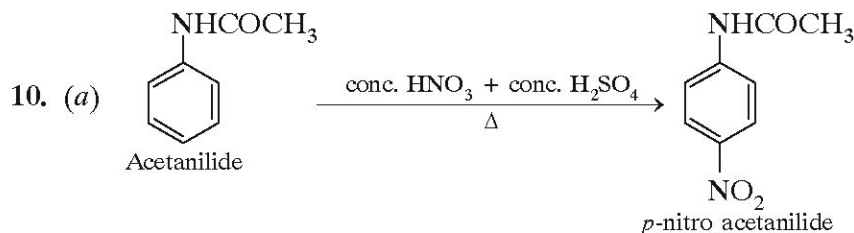


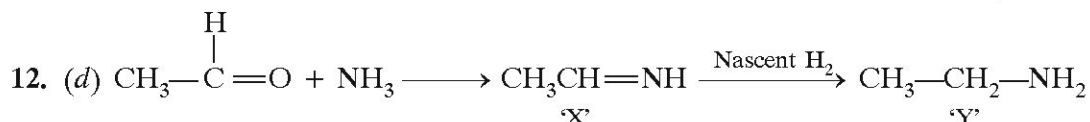
Answers to RCH/Set-3

1. (b) $\text{CH}_3\text{NC} \xrightarrow[\text{(ii) H}_3\text{O}^+]{\text{(i) LiAlH}_4} \text{CH}_3\text{NHCH}_3$
2. (a) \therefore C-I bond is weakest due to larger bond length, has lowest bond dissociation enthalpy.
3. (b) Vanadium has strong metallic bonds than Titanium which has stronger bond than chromium.
4. (b) *o*-dichlorobenzene has highest boiling point due to high dipole moment, more force of attraction (dipole-dipole attraction) than *p*-dichlorobenzene which has slightly more forces of attraction than *m*-dichloro benzene.
5. (a) $k = Ae^{-E_a/RT}$
 \therefore (a) is incorrect statement.
6. (b) Co is in +3 oxidation state, complex ion is negatively charged.
7. (a) Both can gain one electron to become trivalent which is stable.
8. (d) \therefore $\text{NO}_2 > \text{F} > \text{Cl}$ electron withdrawing effect which stabilises carboxylate ion formed.
 $\text{NO}_2\text{CH}_2\text{COO}^- > \text{FCH}_2\text{COO}^- > \text{ClCH}_2\text{COO}^- > \text{HCOO}^-$

9. (b) II and III are correct statements.



11. (d) It is due to cyclic structure of glucose, it does not react with NaHSO_3 .



13. (b) Both A and R are true but R is not the correct explanation of A.
14. (d) A is false but R is true.
15. (b) Both A and R are true but R is not the correct explanation of A.

16. (c) A is true but R is false.

17. (a) According to Henry's Law, $p = K_H X$

\therefore Slope of the p Vs X will be the Henry's Law constant, K_H

$$\frac{K_{H_1}}{K_{H_2}} = \frac{\tan 60^\circ}{\tan 30^\circ} = \frac{\sqrt{3}}{\frac{1}{\sqrt{3}}} = 3$$

(b) $T_1 > T_2 \therefore K_H$ increases with increase in temperature.

Or

(a) Amount of protein = 'X'

Let the amount of protein and sucrose in the mixture be p and q respectively, so

$$p + q = 2 \text{ g} \quad \dots(i)$$

$$\pi V = nRT$$

$$\frac{500}{1000} \times 1 = \left(\frac{p}{80} + \frac{q}{342} \right) \times 0.08 \times 300 \text{ K}$$

$$\Rightarrow \frac{1}{2} = \left(\frac{p}{80} + \frac{q}{342} \right) \times 24$$

$$\Rightarrow \frac{3}{10} p + \frac{12}{171} q = \frac{1}{2}$$

$$\Rightarrow 513 p + 120 q = 855 \dots (i)$$

$$\begin{array}{r} 513 p + 513 q = 1026 \quad [\text{Multiplying (i) by 513}] \\ \underline{\quad \quad \quad} \\ - 393 q = - 171 \end{array}$$

$$- 393 q = - 171$$

$$q = 0.435 \text{ g}$$

$$p = 2 - 0.435 = 1.565 \text{ g} \Rightarrow X = 1565 \text{ J g}$$

(b) Higher, $\therefore \pi \propto \frac{1}{M}$, glucose has lower molar mass than sucrose.

18. $\Lambda_m = \frac{\kappa}{C}$ where ' κ ' is electrolytic conductivity, ' C ' is molar concentration

Λ_m = molar conductivity

$$C = \frac{0.580}{2.416 \times 10^{-2}} = \frac{58}{2.416} = 24 \text{ mol/m}^3$$

$$C = 24 \text{ mol/1000 L} [\therefore 1 \text{ m}^3 = 1000 \text{ L}]$$

$$C = 0.024 \text{ mol L}^{-1}$$

19. (a)

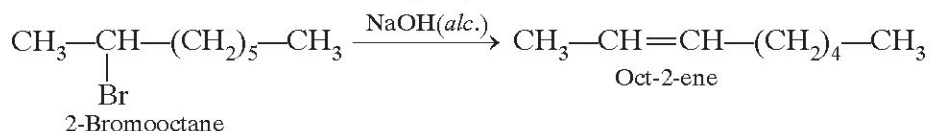
| en : Ni | Colour absorbed |
|---------|-----------------|
| 2 : 1 | Red |
| 3 : 1 | Blue green |

- (b) $[\text{Ni}(\text{H}_2\text{O})_4(\text{en})]^{2+}$ is 1 : 1
 $[\text{Ni}(\text{en})_3]^{2+}$ is 3 : 1

20. (a) $\text{S}_{\text{N}}2$ mechanism, because the configuration of product is opposite to that of the reactant.

- (b) (i) The rate of reaction will be reduced to half.
(ii) The rate of reaction will be reduced to half.

(c) Oct-2-ene will be formed as major product.



21. (a) Keratin is fibrous protein.

The polypeptide chains run parallel and are held together by hydrogen bonds and disulphide linkage in a fibre like structure.

Keratin is insoluble in water

(b) Sucrose is dextro rotatory, but on hydrolysis it produces mixture of $\alpha\text{-D}(+)$ Glucose and $\beta\text{-(D)(-)}$ Fructose. Since the leavo rotation of fructose is more than dextro rotation of $\alpha\text{-glucose}$, so overall mixture becomes leavo rotatory, hence, inversion is observed.

$$22. V = \frac{\text{Mass}}{\text{Density}} = \frac{2\text{g}}{10.5 \text{ g cm}^{-3}} = 0.190 \text{ cm}^3$$

$$V = \text{Area} \times \text{Thickness}$$

$$\text{Thickness} = \frac{V}{\text{Area}} = \frac{0.190 \text{ cm}^3}{1 \text{ cm}^2} = 0.190 \text{ cm}$$

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

$$2\text{g} = \frac{108}{96500} \times I \times 1 \times 60 \times 60 \quad [\because 1 \text{ hour} = 60 \text{ s} \times 60 \text{ s}]$$

$$I = \frac{2 \times 96500}{108 \times 60 \times 60} = \frac{1930}{108 \times 36} = \frac{1930}{3888} = 0.496 \text{ A}$$

23. (i) $\text{Ag} (s) | \text{Ag}^+ (0.001 \text{ M}) || \text{Mn}^{3+} (0.1 \text{ M}) | \text{Mn}^{2+} (0.01 \text{ M}) | \text{Pt}$

(ii) $E_{\text{Cell}}^{\circ} = E_{\text{Mn}^{3+}/\text{Mn}^{2+}}^{\circ} - E_{\text{Ag}^+/\text{Ag}}^{\circ} = 1.50 - 0.80 = 0.70 \text{ V}$

$$E_{\text{cell}} = E_{\text{cell}}^{\circ} - \frac{0.0591}{1} \log \frac{[\text{Mn}^{2+}][\text{Ag}^+]}{[\text{Mn}^{3+}]} \quad [\because \text{Ag} + \text{Mn}^{3+} \longrightarrow \text{Ag}^+ + \text{Mn}^{2+}]$$

$$= 0.70 \text{ V} - \frac{0.0591}{1} \log \frac{10^{-2} \times 10^{-3}}{10^{-1}}$$

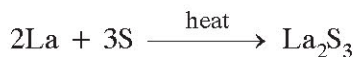
$$= 0.70 \text{ V} - 0.0591 \log 10^{-4} = 0.70 \text{ V} + 0.0591 \times 4 = 0.70 \text{ V} + 0.2364 \text{ V}$$

$$E_{\text{Cell}} = 0.9364 \text{ V}$$

24. (a) (i) MnO_4^{2-} disproportionate in acidic medium to give MnO_4^- (permanganate ion) and manganese dioxide (MnO_2)

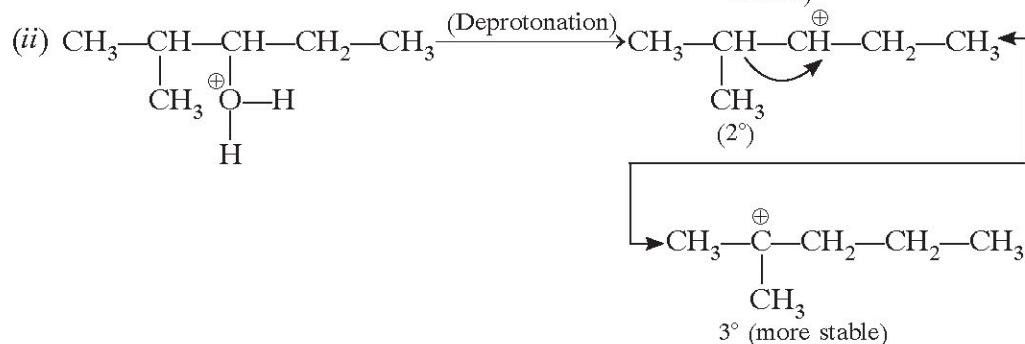
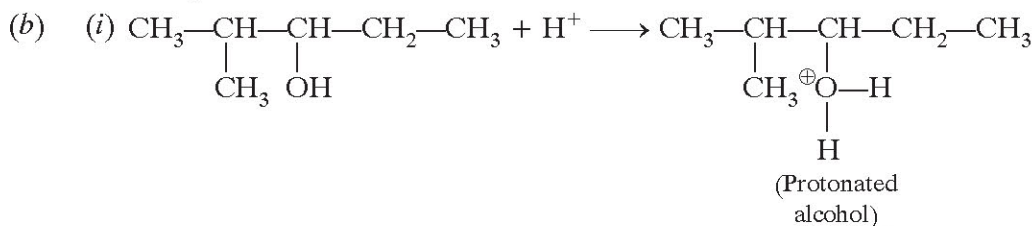


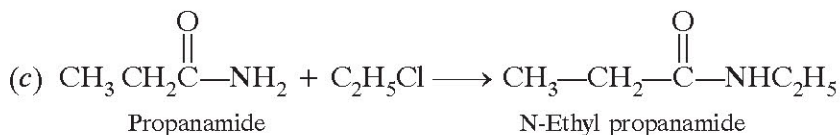
(ii) Lanthanum sulphide is formed.



(b) It is due to increasing stability of the species of lower oxidation state to which they are reduced.

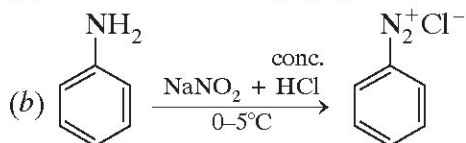
25. (a) $\text{CH}_3 - \overset{\text{Br}}{\underset{\text{CH}_3}{\text{C}}} - \text{CH}_2 - \text{CH}_2 - \text{CH}_3$ (2-Bromo-2-methyl pentane) is major product.



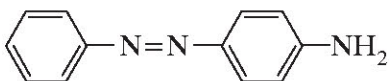


Or

(a) Reagent 'X' is $\text{C}_6\text{H}_5\text{N}_2^+\text{Cl}^-$ (Benzene diazonium chloride)



It is unstable at room temperature, therefore, it is not available in the lab.

(c)  (*p*-amino azo benzene) is structure of yellow dye.

28. (a) In DNA, A = T, C = G

$$A = 100, \quad T = 100, \quad C = 150, \quad G = 150$$

$$\text{Total number of nucleotides} = 100 + 100 + 150 + 150 = 500$$

(b) They must have studied sequence of DNA and must have found same, therefore, the sample belong to same person. It is also called DNA fingerprinting.

(c) Transfer RNA (*t*-RNA), Messenger RNA (*m*-RNA), Ribosomal RNA (*r*-RNA) are needed for synthesis of proteins.

29. (a) $\pi = CRT$

$$2.49 \times 10^{-3} = \frac{1.0}{M} \times 0.083 \times 300 \text{ K} \quad [C = \frac{1}{M}]$$

$$M = \frac{1.0 \times 0.083 \times 300}{2.49 \times 10^{-3}} = \frac{24.9}{2.49} \times 10^3 = 1 \times 10^4 \text{ g/mol}$$

$$(b) \frac{\pi_1}{\pi_2} = \frac{T_1}{T_2}$$

$$\frac{3.0 \text{ bar}}{\pi_2} = \frac{300 \text{ K}}{400 \text{ K}}$$

$$\Rightarrow \pi_2 = \frac{3 \times 400}{300} = 4.0 \text{ bar}$$

Or

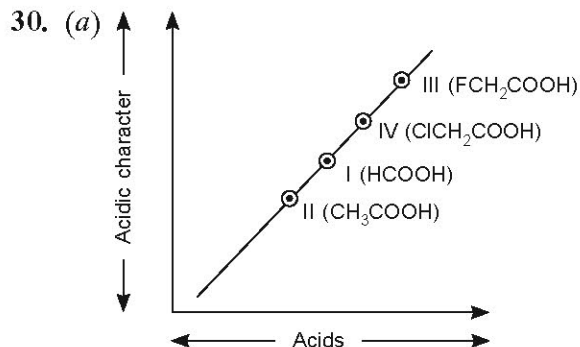
Isotonic solutions are those which have same osmotic pressure. No, glucose and sucrose are not isotonic solutions because they have different osmotic pressure.

$$(c) \quad \Delta T_f = K_f \times m$$

$$18.6 = 1.86 \times m$$

$$\Delta T_f = 0^\circ\text{C} - (-18.6^\circ\text{C}) = 18.6^\circ\text{C}$$

$$\Rightarrow m = 10 \text{ mol/kg}$$



Fluoro acetic acid is strongest because F is most electronegative and more electron withdrawing than Cl.

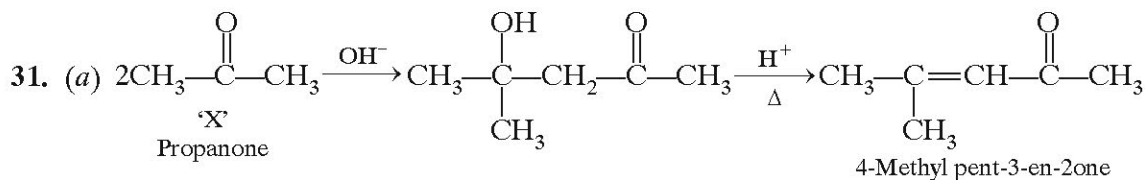
HCOO^- is more stable than CH_3COO^- , therefore, HCOOH is stronger acid than CH_3COOH since $-\text{CH}_3$ group is electron releasing, destabilises CH_3COO^- .

(b) (iv) $-\text{CF}_3$ is most electron withdrawing group.

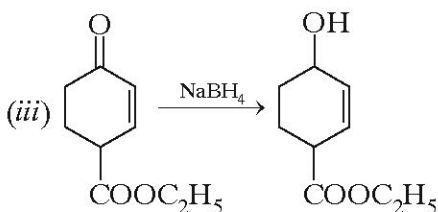
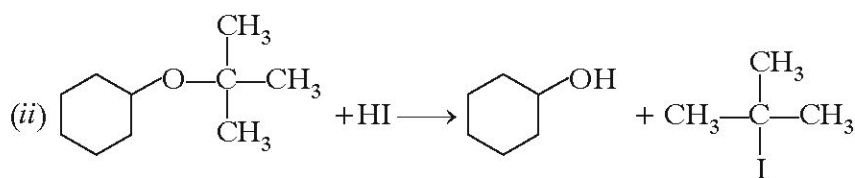
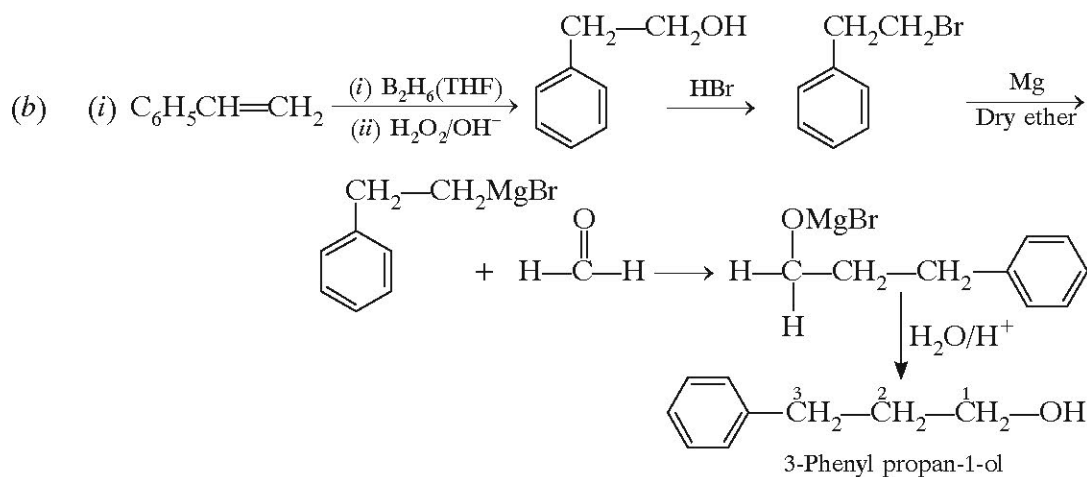
(c) (ii) $\therefore \text{CF}_3\text{COOH}$ is strongest among these, will have lowest pK_a .

Or

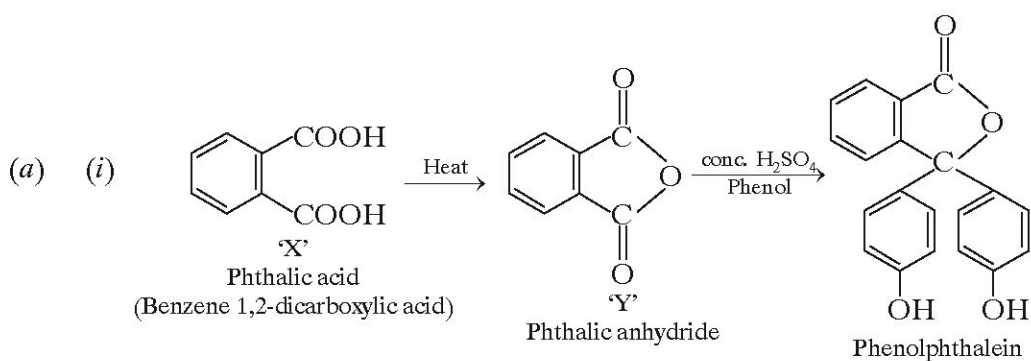
(c) (ii) Salicylate ion is most stable due to chelation (intra-molecular hydrogen bonding). \therefore Salicylic acid has highest K_a .



'X' does not give Tollen's test but gives iodoform test.



Or



(ii) Acetic anhydride has higher boiling point than acetic acid due to greater surface area, more van der Waals' forces of attraction.

- (b) (i) It is bent molecule, dipoles do not get cancelled.
(ii) It is due to +R effect of —OH group, electron density is maximum at *o* and *p*-position.
(iii) CH₃O⁻ is more stable than C₂H₅O⁻ because C₂H₅ is more electron releasing than —CH₃ group.

32. (a)
$$t = \frac{2.303}{k} \log \frac{[R]_0}{[R]}$$

$$= \frac{2.303}{0.693} \times 5730 \log \frac{[R]_0}{\frac{10}{100} [R]_0}$$

$$= \frac{2.303}{0.693} \times 5730 \log 10$$

$$= \frac{5730}{0.3010} = 19036 \text{ years}$$

$$k = \frac{0.693}{t_{1/2}} = \frac{0.693}{5730} \text{ years}^{-1}$$

(b) (i) Slope = $-\frac{E_a}{R}$
Slope = $-\frac{9.2 - 8.4}{(3.50 - 3.62) \times 10^{-3}} = -\frac{0.8}{0.12 \times 10^{-3}} = -6.67 \times 10^3$

$$E_a = 8.31 \times 6.67 \times 10^3 = 55.4 \text{ kJ mol}^{-1}$$

(ii) Two cases:

- When molar conc. of reactants is unity.
- When reaction is zero order reaction.

Or

- (a) (i) The decrease in partial pressure of ethane is constant over time that is $t_{1/2}$ is constant, so its first order reaction.

(ii) $k = \frac{0.693}{t_{1/2}} = \frac{0.693}{100 \text{ min}} = 6.93 \times 10^{-3} \text{ min}^{-1} = \frac{6.93 \times 10^{-3}}{60} \text{ s}^{-1}$

$$k = 1.15 \times 10^{-4} \text{ s}^{-1}$$

(iii) ratio of $\frac{t_{50\%}}{t_{75\%}} = \frac{1}{2}$

(b) rate = $k [\text{NO}_2]^2$ (for slow step)

(c) marble powder has more surface area as compared to marble chips, therefore, rate of reaction is faster.

33. (a) (i) It is because actinoids have lower ionisation enthalpy than lanthanoids due to larger size.
- (ii) It is because chemistry of elements succeeding the actinoids are much less known at the present time.
- (b) (i) It involves both σ as well as π bond. σ bond is formed by donation of lone pair of electron on CO to vacant d -orbitals of transition metal, whereas π -bond is formed by back donation of pair of electron from d -orbital of transition metal to vacant antibonding M.O. of CO.
- (ii) dsp^3 , trigonal bipyramidal
- (iii) $[\text{Ag}(\text{S}_2\text{O}_3)_2]^{3-}$ is complex formed.

Or

- (a) (i) The higher the reduction potential, the larger is the tendency to get reduced. Mn^{3+} has highest reduction potential, therefore, Mn^{3+} could be most easily reduced to Mn^{2+} , hence Mn^{3+} is least stable.
- Fe^{3+} is more stable than Mn^{3+} but less stable than Cr^{3+} although their values of reduction potential given are equal, as Cr^{3+} has $3d^3$, i.e. t_{2g} orbitals are half-filled, hence more stable than Fe^{3+} ($3d^5$)
- (ii) Mn can be oxidised more easily to Mn^{2+} , followed by Cr to Cr^{2+} and Fe is oxidised to Fe^{2+} least readily. $\text{Mn} > \text{Cr} > \text{Fe}$.
- (b) The stability of complex in solution refers to degree of association between two species involved in state of equilibrium. Higher the stability constant, more will be stability of complex compound.

$$K_{\text{dissociation constant}} = \frac{1}{K_{\text{stability constant}}}$$

- (c) It is a series in which ligands are arranged in increasing order of their strength, experimentally determined based on absorption of light by complexes with different ligands.