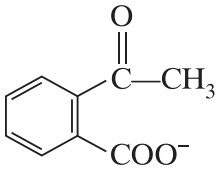
Answers to RCH–DS2/Set-3

1. (*d*) Steric hinderance play no role in gas phase.

2. (*b*)  + 2Ag ↓ (Silver mirror)

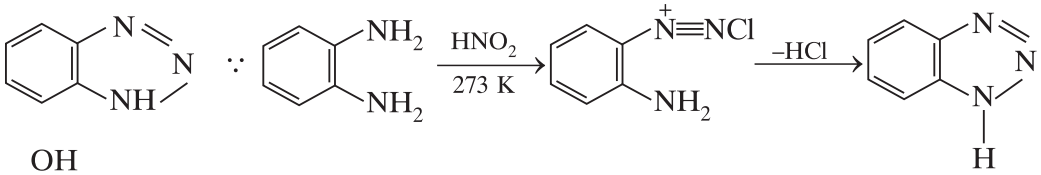
3. (*b*) Co (Cobalamine)

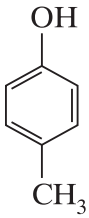
4. (*b*) $CH_3—CH_2—\overset{\overset{O}{\|}}{C}—CH_2—CH_3$ does not give iodoform test.

5. (*d*) All of these

6. (*c*) $Fe^{3+}(3d^5)$, $Ni^{2+}(3d^8)$, $Mn^{7+}(3d^0)$ $Co^{2+}(3d^7)$

7. (*b*) II and III $\because\ k = \dfrac{2.303}{t}\log\dfrac{[R]_0}{[R]}$

8. (*b*) 

9. (*d*)  $\because$ $—CH_3$ is electron releasing i.e., activating.

10. (*a*) I > II > IV > III

11. (*b*) Cu^{2+}, because it has one unpaired electrons. $\therefore\ \mu_B = \sqrt{n(n+2)} = \sqrt{1\times 3}$ = 1.732 BM.

12. (*c*) H_2 and O_2 need activation energy for the reaction to take place.

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

14. (*a*) Both A and R are true and R is the correct explanation of A.

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

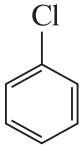
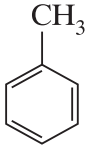
16. (*a*) Both A and R are true and R is the correct explanation of A.

17. $m = \dfrac{M \times 1000}{\text{Mass of soluton} - \text{Mass of solute}} = \dfrac{1 \times 1000}{(1000 \times 1.25) - 85} = \dfrac{1000}{1165} = 0.858$ m.

$$\left[\begin{array}{l}\text{Mass of solution} = \text{Volume of solution in mL} \times d\ (\text{g mL}^{-1}) \\ \qquad\qquad = 1000 \times 1.25 = 1250\ \text{g}\end{array}\right]$$

Mass of solute = 1 mole = 85 g.

18. (*a*) It is because –Cl has –I effect $\therefore$ electron density on benzene ring is less.

(*b*)  + 2Na + $CH_3Cl \xrightarrow[\text{Ether}]{\text{Dry}}$  + 2NaCl

Chlorobenzene Toluene

19. (*a*) Pentacyanido nitrosonium sulphido ferrate (II)

(*b*) $[CoCl_2(en)_2]\ NO_3$ is most stable $\because$ 'en' is didentate.

20. 'A' is $CH_3—\underset{\underset{OH}{|}}{CH}—CH_3$ 'B' is $CH_3—\overset{\overset{O}{||}}{C}—CH_3$ 'C' is CHI_3

Or

(*a*) —COOH is electron withdrawing, reducing electron density at *o* & *p*-position, therefore, electrophile attacks at *m*-position.

(*b*) It is because aldehydes and ketones react with $NaHSO_3$ to form compounds which on hydrolysis give aldehydes and ketones back. Other compounds do not react with $NaHSO_3$.

21. $\Delta T_b = 100 - 99.63 = 0.37°C$

$$\Delta T_b = K_b \times \frac{W_B}{M_B} \times \frac{1000}{W_A}$$

$$0.37 = 0.52 \times \frac{W_B}{342} \times \frac{1000}{500}$$

$$W_B = \frac{0.37 \times 342}{0.52 \times 2} = \frac{126.54}{1.04} = 121.67\ \text{g}$$

22. (*a*) $[Fe(H_2O)_6]^{3+}$ has 5 unpaired electrons, therefore, $\mu_B = \sqrt{n(n+2)} = \sqrt{5\times 7}$ = 5.92 BM

$[Fe(CN)_6]^{3-}$ has 1 unpaired electron therefore, $\mu_B = \sqrt{1\times 3} = 1.732$ BM

(*b*) $[Fe(H_2O)_6]^{3+}$ is outer orbital complex since, sp^3d^2 hybridisation.

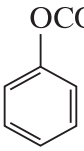
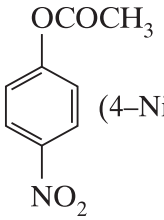
$[Fe(CN)_6]^{3-}$ is inner orbital complex since, d^2sp^3 hybridisation.

(*c*) $[Fe(CN)_6]^{3-}$ has higher CFSE (Δ_0) since, CN^- is strong field ligand.

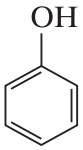
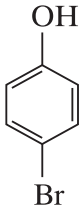
23. (*a*) (*i*) At cathode: $Ag^+ + e^- \longrightarrow Ag$, At anode: $2H_2O \longrightarrow 4H^+ + 4e^- + O_2(g)$

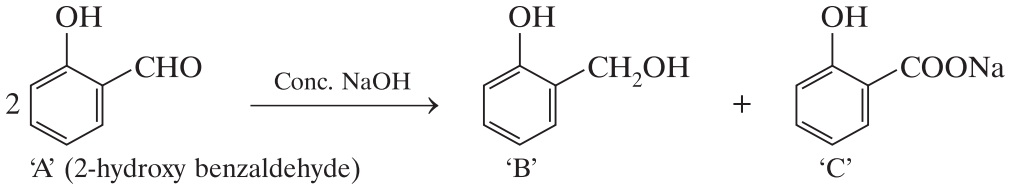
(*ii*) At cathode: $2H^+ + 2e^- \longrightarrow H_2(g)$, At anode: $2H_2O \longrightarrow 4H^+ + 4e^- + O_2(g)$

(*b*) $Zn(s)/Zn^{2+}(1\ M) \parallel Cu^{2+}(1\ M) \parallel Cu(s)$

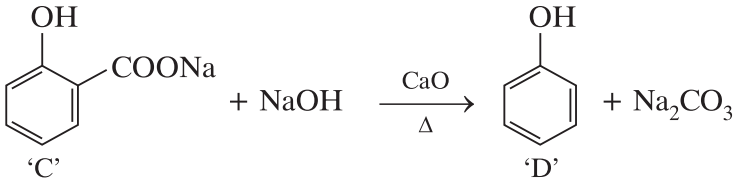
24. (*a*) 'A' is  (Phenyl ethanoate) 'B' is  (4–Nitro phenyl ethanoate)

(*b*) 'A' is $CH_3CH(OH)CH_3$ (Propan–2–ol) 'B' is CH_3COCH_3 (Propanone)

(*c*) 'A' is  (Phenol) 'B' is  (4–Bromo phenol)

25. 

'A' (2-hydroxy benzaldehyde) 'B' 'C'



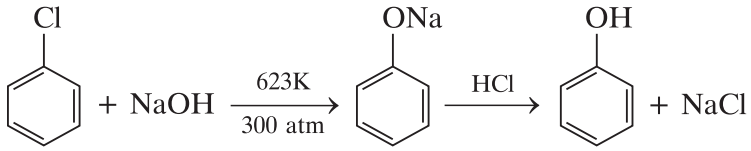
'C' 'D'

'A' gives violet colour with $FeCl_3$ due to presence of phenolic group and Schiff's reagent test due to presence of aldehyde group.

26. Slope $= -\dfrac{Ea}{2.303R} \Rightarrow -4250K = -\dfrac{Ea}{2.303 \times 8.314}$

$$Ea = \frac{4250 \times 19.147}{1000} = 81.374 \text{ kJ mol}^{-1}$$

27. (*a*) 1–Bromo, 2, 2–dimethyl propane < 1–Bromo–2–methyl butane < 1–Bromo–3–methyl butane < 1 – Bromo butane.

(*b*) 

Chlorobenzene Sodium phenoxide Phenol

(*c*) Those optical isomers which are mirror images but non-superimposable are called enantiomers e.g. *d*(+) 2– Chloro butane and *l*(–) 2–Chloro butane.

28. (*a*) $K_4[Fe(CN)_6](aq) \longrightarrow 4K^+(aq) + [Fe(CN)_6]^{4-}(aq)$, $n = 5$

$$\alpha = \frac{i-1}{n-1} \Rightarrow 0.5 = \frac{0-1}{5-1} \Rightarrow i - 1 = 2 \Rightarrow i = 3$$

(*b*) $\pi V = \dfrac{W_2}{M_2} \times R \times T$

$$0.035 \text{ atm} \times 0.05 \text{ L} = \frac{3.5}{M_2} \times 0.0821 \times 310K$$

$$M_2 = \frac{3.5 \times 0.0821 \times 310}{0.035 \times 0.05} = \frac{89.0785}{0.00175} = 50{,}902 \text{ g mol}^{-1}$$

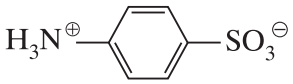
29. (*a*) They are good source of protein, carbohydrates and fibres.

(*b*) Moong dal is easily digestible because it contains lesser amount of oligosaccharide which are non-digestible.

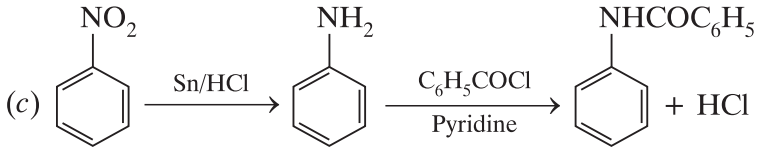
(*c*) Women need 20 g and Men need 38 g fibre daily. Raffinose gives glucose, fructose and galactose.

Or

(*c*) Urad dal is difficult to digest because it is rich in oligosaccharides and our body does not have enzymes to digest it. These are fermented by intestinal microbes and produce gases.

30. (*a*) 

(*b*) It is because C_6H_5 – is electron withdrawing C_2H_5 – is electron releasing.

(*c*) 

Or

(*c*) It is used to reduce cyanides and isocyanides to 1° and 2° amines respectively with the help of Na/C_2H_5OH.

$$CH_3—C \equiv N + 4[H] \xrightarrow{Na/C_2H_5OH} CH_3CH_2NH_2$$

$$CH_3—N \rightrightarrows C + 4[H] \xrightarrow{Na/C_2H_5OH} CH_3NHCH_3$$

31. (*a*) It is because it does not have unpaired electrons, therefore, can't undergo $f - f$ transitions.

(*b*) $Eu^{2+}(4f^7)$ has 7 unpaired electrons, therefore, it is most paramagnetic.

(*c*) $Mn^{2+}(3d^5)$ has five unpaired electrons, therefore, It has highest magnetic moment.

(*d*) Misch metal is used in Mg-based alloy to produce bullets.

(*e*) It is because Ac^{3+} has nearest noble gas configuration of Radon (86).

(*f*) $(E_1 + E_2 + E_3 + E_4)$ are lower in Pt than Ni.

(*g*) +7 is highest oxidation state of Neptunium.

32. (*a*) $t_{1/2} = \frac{[R]_0}{2k}$ for zero order reaction.

(*b*) Those reactions which are bimolecular but order is one because one of the reactants is in large amount are called Pseudo first order reaction.

For example – $\underset{\text{Sucrose}}{C_{12}H_{22}O_{11}} + H_2O \text{ (Excess)} \xrightarrow{H^+} \underset{\text{Glucose}}{C_6H_{12}O_6} + \underset{\text{Fructose}}{C_6H_{12}O_6}$

(*c*) Fraction of molecules having E_a or $> E_a, \left(\frac{N_E}{N_T}\right) = e^{-Ea/RT}$

Taking *ln* both side

$$ln\left(\frac{N_E}{N_T}\right) = ln e^{-Ea/RT}$$

$$ln\frac{N_E}{N_T} = -\frac{Ea}{RT} \quad [\because \log_e e = 1]$$

$$= -\frac{209.5 \times 1000}{8.314 \times 581K}$$

$$ln\frac{N_E}{N_T} = -43.3708$$

Or

(*a*) $k = Ae^{-Ea/RT}$

(*b*) The time in which 50% of reactants change into products is called half life of the reaction.

(*c*) (*i*) $t_{3/4} = 2t_{1/2}$ for first order reaction.

$t_{3/4} = 2 \times 37.9 = 75.8$ s

(*ii*) $k = \frac{2.303}{t} \log \frac{[R]_0}{[R]}$, $\boxed{k = \frac{0.693}{t_{1/2}} = \frac{0.693}{37.9\text{ s}}}$

$$\frac{0.693}{37.9} = \frac{2.303}{1 \times 60} \log \frac{1}{[R]}$$

$$\Rightarrow \log \frac{1}{[R]} = \frac{0.3010 \times 60}{37.9} = 0.4765$$

$$\frac{1}{[R]} = \text{Antilog } 0.4765 = 3 \quad \Rightarrow \quad [R] = \frac{1}{3} = 0.33$$

$$[R] = 0.33 \quad \text{or} \quad 33\%$$

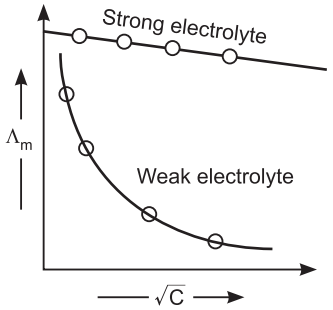
33. (*a*) S cm^{-1} is S.I. unit of specific conductivity.

(*b*) $E^\circ_{cell} = E^\circ_{Cu^{2+}/Cu} - E^\circ_{Zn^{2+}/Zn}$

$E^\circ_{cell} = 0.34V - (-0.76V) = +1.10V$

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

(*c*) Λ_m increases slightly on dilution (decrease in concentration) in case of strong electrolyte. In case of weak electrolyte, Λ_m increases sharply with dilution.



Or

(*a*) Salt bridge completes internal circuit and does not involve accumulation of ions so that current keeps on flowing.

(*b*) It is because D.C. current may cause electrolysis and composition of solution will change.

(*c*) $m = Z \times I \times t$

$$m = \frac{200.6}{2 \times 96500} \times 2 \times 3 \times 60 \times 60$$

$$m = \frac{43329.6}{1930} = 22.45 \text{ g}$$

$$\text{number of moles} = \frac{\text{Mas of Hg}}{\text{Molar mass}} = \frac{22.45}{200.6} = 0.112 \text{ mole}$$