Answers to RCH/Set-2

1. (*d*) $[Pt(en)_2Cl_2]^{2+}$, $x + 0 - 2 = +2, x = +4$

2. (*d*) $\because$ $C_6H_5SO_2NHCH_2CH_3$ is acidic in nature.

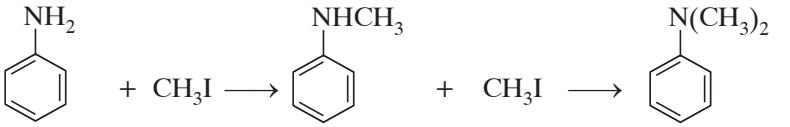
3. (*a*) $\because$ Intercept $= [R]_0$, slope $= -k$, It is graph of zero order reaction.

4. (*b*)

5. (*b*) $M = \frac{W_B}{M_B} \times \frac{1000}{\text{volume of solution}} \Rightarrow 3 = \frac{84}{40} \times \frac{1000}{V} \Rightarrow V = \frac{84000}{120} = 700$ mL

6. (*c*) $E^\circ_{Mn^{3+}/Mn^{2+}} = +1.57$ V, $E^\circ_{Fe^{3+}/Fe} = +0.77$ V, $E^\circ_{Co^{3+}/Co^{2+}} = +1.97$ V

7. (*b*) I and IV, (I) has $CH_3-\overset{\overset{O}{\|}}{C}-$, (IV) $CH_3-\overset{\overset{OH}{|}}{CH}-CH_3$ on oxidation with I_2/NaOH gives $CH_3-\overset{\overset{O}{\|}}{C}-CH_3$ which gives iodoform test.

8. (*a*) 

Aniline N, N–Dimethyl aniline

9. (*b*) Vitamin-K helps in coagulation of blood.

10. (*a*) Chloramphenicol is an antibiotic, used for treatment of typhoid.

11. (*c*) Prefix for $-\overset{\overset{O}{\|}}{C}-$ is oxo. —COOH is preferred over keto group.

12. (*b*) Trimethyl amine (boiling point 2.9°)

13. (*b*) **14.** (*a*) **15.** (*b*) **16.** (*a*)

17. A. I. Iron $[Fe(CO)_5]$, because its effective atomic number is 26 + 10 = 36 which is stable like noble gas (Krypton).

II. $[MnO_3F]$, because Mn can show +7 oxidation state.

OR

B. I. Because of large number of unpaired electrons in their atoms they have stronger interatomic interaction and hence stronger bonding between atoms involving $d\pi - d\pi$ bonds.

II. Zinc(Zn) has lowest $\Delta_a H$ due to $3d^{10}$, weak metallic bonds due to absence of unpaired electrons.

18. $Pt|I^-(aq)|I_2||F_2(g)|F^-(aq)|Pt$

$$E_{cell} = E^\circ_{cell} - \frac{0.0591}{2} \log \frac{[F^-]^2}{[I^-]^2}$$

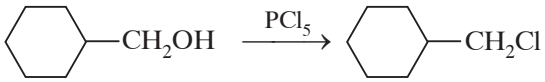
$[\because 2I^- + F_2 \longrightarrow 2F^- + I_2]$

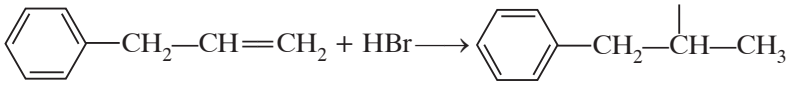
19. Glycine is optically inactive. Zwitter ion structure of Glycine is $H_3N^+—CH_2—COO^-$. Glycine is non-essential amino acid, because it is synthesised in our body.

20. (*a*) It is because 1 M glucose and 1 M solution of sugar are isotonic i.e. same molar concentration as both are non-electrolyte.

(*b*) $KCl \longrightarrow K^+ + Cl^-$

KCl is strong electrolyte. It dissociate completely into ions. The number of particles are double as compared to sugar solution. Sugar is non-electrolyte, does not form ions. $i = 2$ for KCl and $i = 1$ for sugar, therefore, ΔT_b is double in KCl as $\Delta T_b \propto i$.

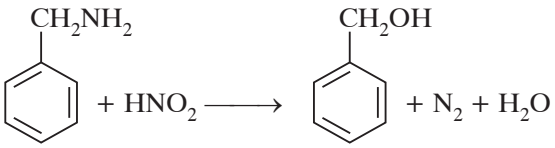
21. (*a*) 

(*b*) 

22. (*a*) It is because F_2 is strong oxidising agent, it has ability to form fluorides in higher oxidation state which has high lattice energy.

(*b*) Co^{2+} because it has unpaired electrons, it is paramagnetic, attracted by magnetic field.

(*c*) It is due to lanthanoid contraction which is due to poor shielding effect of *f*-electrons, effective nuclear charge increases, hence, I.E. of 5*d* is higher than 3*d* and 4*d* series.

23. (*a*) 

(*b*) $C_6H_5SO_2Cl + C_2H_5NH_2 \longrightarrow C_6H_5SO_2NHC_2H_5 + HCl$

(*c*) $C_2H_5N\equiv C \xrightarrow{Na/C_2H_5OH} C_2H_5NHCH_3$

24. (*a*)

$$\rho = \frac{RA}{l} = \frac{5 \times 10^3 \times 0.625}{50} = 62.5 \text{ ohm cm}$$

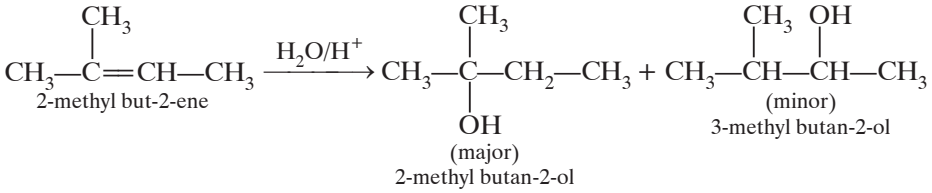
$$\kappa = \frac{1}{\rho} = \frac{1}{62.5} = 1.6 \times 10^{-2} \text{ ohm}^{-1} \text{ cm}^{-1}$$

$$\Lambda_m = \frac{1000\,\kappa}{M} = \frac{1000 \times 1.6 \times 10^{-2}}{0.05}$$

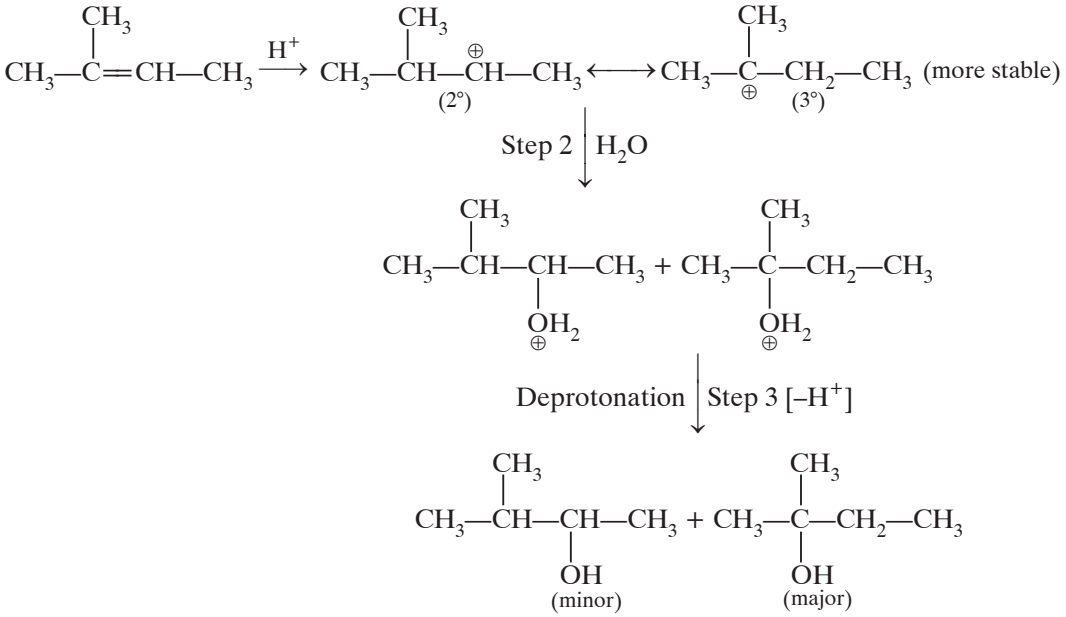
$$= 320 \text{ S cm}^2 \text{ mol}^{-1}$$

(*b*) At cathode: $Cu^{2+} + 2e^- \longrightarrow Cu(s)$

At anode: $2Cl^- - 2e^- \longrightarrow Cl_2(g)$

25. (*a*) 

(*b*) Step-1:



26. (*a*) $I = 2$ A, $t = ?$,

Atomic weight of : Fe = 56 g mol^{-1}, Zn = 65.0 g mol^{-1}, $m = 2.8$ g

$$m = Z \times I \times t$$

$$2.8 = \frac{56}{2 \times 96500} \times 2 \times t$$

$$Z = \frac{\text{Eq. wt}}{96500} = \frac{\text{Atomic mass}}{\text{valency} \times 96500}$$

$$Z = \frac{56}{2 \times 96500} \text{ for Iron}$$

$$t = \frac{2.8 \times 2 \times 96500}{56 \times 2} = 4825 \text{ s}$$

$$t = \frac{4825}{60 \times 60} = 1.34 \text{ hours}$$

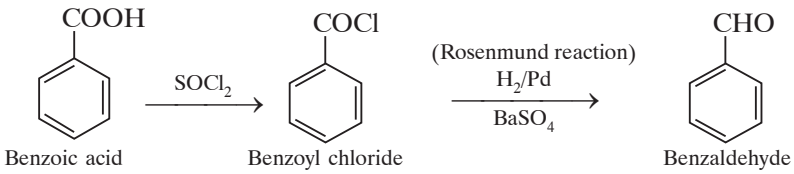
$$\frac{m_{Zn}}{E_{Zn}} = \frac{m_{Fe}}{E_{Fe}}$$

$$\Rightarrow \quad \frac{m_{Zn}}{\frac{65.3}{2}} = \frac{2.8}{\frac{56}{2}} \Rightarrow m_{Zn} = \frac{2.8}{28} \times \frac{65.0}{2} = 3.250 \text{ g}$$

(*b*) (*i*) 'A' is strong electrolyte, 'B' is weak electrolyte.

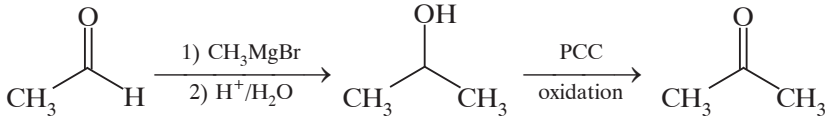
(*ii*) Λ_m° (limiting molar conductivity) of 'A' can be obtained by extrapolation but Λ_m° of 'B' cannot be obtained because a curve cannot be extrapolated.

27. (*a*)



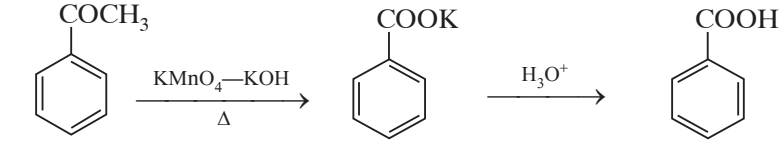
Benzoic acid — Benzoyl chloride — Benzaldehyde

(*b*)



Ethanal — Propan-2-ol — Propanone

(*c*)

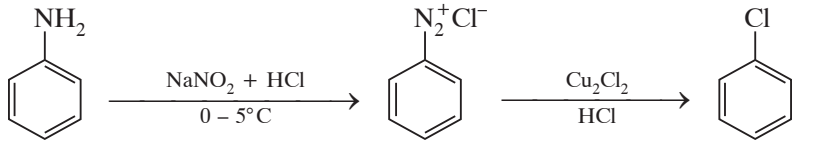


Acetophenone — Potassium benzoate — Benzoic acid

(*d*) $C_6H_5—CHO + CH_3—\underset{\underset{O}{\|}}{C}—CH_3 \xrightarrow[\text{Aldol}]{\text{dil. NaOH}} C_6H_5—CH(OH)—CH_2—CO—CH_3$

Benzaldehyde — Propanone — 4-hydroxy-4 phenyl butan-2-one

28. (*a*)



Aniline — Benzene diazonium chloride — Chlorobenzene

(*b*) $CH_3—\underset{\underset{Br}{|}}{CH}—CH_3 + KOH\ (alc.) \longrightarrow CH_3—CH=CH_2 \xrightarrow[\text{Peroxide}]{\text{HBr}} CH_3CH_2CH_2Br$

2-Bromopropane — Propene — 1-Bromopropane

(*c*) $CH_3CH_2CH=CH_2 + HBr \xrightarrow{\text{Peroxide}} CH_3CH_2CH_2CH_2Br \xrightarrow[\text{NaI}]{\text{Dry acetone}} CH_3CH_2CH_2CH_2I$

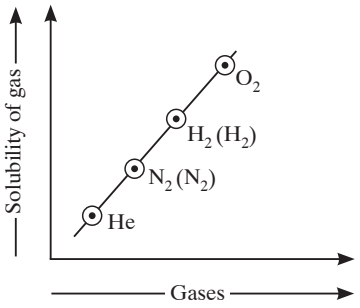
But-1-ene — 1-Bromobutane — 1-Iodobutane

29. I. Helium, because it is least soluble in our blood, does not cause pain (bends).

II. (*d*) Solubility of gas increases with decrease in temperature and increase in pressure because the process is exothermic.

OR

The value of K_H remains same, because the value of K_H only depends upon temperature.

III. 

As K_H decreases, solubility of gas in liquid increases because solubility is inversely proportional to K_H.

30. I. *m*-RNA, *t*-RNA, *r*-RNA

OR

Phosphodiester linkage

II.

DNA	RNA
(*i*) It has deoxyribose sugar	(*ii*) It has ribose sugar
(*ii*) Thymine is present	(*ii*) Uracil is present
(*iii*) It is double stranded	(*iii*) It is single stranded (*Any two*)

III. Adenine, Thymine, Guanine, Cytosine, Phosphoric acid and Deoxyribose sugar will be formed, on hydrolysis.

31. A. I. $\Delta_t = \left(\frac{4}{9}\right) \Delta_o$

II. Dichloridobis (ethane $-1, 2-$diamine) platinum (IV) nitrate

III. sp^3, diamagnetic due to absence of unpaired electron

IV. Hexaamminechromium(III) hexacyanidocobaltate(III).

It shows coordination isomerism because both cation and anion are complex ions.

OR

B. I. Coordination isomerism $\because$ cation and anion are complex ion

II. $t_{2g}^3 e_g^1$, high spin [$\because \Delta_o < P$] where Δ_0 is CFSE, 'P' is energy needed for paring of electrons.

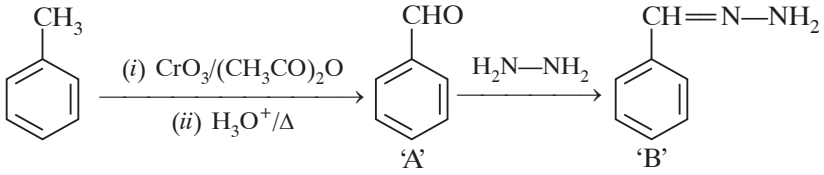
III. $[Co(NH_3)_4Cl_2]^+$, as the metal is bound to more than one donor group (ligand). *i.e* different types of ligand.

IV. (*a*) Medicinal chemistry. *Cis*-platin is used as anticancer agent.

(*b*) Analytical chemistry. In estimation of Ca^{2+} and Mg^{2+}, EDTA is used. Ni^{2+} are estimated with the help of dimethyl glyoxime.

32. A. I. (*a*) $CH_3CH_2CN \xrightarrow{CH_3MgBr/H_3O^+} CH_3CH_2\overset{\overset{O}{\|}}{C}CH_3 \xrightarrow{LiAlH_4} CH_3CH_2\overset{\overset{OH}{|}}{C}HCH_3$

'A' 'B'

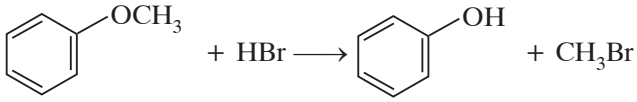
(*b*) 

'A' 'B'

II. (*a*) $CH_3—CH=CH_2 \xrightarrow[(ii)\ H_2O_2/OH^-]{(i)\ B_2H_6} CH_3—CH_2—CH_2OH$

Propene Propanol

(Hydroboration-oxidation reaction)

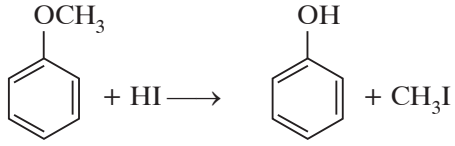
(*b*) 

Anisole Phenol

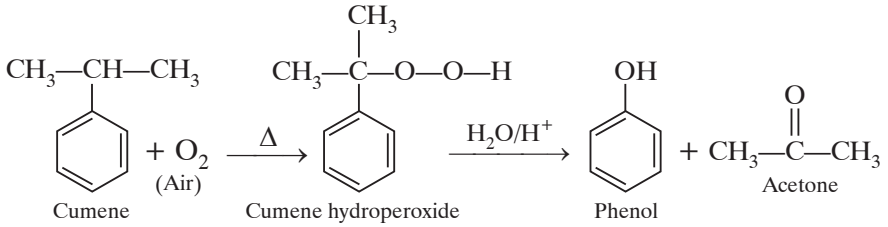
(*c*) It is because *p*-nitro phenoxide ion is more stable than phenoxide ion as $—NO_2$ group is electron withdrawing.

OR

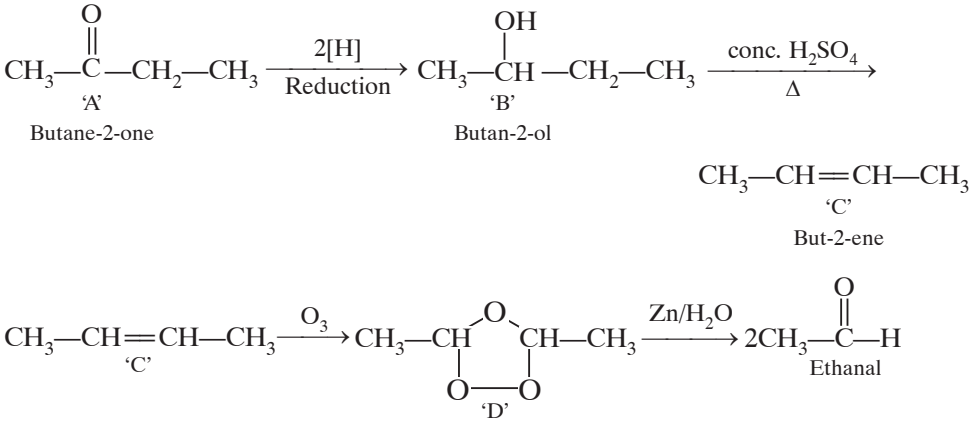
B. I. (*a*) *n*-Butane < Ethoxy ethane < Butanal < Butanol

(*b*) 

Anisole Phenol

(*c*) 

Cumene Cumene hydroperoxide Phenol Acetone

II. 

33. A. I.

$$k_1 = \frac{0.693}{t_{1/2}} = \frac{0.693}{30 \text{ min}} \text{ at } T_1 = 300 \text{ K}$$

$$k_2 = \frac{0.693}{t_{1/2}} = \frac{0.693}{10 \text{ min}} \text{ at } T_2 = 320 \text{ K}$$

$$\log \frac{k_2}{k_1} = \frac{E_a}{2.303\, R}\left(\frac{1}{T_1} - \frac{1}{T_2}\right)$$

$$\log \frac{0.693}{10} \times \frac{30}{0.693} = \frac{E_a}{2.303 \times 8.314}\left(\frac{1}{300} - \frac{1}{320}\right)$$

$$E_a = \frac{19.147 \times 300 \times 320}{20} \log 3$$

$$E_a = 19.147 \times 4800 \times 0.4771 \text{ J}$$

$$E_a = 43848.16 \text{ J mol}^{-1}$$

$$E_a = 43.848 \text{ kJ mol}^{-1}$$

II. (*a*) 1st order

(*b*) No, due to exponential relation/the curve never touches the *x*-axis.

OR

B. I.

$$ln\, k_1 = ln\, A - \frac{E_{a_1}}{RT};$$

$$ln\, k_2 = ln\, A - \frac{E_{a_2}}{RT}$$

$$ln\, k_2 - ln\, k_1 = \frac{1}{RT}(E_{a_1} - E_{a_2})$$

$$\Rightarrow \qquad \log \frac{k_2}{k_1} = \frac{1}{2.303\,RT}\,(75.24 \text{ kJ mol}^{-1} - 50.14 \text{ kJ mol}^{-1})$$

$$\log \frac{k_2}{k_1} = \frac{25100}{5705.8} = 4.40$$

$$\Rightarrow \qquad \frac{k_2}{k_1} = \text{Antilog of } 4.40 = 2.512 \times 10^4$$

The rate of reaction will grow by 25120 times in presence of catalyst. The decrease in activation energy takes place by $75.24 - 50.14 = 25.1$ kJ mol^{-1}.

II. (*a*) (*i*) Molecule must have activation energy.

(*ii*) These molecules must collide in proper orientation.

(*b*) In complex reaction, slowest step is the rate determining step which determines order of reaction.

Each step of complex reaction is called elementary reaction which has its own molecularity.