Answers to RCH–DS2/Set-2

1. (*b*) Higher the reduction potential, greater will be tendency of M^{2+} to get reduced and lower will be oxidation state stability. $Mn^{2+}(3d^5)$ is most stable due to lowest standard reduction potential.

2. (*a*) $CH_3COONa + NaOH\ (CaO) \xrightarrow{\Delta} CH_4 + Na_2CO_3$, 2 moles of $CH_4 = 2 \times 16 = 32$ g

3. (*d*) S only

$\because$ Lactose is made up of β-D-Glucose, Amylose constitute 15-20% starch and cellulose is linear polymer of β-glucose.

4. (*d*) $\because$ It has bidentate ligand which makes it chiral.

5. (*d*) All of these

6. (*b*) ZnO is amphoteric, MnO is basic, Mn_2O_7 is acidic oxide.

7. (*b*) $k[NO]^2[O_2]^1$

$\because$ When $[O_2]$ is kept constant [NO] is doubled, rate becomes 4 times. When [NO] is kept constant $[O_2]$ is doubled, rate becomes 2 times.

8. (*d*) $CH_3—\underset{\displaystyle CH_3}{\underset{|}{CH}}—CH_2—NH_2 + C_6H_5SO_2Cl \longrightarrow CH_3—\underset{\displaystyle CH_3}{\underset{|}{CH}}—CH_2NHSO_2C_6H_5 \xrightarrow{KOH}$ Soluble

Primary amines can be prepared by Gabriel phthalimide synthesis.

9. (*d*) All of these

$\because$ All have phenolic group.

10. (*d*) $\text{rate} = -\dfrac{1}{2}\dfrac{\Delta[A]}{\Delta t} = -\dfrac{1}{2} \times \dfrac{(0.4 - 0.6)}{10}$

$= +\dfrac{0.2}{2 \times 10} = \dfrac{1 \times 10^{-1}}{10} = 1 \times 10^{-2}\ \text{mol L}^{-1}\ \text{mol}^{-1}$

11. (*a*) Partial double bond character between C$\overset{....}{=}$O bond.

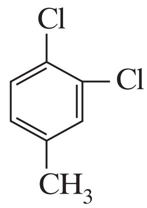
12. (*b*) Cu^+ is colourless due to absence of unpaired electrons.

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

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

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

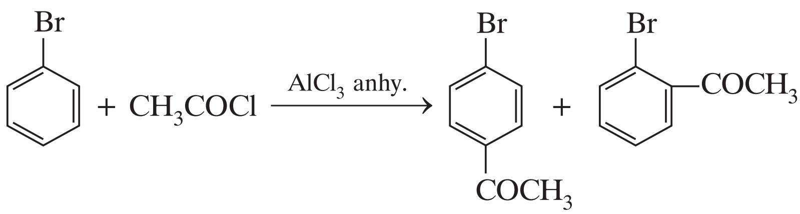
16. (*b*) Both A and R are true but R is not the correct explanation of A.

17. (*a*) CH_3CN (*b*) 

$+ HCl$

Or

(*a*) $CH_3Cl + AgNO_2 \longrightarrow CH_3NO_2 + AgCl$

(*b*) 

18. (*a*) Those carbohydrates which give brick red ppt with Fehling's solution e.g., glucose.

(*b*) Those isomers which differ in position of —OH group on C—1 carbon e.g. α-glucose and β-glucose.

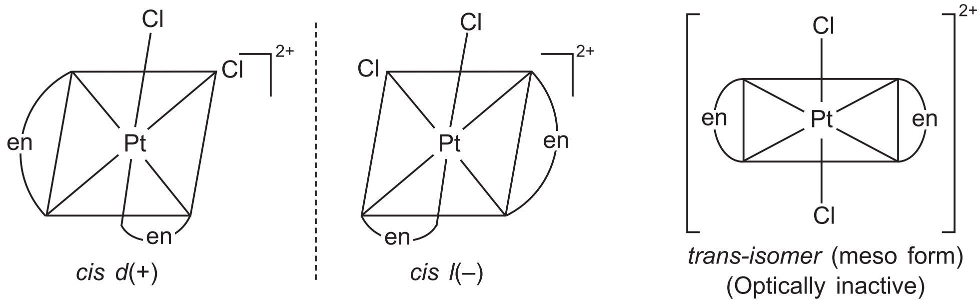
19. $P_T = p_A^\circ x_A + p_B^\circ x_B = 100 \times 0.4 + 50 \times 0.6$

$$P_T = 40 + 30 = 70 \text{ kPa}$$

20. I. sp^3d^2 II. dsp^2 III. sp^3 IV d^2sp^3

21. When concentration is increased, total number of collisions increase, probability of effective collisions increase, hence, rate of reaction increases.

When we increase temperature, K.E. of molecules increases, number of molecules possessing Ea increases, hence, effective collisions and rate of reaction increases.

22. (*a*) 

Dichloridobis(ethane 1,2-diamine) platinum II

(*b*) $[MnBr_4]^{2-}$ has five unpaired electrons, $[Ni(CN)_4]^{2-}$ does not have unpaired electrons.

(*c*) Potassium tetra chlorido nickelate (II)

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

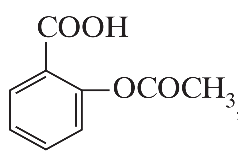
(*b*) (*i*) $Q = I \times t = 0.1287A \times 50 \times 60 = 386.1C$

(*ii*) $m = Z \times I \times t = Z \times Q$

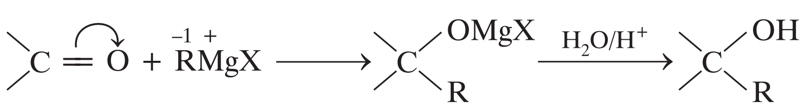
$$m = \frac{63.5}{2 \times 96500} \times 386.1C = 0.127 \text{ g} \qquad \left[Z = \frac{63.5}{2 \times 96500}\right]$$

24. (*a*) Hydroboration oxidation, $CH_3—CH_2—CH_2—CH_2—OH$, Butan–l–ol

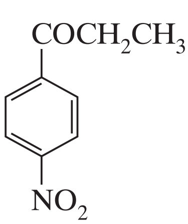
(*b*) Dehydration, $C_2H_5OC_2H_5$, Ethoxy ethane.

(*c*) Acetylation, 

, 2-Acetoxy benzoic acid.

25. (*a*) 

(*b*) (*i*) $HOOC—CH_2—CH_2—CH_2—CH_2—COOH$

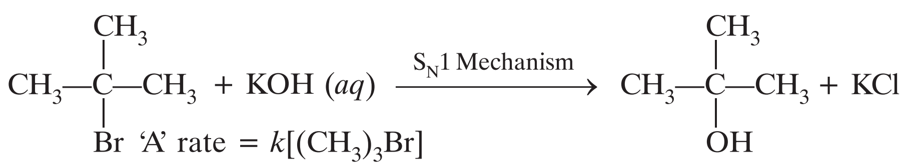
(*ii*) 

26. $k = \frac{2.303}{t} \log \frac{[R]_0}{[R]} = \frac{2.303}{10} \log \frac{0.10}{0.05} = \frac{2.303}{10} \log 2 = \frac{2.303}{10} \times 0.3010$

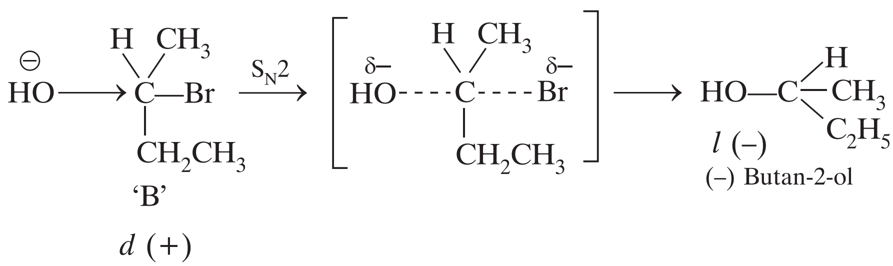
$k = 6.93 \times 10^{-2} s^{-1}$

$$k = \frac{2.303}{20} \log \frac{0.10}{0.025} = \frac{2.303}{20} \log 4 = \frac{2.303}{20} \times 0.6021 = \frac{1.386}{20} = 6.93 \times 10^{-2} s^{-1}$$

Since 'k' remains constant ∴ it is first order reaction.

27. 

2-Bromo-2-methyl propane 2-Methyl propan-2-ol



d (+)

(+) 2-Bromo butane (–) Butan-2-ol

'B' will follow S_N2 mechanism and product will be inverted and rate depends on concentration of sec. butyl bromide and $[OH^-]$.

rate = $k\,[CH_3—CH(Br)—CH_2—CH_3]\,[OH^-]$

28. $k = Ae^{-Ea/RT}$ ...(*i*)

$k = 4.5 \times 10^{+11}\ s^{-1}\ e^{\frac{-28000K}{T}}$ ...(*ii*)

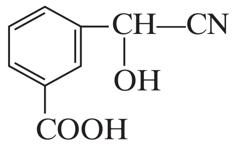
Comparing (*i*) and (*ii*)

$e^{-Ea/RT} = e^{\frac{-28000K}{T}}$

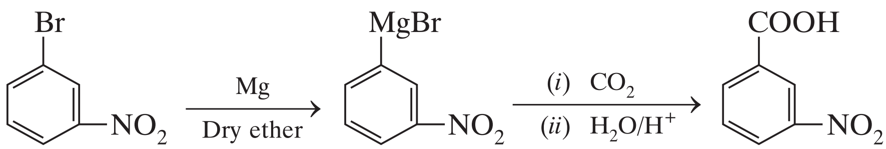
Taking ln both sides

$$\frac{-Ea}{RT} = \frac{-28000K}{T} \qquad [\because \ln e = 1]$$

$$Ea = \frac{28000 \times 8.314}{1000} = 232.792 \text{ kJmol}^{-1}$$

29. (*a*) A is 

(*b*) $C_6H_5CH_2COOH < C_6H_5COOH < FCH_2COOH < O_2NCH_2COOH$.

(*c*) 

Or

I. Butanone < Propanone < Propanal < Ethanal

II. $R{-}CH{=}CH{-}\overset{O}{\overset{\|}{C}}{-}H + H_2N{-}\overset{O}{\overset{\|}{C}}{-}NH{-}NH_2 \xrightarrow{H^+}$

$$R{-}CH{=}CH{-}CH{=}N{-}NH{-}\overset{O}{\overset{\|}{C}}{-}NH_2$$

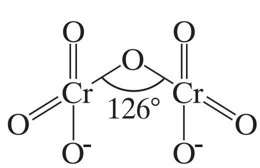
'X'

30. (*a*) Sc shows +3 oxidation state.

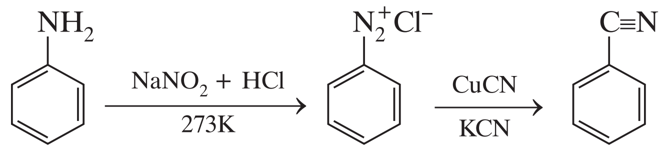
(*b*) Ce^{2+} can lose electron to form Ce^{3+} which is more stable.

(*c*) $4FeCr_2O_4 + 8Na_2CO_3 + 7O_2 \longrightarrow 8Na_2CrO_4 + 2Fe_2O_3 + 8CO_2$

Or

(*c*) 

6 Cr—O bonds are equivalent due to resonance.

31. (*a*) 

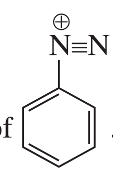
Aniline — Benzene diazonium chloride — Benzonitrile

(*b*) It is because —C_6H_5 group is electron withdrawing, reduces electron density on nitrogen as compared to NH_3.

(*c*) $C_2H_5NH_2$ forms OH^- in aqueous solution which reacts with $FeCl_3$ to give reddish brown precipitate of $Fe(OH)_3$.

$$C_2H_5NH_2 + H_2O \longrightarrow C_2H_5\overset{\oplus}{N}H_3 + OH^-$$

$$FeCl_3 + 3OH^- \longrightarrow \underset{\text{(reddish brown ppt)}}{Fe(OH)_3} + 3Cl^-$$

(*d*) It is due to resonance stabilisation of  .

(*e*) It is because product formed, $(C_2H_5)_2NSO_2C_6H_5$ is not acidic in nature.

(*f*) $$\underset{\text{Methyl amine}}{CH_3NH_2} + \underset{\text{Acetic anhydride}}{(CH_3CO)_2O} \xrightarrow{\text{Pyridine}} \underset{\text{N-Methyl ethanamide}}{CH_3NHCOCH_3} + CH_3COOH$$

(*g*) $$\underset{\text{Nitroethane}}{C_2H_5NO_2} \xrightarrow{\text{Sn/HCl}} \underset{\text{Ethanamine}}{C_2H_5NH_2} \xrightarrow{HNO_2} \underset{\text{Ethanol}}{C_2H_5OH} \xrightarrow{PCl_5} \underset{\text{Chloroethane}}{C_2H_5Cl} \xrightarrow{\text{KCN}} \underset{\text{Propane nitrile}}{C_2H_5CN}$$

$$\underset{\text{Propane nitrile}}{C_2H_5C\equiv N} \xrightarrow{H_2O/H^+} \underset{\text{Propanoic acid}}{C_2H_5COOH}$$

32. (*a*) $H_2SO_4\,(aq) \longrightarrow 2H^+(aq) + SO_4^{2-} \;\therefore\; i = 3$

$$\pi V = i \times \frac{W_2}{M_2} \times RT \quad \Rightarrow \quad \pi \times 2 = 3 \times \frac{50 \times 10^{-3}}{98} \times 0.0821 \times 300\text{ K}$$

$$\pi = \frac{150 \times 10^{-3} \times 24.63}{98 \times 2} = 0.0189 \text{ atm.}$$

(*b*) $C_6H_5COOH < \text{Glucose} < KCl < BaCl_2 < H_3PO_4$

(*c*) Positive deviation from Raoult's law.

Or

(*a*) $\frac{p_A^\circ - p_A}{p_A^\circ} = ix_B \Rightarrow \frac{0.900 - 0.200}{0.900} = i\frac{1}{1+2} \Rightarrow i = \frac{7}{9} \times \frac{3}{1} = \frac{21}{9} = 2.33$

(*b*) Cell will shrink in hypertonic solution and will swell or burst in hypotonic solution, therefore, they must be isotonic with body fluids.

(*c*) Salt forms hypertonic solution so cell fluids will come out and bacteria and virus can't survive in presence of salt.

33. (*a*) Cu acts as anode ∵ its reduction potential is lower than Ag.

(*b*) Ag < Cu < Ni < K < Li is order of increasing reducing power.

(*c*) $\Lambda_m = \frac{1000\,\kappa}{M} = \frac{1000 \times 8 \times 10^{-5}}{2 \times 10^{-3} M} = 40 Scm^2 mol^{-1}$

$\alpha = \frac{\Lambda_m}{\Lambda_{m^\circ}} = \frac{40}{400} = 0.1, \alpha = 0.1 \times 100 = 10\%$

Or

(*a*) $\Delta rG^\circ = -nE^\circ F = -2 \times 1.05\ V \times 96500\ C = -202.65\ kJ\ mol^{-1}$

$\log K_C = \frac{nE^\circ}{0.059} = \frac{2 \times 1.05}{0.059} = 35.6$

(*b*) At cathode, O_2 is reduced to OH^-.

$O_2(g) + 2H_2O(l) + 4e^- \longrightarrow 4OH^-$

At anode, H_2 is oxidised to form water.

$2H_2(g) + 4OH^-(aq) \longrightarrow 4H_2O(l) + 4e^-$

$2H_2(g) + O_2(g) \longrightarrow 2H_2O(l)$ [Overall reaction]

Water is formed as product used by Astronaut for drinking. The cell works only when reactants are supplied continuously.