac{63.5}{2 \times y}$$

$$y = \frac{31.75}{\cancel{63.5} \times 1.45} = .4264 \text{ g}$$

$$108 \times 2$$

Time = 863.8 sec

mass of Zn deposited = .439 g

" " Cu " = .4264 g

5011

Nr: 1.5018
0.1614
1.6832

Dr: 2.0334
1.6298

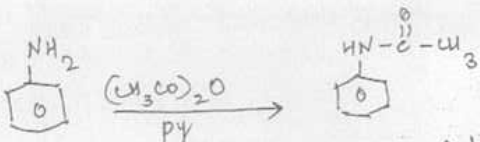
1.2

425
4264 $\times 10^{-1}$

29) a(i) In cannizzaro reaction 2 moles of aldehydes which have no α H atom, in the presence of concentrated alkali undergo self oxidation & self reduction (disproportionation rxn) giving corresponding alcohol & salt of carboxylic acid

(sodium benzoate)

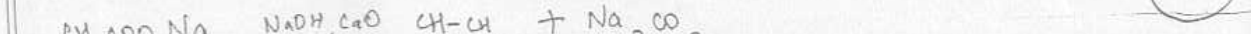
(ii) In acetylation, $CH_3-\overset{O}{\overset{\|}{C}}-$ gp is introduced by treating the substance with acetic anhydride (or acetyl chloride) by electrophilic substitution



Aniline Acetanilide.

Here, the reactivity of aniline is reduced by its acetylation and makes it slightly deactivating toward electrophilic substitution.

(iii) Decarboxylation: In this reaction, sodium salt of a carboxylic acid is treated with soda lime (3 parts of NaOH + 1 part of CaO) where one molecule CO_2 is removed and it is converted to respective hydrocarbon.

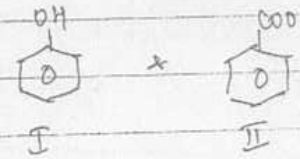


(b)(i) $CH_3.CH_2.CHO$ & $CH_3-\overset{O}{\overset{\|}{C}}-CH_3$

When NaOH & I_2 is added to I, there is no reaction. But when it is added to II, a yellow ppt is formed.

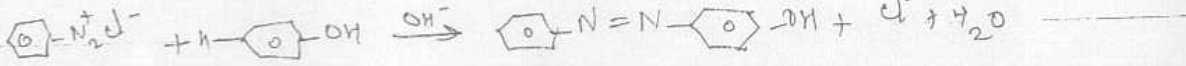
$$CH_3\overset{O}{\overset{\|}{C}}-CH_3 + 4NaOH + 3I_2 \xrightarrow{(NaOI)} CH_3-\overset{O}{\overset{\|}{C}}-ONa + \underset{\text{yellow ppt.}}{\underset{\text{(Iodoform)}}{CHI_3\downarrow}} + 3NaI + 3H_2O$$

(ii)



I II

When a soln of benezene diazonium chloride is passed thro' I, a orange dye is formed but II gives no answer.



p-hydroxyazobenzene
(orange)

C

30 (i) At elevated temperatures (1000K) S exists as sulphur vapour S_2. It has 2 unpaired electrons in π^* antibonding orbital like O_2 which accounts for its paramagnetic behaviour.

(ii) Nitrogen is in NH_3 due to its small size & high electronegativity, has great electron density than 'P' in PH_3 due to its large and diffused size. So, NH_3 acts as a better lewis base (donates e^-) and attracts protons.

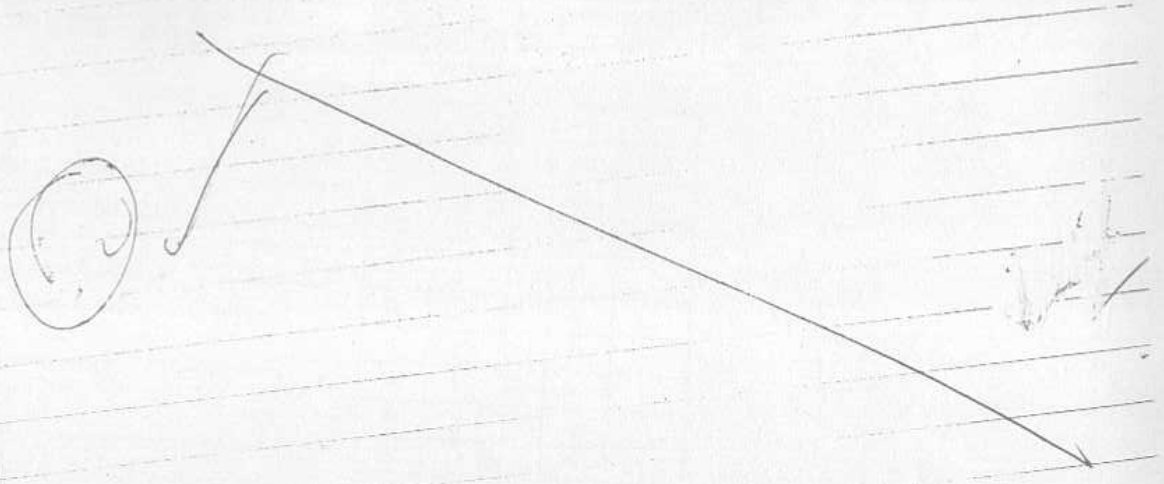
(iii) 2p orbitals of fluorine are smaller in size than 3p orbitals of Cl. So, when an extra e^- enters its 2p orbitals, it will not experience as much attraction as in 3p orbitals of Cl due to its inter electronic repulsions & compact size. ∴ EGE of F is less -ve than that of Cl.

(iv) In SF_6, S is ~~at~~ octahedrally surrounded by 6 F atoms and so, it provides high steric hindrance than SF_4 for incoming agents and is less reactive than SF_4

(9)

(v) Xe only forms compounds due to:

* its low ionisation enthalpy comparable to O_2.
* its high polarizing power
* its large size & thus has greater tendency to form covalent bonds.



08