Answers to RSPL/2

1. (*a*) Since CH_3OH is most acidic, therefore, most reactive towards Na metal.

2. (*a*) Since it is primary halide, has least steric hindrance.

3. (*d*) All of these

4. (*d*) $\because\ k = \dfrac{0.693}{t_{1/2}}$, lesser the $t_{1/2}$, higher will be decay constant.

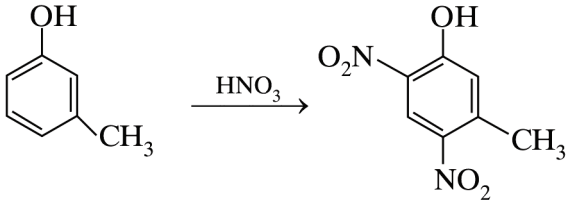
5. (*c*) $2Cl^{-1} - 2e^- \longrightarrow Cl_2$ (at anode)

6. (*c*) Catalyst lowers down the activation energy

7. (*b*) $CH_3-\underset{\underset{\text{Ethanamide}}{}}{\overset{\overset{O}{\|}}{C}}-NH_2 \xrightarrow[(ii)\ H_2O]{(i)\ LiAlH_4} \underset{\text{Ethanamine}}{CH_3CH_2NH_2}$

8. (*b*) $\because\ NO_2$ is ambidentate ligand.

9. (*b*)



3-Methyl phenol 5-Methyl-2, 4-Dinitro phenol

10. (*b*) $\underset{\text{Aniline}}{C_6H_5NH_2} + \underset{\text{Benzoyl chloride}}{C_6H_5COCl} \xrightarrow{\text{pyridine}} \underset{\text{N-Phenyl benzamide}}{C_6H_5NHCOC_6H_5} + HCl$

11. (*c*) HCOOH gives silver mirror with Tollen's reagent test but CH_3COOH does not.

12. (*b*) The order of reaction will be 1. $\because$ Concentration will become half, rate is halved.

13. (*d*) $\because$ All of them have α-hydrogen.

14. (*c*) $\because\ H_2O < NH_3 < NO_2^-$ is order of strength of ligands and Δ_0.

$\boxed{\Delta_0 = \dfrac{hc}{\lambda}}$, lower Δ_0, higher 'λ'.

15. (*c*) A is true but R is false.

16. (*b*) Both A and R are true but R is not the correct explanation of A.

17. (*c*) A is true but R is false.

18. (*c*) A is true but R is false.

19.

$$\text{Rate} = -\frac{d[A]}{2dt} = -\frac{d[B]}{dt}$$

$$= +\frac{1}{3}\frac{d[C]}{dt} = \frac{d[D]}{dt}$$

$$-\frac{d[B]}{dt} = -\frac{1}{2}\frac{d[A]}{dt} = \frac{1}{2} \times 4 \times 10^{-3}$$

$$-\frac{d[B]}{dt} = 2 \times 10^{-3}\ \text{Ms}^{-1}$$

$$\frac{1}{3}\frac{d[C]}{dt} = \frac{1}{2} \times 4 \times 10^{-3}$$

$$\Rightarrow \quad +\frac{d[C]}{dt} = 6 \times 10^{-3}\ \text{Ms}^{-1}$$

20. (*i*) Glucose does not give Schiff's reagent test and does not react with $NaHSO_3$.

(*ii*) Glucose pentaacetate does not react with NH_2OH, showing it does not have free aldehyde group.

(*iii*) α and β-glucose cannot be explained by open chain structure. (*Any two*)

Or

(*a*) $(CHOH)_4$ (CH_2OH) (Glucose) $\xrightarrow{HI}$ $CH_3—CH_2—CH_2—CH_2—CH_2—CH_3$ (*n*-Hexane)

(*b*) $(CHOH)_4$ (CH_2OH) (Glucose) $\xrightarrow[\text{Fehling solution}]{CuSO_4+NaOH}$ $(CHOH)_4$ ($COOH$, CH_2OH) (Gluconic acid) + $Cu_2O\downarrow$ (Brick red ppt)

21. (*a*) It is due to +R effect, electron density is maximum at *o* and *p*-position.

(*b*) It is because alcohols are associated with intermolecular H-bonding whereas alkyl halides do not form H-bonds.

Or

'X' is $CH_3—CH(CH_3)—CH_2—CH_3$ (2-Methyl butane)

$$CH_3—\underset{\displaystyle CH_3}{\overset{\displaystyle |}{CH}}—CH_2—CH_3 \xrightarrow[\text{Sunlight}]{Cl_2} CH_3—\underset{\displaystyle CH_3}{\overset{\displaystyle |}{CH}}—CH_2—CH_2Cl +$$

I

$$+ CH_3—\underset{\displaystyle CH_3}{\overset{\displaystyle |}{CH}}—\overset{\displaystyle Cl}{\overset{\displaystyle |}{CH}}—CH_3 + CH_3—\underset{\displaystyle CH_3}{\overset{\displaystyle Cl}{\overset{\displaystyle |}{C}}}—CH_2—CH_3 + ClCH_2—\underset{\displaystyle CH_3}{\overset{\displaystyle |}{CH}}—CH_2—CH_3$$

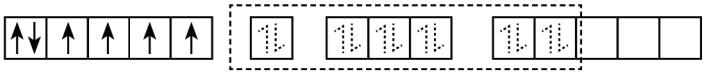
II III IV

22. (*a*) $FeSO_4.(NH_4)_2SO_4.6H_2O$ (Mohr's salt) forms simple ions in aqueous solution and not complex ions, hence, it is a double salt.

(*b*) Co(27) : [Ar] $4s^2\,3d^7$; Co^{3+}(27) : [Ar] $4s^0\,3d^6$

F^- is a weak field ligand, cannot cause pairing of electrons.

$[CoF_6]^{3-}$:



sp^3d^2

$$\mu_B = \sqrt{n(n+2)} = \sqrt{4(4+2)} = \sqrt{24} = 4.90 \text{ B.M.}$$

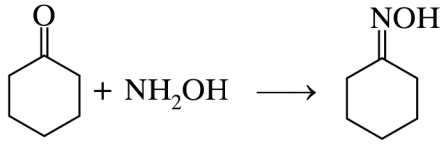
23. $Zn(s) \longrightarrow Zn^{2+} + 2e^-$ (At anode)

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

$$\log K_c = \frac{nE^\circ}{0.0591} = \frac{2 \times 1.10V}{0.0591} = 37.2250$$

24. Rate of reaction depends upon number of effective collisions which lead to formation of products. When temperature is increased, K.E of molecules increases, number of molecules possessing E_a increase, hence, effective collisions become almost double for every 10° rise in temperature.

25. (*i*) Cyclohexanonoxime is formed.

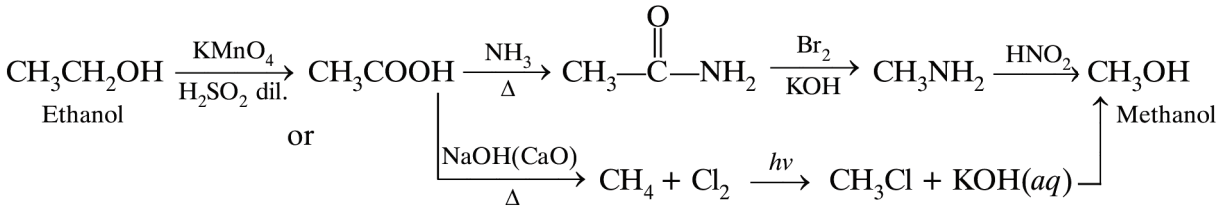


Cyclohexanone Cyclohexanonoxime

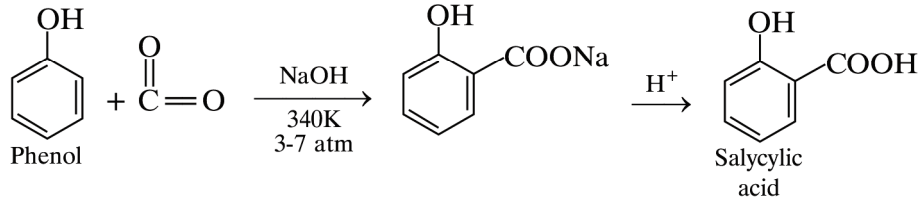
(*ii*) Sodium benzoate and benzyl alcohol will be formed.

$$\underset{\text{Benzaldehyde}}{2C_6H_5CHO} \xrightarrow{\text{conc. NaOH}} \underset{\text{Sodium benzoate}}{C_6H_5—COONa} + \underset{\text{Benzyl alcohol}}{C_6H_5CH_2OH}$$

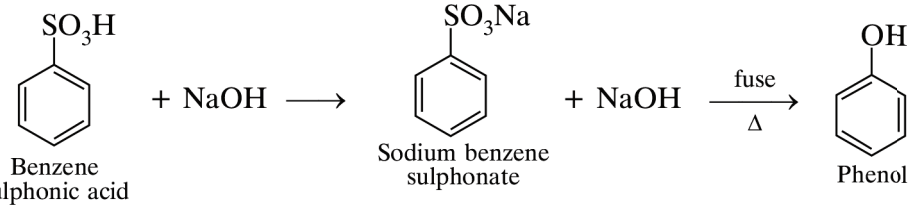
26. (*i*)



(*ii*)



(*iii*)



27. (*a*) $t_{2g}^3 e_g^2$ $[\because \Delta_o < P]$

(*b*) It is diamagnetic due to absence of unpaired electron, d^2sp^3 hybridisation.

(*c*) $[Fe(CN)_6]^{3-}$, it is because Fe^{3+} has higher charge and smaller in size.

28. (*a*) Sea water contains more dissolved salts which reduces escaping tendency of water molecules into vapours, hence, vapour pressure decreases more than river water having less dissolved salts.

(*b*)
$$\frac{p_A^o - p_A}{p_A^o} = x_B$$

$$\frac{640 - 600}{640} = \frac{\frac{W_B}{M_B}}{\frac{W_B}{M_B} + \frac{W_A}{M_A}}$$

$$\frac{640 - 600}{640} = \frac{W_B}{M_B} \times \frac{M_A}{W_A} \qquad \left[\because \frac{W_B}{M_B} <<< \frac{W_A}{M_A}\right]$$

$$\frac{40}{640} = \frac{2.175}{M_B} \times \frac{78}{39}$$

$$M_B = 2.175 \times 2 \times 16 = 69.6 \text{ g mol}^{-1}$$

29. (*a*) It is due to oxidation in presence of air.

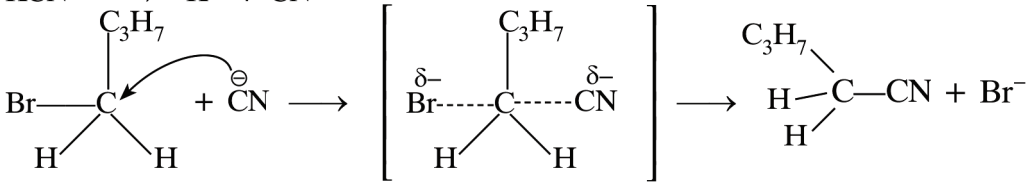
(*b*) It is because alcohols are associated with stronger hydrogen bond than amines, Since, 'O' is more electronegative than N.

(*c*) Tertiary amines do not have hydrogen attached to nitrogen, so, do not react with Hinsberg's reagent.

(*d*) In *p*-toluidine, $-CH_3$ group is electron releasing which increases basic character than aniline.

30. (*a*) 3-Bromo propene.

(*b*) $KCN \longrightarrow K^+ + CN^-$

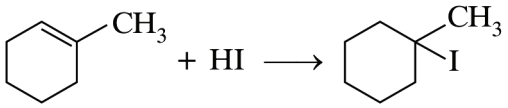


n-BuBr *n*-Bu-CN

Or

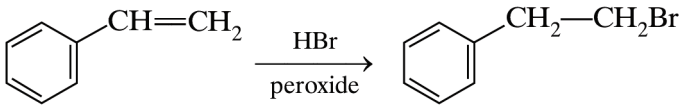
(*a*) Freon is used in refrigerator and air conditioner for cooling and CCl_4 is used as solvent and fire extinguisher under the name of pyrene.

(*b*) (*i*)



1-Methyl cyclo hexene 1-Iodo-1-methyl cyclohexane

(*ii*)



Phenyl ethene 1-Bromo-2-phenyl ethane

31. (*a*) It is because Vitamin 'B' and 'C' are water soluble and excreted through urine, so it should be taken regularly.

(*b*) Vitamin B_{12} (Cyanocobalamin). It is neither fat nor water soluble.

(*c*) (*i*) It consists of Vitamin B_1, B_2, B_3, B_5, B_6, B_7, B_9 (folate) and B_{12} (cobalamin).

(*ii*) Vitamin E deficiency leads to dry skin and loss of reproductive power.

Or

(*c*) (*i*) Vitamin K. It is present in green leafy vegetable.

(*ii*) Fibre helps in digestion and helps to reduce weight.

32. (*a*) It is because glucose has molar mass 180 g/mol where as sucrose has molar mass 342 g mol^{-1} , they differ in molality on which ΔT_f depends.

(*b*) It is because it is an electrolyte, number of particles are more, and molar mass is lowest.

(*c*) $$\Delta T_f = iK_f \times \frac{W_B}{M_B} \times \frac{1000}{W_A}$$

$$0.383 = i \times 3.83 \times \frac{2.56}{32} \times \frac{1000}{100}$$

$$i = \frac{1}{8}$$

(*c*) It means sulphur exists as S_8.

Or

$$\Delta T_f = iK_b \times \frac{W_B}{M_B} \times \frac{1000}{W_A}$$

$$1.62 = i \times 4.9 \times \frac{3.9}{122} \times \frac{1000}{49}$$

$$i = \frac{1.62 \times 122 \times 49}{4.9 \times 3.9 \times 1000} = \frac{162 \times 122 \times 49 \times 10 \times 10}{100 \times 39 \times 49 \times 1000}$$

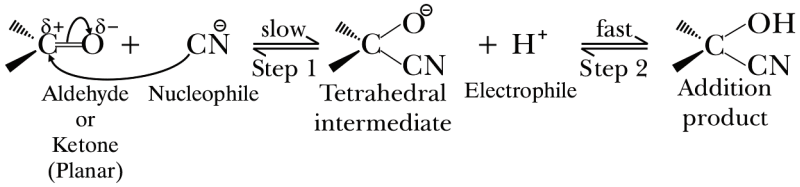
$$i = \frac{19764}{39000} = 0.507$$

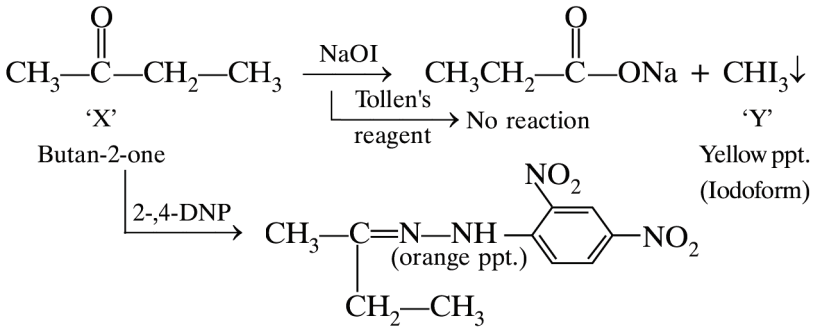
$$\alpha = \frac{1-i}{1-\frac{1}{n}} = \frac{1-0.507}{1-\frac{1}{2}} = \frac{0.493}{\frac{1}{2}} = 0.986$$

$$\alpha = 0.986 \times 100 = 98.6\%$$

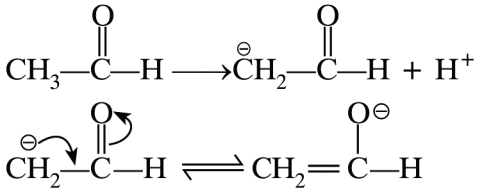
33. (*a*) $>C=O$ is a polar group in which carbon has positive charge whereas oxygen has negative charge. The nucleophile attacks on 'C' and forms a tetrahedral intermediate and then electrophile attacks on oxygen and forms a compound (Addition product).

$HCN \longrightarrow H^+ + CN^-$



(*b*) 

(*c*) It is because carbanion formed is stabilised by resonance.



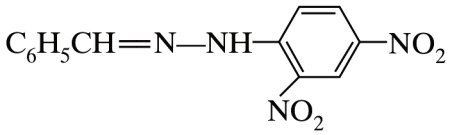
Or

(*a*) (*i*) $C_6H_5COONa + NaOH(CaO) \xrightarrow{\Delta} C_6H_6 + Na_2CO_3$

Sodium benzoate — Benzene

(*ii*) $CH_3CH_2COOH \xrightarrow[H_2O]{\text{red } P_4/Cl_2} CH_3-\underset{\underset{Cl}{|}}{CH}-COOH$

Propanoic acid — 2-Chloro propanoic acid

(*b*) 

(*c*) 2-hydroxy benzaldehyde

(*d*) It is because $HCOO^-$ is more stable than CH_3COO^- because $-CH_3$ group is electron releasing destabilises CH_3COO^- by increasing negative charge.

34. (*a*) $2Cr(s) \longrightarrow 2Cr^{3+} + 6e^-$

$3Fe^{2+}(aq) + 6e^- \longrightarrow 3Fe(s)$

$$E_{cell} = E^\circ_{cell} - \frac{0.0591}{n} \log \frac{[Cr^{3+}]^2}{[Fe^{2+}]^3}$$

$$= (E^\circ_{Fe^{2+}/Fe} - E^\circ_{Cr^{3+}/Cr}) - \frac{0.0591}{6} \log \frac{[Cr^{3+}]^2}{[Fe^{2+}]^3} \quad \boxed{n = 6}$$

$$= [-0.44\ V - (0.74\ V)] - \frac{0.0591}{6} \log \frac{(10^{-2})^2}{(10^{-1})^3}$$

$$= +0.30\ V - \frac{0.0591}{6} \log 10^{-1}$$

$$= +0.30\ V + \frac{0.0591}{6} = 0.30\,V + 0.00985$$

$$= +0.30985 \cong 0.31V$$

(*b*) The cell in which electricity is produced as a result of redox reaction is called electrochemical cell.

If external applied emf is equal to E°_{cell}, the cell will stop working.

Or

(*a*) $$\Lambda^\circ_{NaCl} = \lambda^\circ_{Na^+} + \lambda^\circ_{Cl^-} = 50.1 + 76.5 = 126.6\ S\ cm^2\ mol^{-1}$$

$$\Lambda_m = \frac{1000\,\kappa}{M} = \frac{1000 \times 1.06 \times 10^{-2}}{0.1} = 106\ S\ cm^2\ mol^{-1}$$

$$\alpha = \frac{\Lambda_m}{\Lambda^o_m} = \frac{106}{126.6} = 0.8373$$

$$\alpha = 0.8373 \times 100 = 83.73\%$$

(*b*)

Primary battery	**Secondary battery**
It is device in which reaction occurs only once and after its use becomes dead and cannot be used again e.g. Dry cell.	It is device which is capable of being charged after discharge again and again e.g. Lead storage battery.

35. (*a*) Sc^{3+} does not have unpaired electrons where as Ti^{3+} has one unpaired electron.

(*b*) $2Na_2CrO_4 + H_2SO_4$ (conc.) $\longrightarrow Na_2Cr_2O_7 + Na_2SO_4 + H_2O$

(*c*) It is due to smaller cation, higher charge and availability of vacant *d*-orbitals.

(*d*) Eu^{2+} loses one electron to form Eu^{3+} which has higher hydration enthalpy.

(*e*) MnO has Mn in +2 oxidation state, ionic, therefore, basic in nature. Mn_2O_7 has Mn^{7+}, is covalent, acidic in nature. Higher the oxidation state, more will be acidic character.