CBSE
Class XII Chemistry
Sample Paper 2 - Solution

Time: 3 Hrs **Maximum Marks: 70**

Section A

1.

(i) (a) $Zn(s) \rightarrow Zn^{+2} + 2e^-$

(ii) (b)Two electrons are released by Zn. So, according to Faraday's law, 1 mole of Zn produces 2F electricity.

(iii) In Leclanche cell, the reaction occurs only once, and after use over a period of time, the battery dies and cannot be used as the reaction is not reversed. So, it is considered a primary cell.

(iv) Leclanche cells are used in a tape recorder, radio, flashlight, transistor etc.

2.

(i) (d) When pyrolusite is fused with KOH and KNO_3, we get K_2MnO_4. MnO_2 is pyrolusite.

(ii) (a) Purple colour of $KMnO_4$ is due to charge transfer.

(iii) (a) Mohr salt is preferred over $FeSO_4.7H_2O$ for standardization of $KMnO_4$ solution.
$FeSO_4.7H_2O$ contains only ferrous ions whereas ferrous sulphate contains some Ferric ions.

(iv) (b) If instead of H_2SO_4, HCl or HNO_3 of suitable concentration were used, the volume of $KMnO_4$ solution used would have been more than HCl.

3. (c) Two unpaired electrons

4. (b) The formation of micelles takes place above a particular temperature called Kraft temperature.

5. (b) The process of extraction of aluminium is known as Hall-Heroult process.

6. (a) Buna-S is a copolymer of butadiene and styrene. It is prepared by copolymerisation of 1,3 butadiene and styrene along with sodium.

7. (a) Degeneracy of the d-orbital is removed with the approach of the ligand due to ligand electron-metal electron repulsion.

8. (c) The number of S-S bonds in pyrosulphuric acid (oleum) is zero.

9. (a) Pyrolusite is an oxide (MnO_2).

10. (b) Electrophoresis movement of colloidal particles towards an electrode when they are subjected to an electrical field.

11. (b) $[Pt(NH_3)_4Cl_2]Br_2$ and $[Pt(NH_3)_4Br_2]Cl_2$ are types of ionisation isomers.

OR

(b) Ferrocyanide ion, i.e. $[Fe(CN)_6]^{4-}$ is a type of octahedral complex.

12. (a) Both assertion and reason are correct, and the reason is the correct explanation of the assertion.

13. (b) Assertion is wrong, but reason is correct.

14. (b) Both assertion and reason are correct, but the reason is not the correct explanation of the assertion.

15. (b) Both assertion and reason are correct, but the reason is not the correct explanation of the assertion.

16. (c) Assertion is correct, but reason is wrong.

Section B

17. $\Delta T_B = 80.31^{\circ}C - 80.10^{\circ}C = 0.21^{\circ}C$

W_B= 1.25 g, K_b =2.53°C kg mol^{1-}, M_B =? W_A = 99 g

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

$$= \frac{2.53 \times 1.25 \times 1000}{0.21 \times 99}$$

$$M_B = 152\, g/mol$$

OR

Given:

i = 3, K_f = 1.86 K kg mol^{-1}, W_B = 10.5 g, M_B = 184 g mol^{-1}, W_A = 200 g

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

On substituting the values in the above equation, we get

$$\Delta T_f = \frac{3 \times 1.86 \times 10.5 \times 1000}{184 \times 200} = 1.59\, K$$

As we know ΔT_f, lets find freezing point of aqueous solution,

$$T_f = T_f^{o} - \Delta T_f$$

$$T_f = 273.15 K - 1.59 K = 271.56 K$$

18. $C_6H_5CH_2Br < C_6H_5CH(CH_3)Br < C_6H_5CH(C_6H_5)Br < C_6H_5C(CH_3)(C_6H_5)Br$ (S_N1)

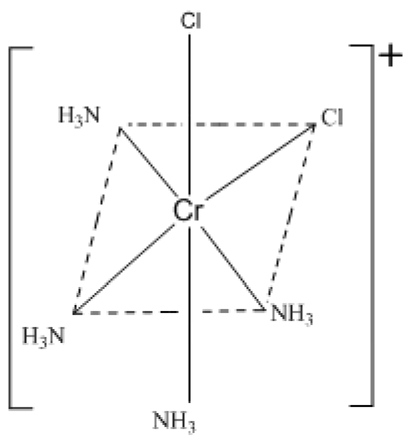
$C_6H_5C(CH_3)(C_6H_5)Br < C_6H_5CH(C_6H_5)Br < C_6H_5CH(CH_3)Br < C_6H_5CH_2Br$ (S_N2)

19. $$\underset{\text{Ethanol}}{CH_3CH_2OH} \xrightarrow[\text{Oxidation}]{K_2Cr_2O_7/H_2SO_4} \underset{\text{Ethanoic acid}}{CH_3COOH} \xrightarrow{CaCO_3} \underset{\text{Ca.Ethanoate}}{(CH_3COO)_2Ca} \longrightarrow \underset{\text{Ethanol}}{CH_3COCH_3}$$

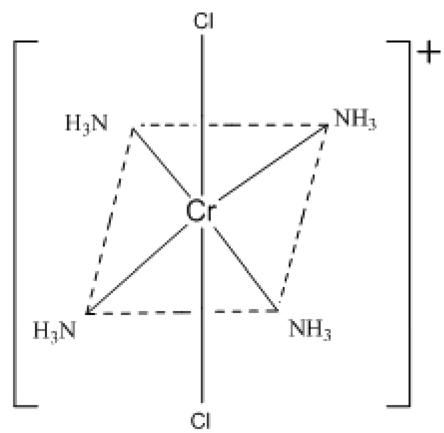
20. $$Cd_{(s)} + 2OH^-_{(aq)} \longrightarrow Cd(OH)_{2(s)} + 2e^-$$

$$NiO_{2(s)} + 2H_2O + 2e^- \longrightarrow Ni(OH)_{2(s)} + 2OH^-$$

21.



cis-Tetraamminedichlorido chrommium (III) ion

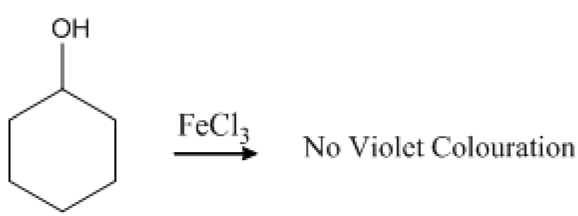


trans-Tetraamminedichlorido chrommium (III) ion

22.

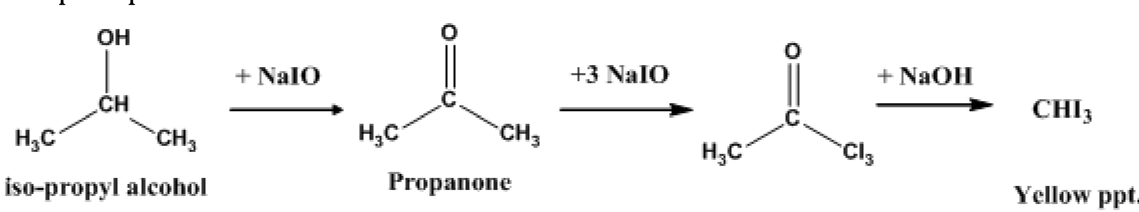
(a) When phenol is treated with $FeCl_3$ solution, it gives violet colouration. Cyclohexanol does not give any colouration.

$$\underset{\text{Phenol}}{6C_6H_5OH} + FeCl_3 \longrightarrow \underset{\text{Violet colouration}}{[Fe(OC_6H_5)_6]^{3-}} + 3H^+ + 3HCl$$



Cyclohexanol

(b) In the iodoform test, isopropyl alcohol is warmed with NaOI (I_2NaOH) to give a yellow precipitate of iodoform, while benzyl alcohol does not give any yellow precipitate.



23.

(a) $CH_3CH_2CH_2OH + SOCl_2 \rightarrow CH_3CH_2CH_2Cl$

(b) $CH_3CH_2CH = CH_2 + HBr \xrightarrow{\text{Peroxide}} CH_3CH_2CH_2CH_2Br$

24.

(a) Glucose does not restore the colour of Schiff's reagent and does not react with $NaHSO_3$.

(b) Due to the presence of the acidic –COOH group and basic $–NH_2$ group, amino acids occur in the zwitterion form and are thus water soluble.

25. Hoffmann bromamide reaction: A reaction where amides are made to react with bromine in aqueous or ethanolic NaOH solution to yield primary amines with one carbon less than the corresponding amide. It is used in stepping down the series.

$$R\text{-}\overset{\overset{\large O}{\|}}{C}\text{-}NH_2 + Br_2 + 4\,NaOH \longrightarrow RNH_2 + Na_2CO_3 + 2NaBr + 2H_2O$$

Section C

26. Given:

Moles of glucose = 18 g/180 g/mol = 0.1 mol

Mass of the solvent = 1 kg

Hence, molarity of glucose solution = $\frac{0.1\,mol}{1\,Kg} = 0.1\,mol\,kg^{-1}$

Change in boiling point will be

$\Delta T_b = K_b \times m$

$\Delta T_b = 0.52 \times 0.1 = 0.052\,K$

Water boils at 373.15 K at 1.013 bar pressure.

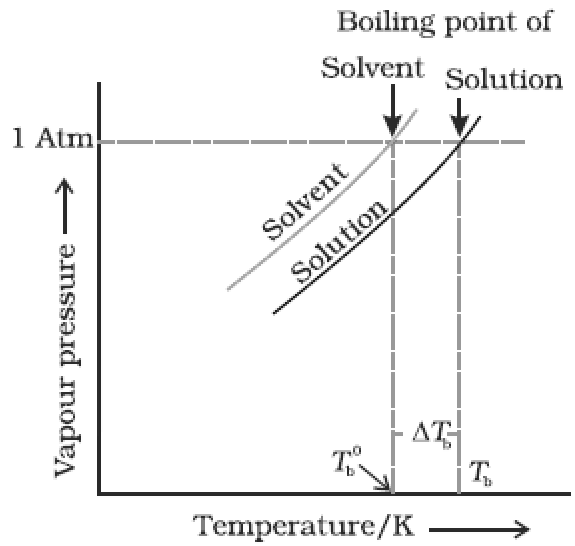
So, the boiling point will be

373.15 + 0.052 = 373.202 K

OR

The boiling point is the temperature at which the vapour pressure of the solution is equal to the atmospheric pressure of the solution. In a solution containing a non-volatile solute, the vapour pressure is lowered as the surface of the liquid is also occupied by some molecules of a non-volatile solute.

Hence, high temperature is required to make the vapour pressure of the solution equal to the atmospheric pressure which eventually increases the boiling point of the solution.



27.

(a) $4NaCl + MnO_2 + 4H_2SO_4 \rightarrow MnCl_2 + 4NaHSO_4 + 2H_2O + Cl_2$

(b) $4Al + 3O_2 \rightarrow 2Al_2O_3$

(c) $2Pb(NO_3)_2 \xrightarrow{673\,K} 4NO_2 + 2PbO + O_2$

28.

(a) $NH_4Cl\,(aq) + NaNO_2\,(aq) \rightarrow N_2(g) + 2H_2O(l) + NaCl(aq)$

(b) $P_4 + 3NaOH + 3H_2O \rightarrow PH_3 + 3NaH_2PO_2$

(c) $CaF_2 + H_2SO_4 \rightarrow CaSO_4 + 2HF$

29.

(i) For a first-order reaction,

$$k = \frac{2.303}{t} \log \frac{a}{a - x}$$

$$k = \frac{2.303}{15} \log \frac{a}{a - 0.2a}$$

$$= 0.0149\ min^{-1}$$

(ii)

$$t = \frac{2.303}{k} \log \frac{a}{0.1a}$$

Substituting the values,

$$= 154.6\ min$$

(iii) In the first 15 min, 80% is left unreacted. Now the initial conc. is 0.80a.

x = 20% of 0.8a = 0.16a

$$t = \frac{2.303}{k} \log \frac{0.8a}{0.8a - 0.16a}$$

$$= 15\ min$$

30.

(i) $\underset{\text{Acetaldehyde}}{CH_3CHO} \xrightarrow{\text{dil.NaOH}} CH_3CH(OH)CH_2CHO \xrightarrow{\text{Heat}} CH_3CH=CHCHO \xrightarrow[NH_4OH]{AgNO_3} \underset{\text{Crotonic acid}}{CH_3CH=CHCOOH}$

(ii) $HCHO \xrightarrow{H_2,Ni} CH_3OH \xrightarrow{PCl_5} CH_3Cl \xrightarrow{\text{Na, ether}} CH_3CH_3 \xrightarrow{Cl_2,\text{light}} CH_3CH_2Cl$

(iii) $CH_3COOH \xrightarrow{LiAlH_4} CH_3CH_2OH \xrightarrow{P,I_2} CH_3CH_2I \xrightarrow{KCN} CH_3CH_2CN \xrightarrow{H_3O^+} CH_3CH_2COOH$

Section D

31.

(a)

Suppose $r = k[A]^x$ where x = order of the reaction.

Given is that

$2.40 \times 10^{-4} = k[2.0 \times 10^{-3}]^x$ (Eq.1)

and

$(0.60 \times 10^{-4}) = k[1.0 \times 10^{-3}]^x$ (Eq.2)

Dividing equation (1) by (2) gives

$(2.40 \times 10^{-4}) / (0.60 \times 10^{-4}) = [(2.0 \times 10^{-3}) / (1.0 \times 10^{-3})]^x$

Or

$2^x = 4 = 2^2$

Therefore,

$x = 2$

The rate law is

$R = k[A]^2$ and order of reaction = 2

The rate constant

$$k = \frac{r}{[A]^2}$$

$$= \frac{2.40 \times 10^{-4}}{(2.0 \times 10^{-3})^2}$$

$= 60\ mol^{-1}\ L\ s^{-1}$

(b)

Suppose the order w.r.t A is x and w.r.t B is y, then the rate expression is

$r = k [A]^x [B]^y$

The rate becomes double when [A] is doubled, then the rate law is

$2r = k [2A]^x [B]^y$

$2r = 2^x k [A]^x [B]^y$

$2r = 2^x r$

or

$2^x = 2$

$x = 1$

The rate becomes 16 times when both [A] and [B] are doubled then we have

$16r = k[2A]^x [2B]^y$

$16r = 2^x \times 2^y r$

$16 = 2^x 2^y$

$16 = 2^x 2^y$

$2^y = 8 = 2^3$ (Since x = 1)

$y = 3$

Therefore, the rate law is

$r = k[A][B]^3$

Overall order of reaction = 1 + 3 = 4

32.

(a)

(i) $CH_3COOH \xrightarrow{LiAlH_4} CH_3CH_2OH \xrightarrow{PCl_5} CH_3CH_2Cl \xrightarrow{NH_3} CH_3CH_2NH_2$

(ii) $CH_3CH_2COOH \xrightarrow{P/Br_2} CH_3CH(Br)COOH \xrightarrow{aq.KOH} CH_3CH(OH)COOH$

(b) A is $CH_3CH(OH)CH_3$, B is $CH_3CH(Cl)CH_3$, C is $CH_3CH{=}CH_2$

33.

(a) Cr^{2+} is less stable than Cr^{3+}; therefore, it is a good reducing agent, whereas Mn^{2+} is stable due to half-filled d-orbital; therefore, it is not a reducing agent.

(b) Cu^+, Ag^+ and Sc^{3+} are colourless because they do not have unpaired electrons and cannot undergo d–d transitions.

(c) It is due to an irregular trend of atomic size that the number of unpaired electrons first increase and then decrease.

(d) It is because the effective nuclear charge is more in Fe^{2+} than in Mn^{2+}.

(e) In actinoids, energy of 5f, 6d and 7s is comparable, and therefore, they show high oxidation states and their chemistry is more complicated. All of them are radioactive.

OR

(a)

1) $4FeCr_2O_4 + 8Na_2CO_3 + 7O_2 \rightarrow 8Na_2CrO_4 + 2Fe_2O_3 + 8CO_2$

2) $2KMnO_4 \xrightarrow[\Delta]{513\,K} K_2MnO_4 + MnO_2 + O_2$

3) $2CrO_4^{2-} + 2H^+ \rightarrow Cr_2O_7^{2-} + H_2O$

(b) Electronic configuration of Ce and Ce^{3+} ions:

Ce (Z = 58) = [Xe] $4f^1\ 5d^1\ 6s^2$

Ce^{3+} = [Xe] $4f^1$

It has one unpaired electron.

'Spin only' formula for magnetic moment of a species is

$$\mu = \sqrt{n(n+2)}\ \text{B.M.}$$

where n = no. of unpaired electrons

Magnetic moment of Ce^{3+}

$$\mu = \sqrt{1(1+2)} = \sqrt{3}\ \text{B.M.} = 1.732\ \text{B.M.}$$