CBSE
Class XII Chemistry
Sample Paper 3 - Solution

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

Section A

1.

(i) (c) This is because when an ideal solution is formed, no heat is evolved or absorbed.

(ii) (c) According to Raoult's law,

$$\frac{p^0 - p_s}{p^o} = x_B$$

$$\frac{760-750}{760} = \frac{10}{760} = \frac{1}{76}$$

(iii) (b) For solutions showing negative deviation the interaction between the components are greater than the pure components. For solutions having negative deviation, $\Delta v_{mix} < 0$ and $\Delta H_{mix} < 0$. In this case, the escaping tendency of the molecules is reduced and so it shows negative deviation.

(iv) (d)

$$p_s = \frac{p^o - p_s}{p^o} = x_B$$

$$= \frac{760-750}{760} = \frac{10}{760} = \frac{1}{76}$$

2.

(i) (a) As the metal has fcc arrangement, so its coordination number is 12.

(ii) (a) In fcc arrangement, the packing efficiency is 74% so the fraction occupied by metal ions in crystal is 0.74.

(iii) (d)

$$\text{For fcc}, r = \frac{a}{2\sqrt{2}} = 0.3535 \times 407 = 143.9\,\text{pm}$$

(iv) (a)

The density is given by –

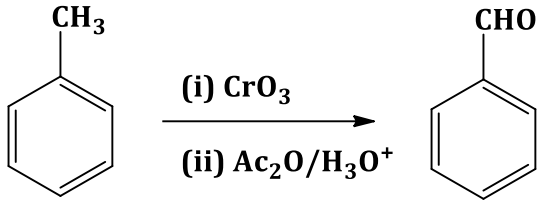
$$\rho = \frac{z \times M}{a^3 \times N_A}$$

$$a^3 = \frac{4 \times 197}{6.02 \times 10^{23} \times 10^{-30} \times 19.4} = 407\,\text{pm}$$

3. (d) On heating ammonium dichromate nitrogen gas is released.

4. (d) K_2MnO_4 cannot be converted to $KMnO_4$ using HCl.

5.



6. (a) The order of reaction is 3.

7. (c) Ni^{2+}, Ti^{3+}

8. (b) Ethylene oxide when treated with Grignard reagent yields a primary alcohol.

9. (d) Lyophillic colloids are stable due to layer of dispersion of medium on the particles.

10. (b) Turnbull's blue is Ferrous ferricyanide.

11. (b) The boiling point of azeotropic mixture of water and ethanol is less than that of water and ethanol. This mixture shows positive deviation from Raoult's law.

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

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

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

Section B

17. For a cell, $E^{\theta}_{cell} = \frac{0.059}{n} \log K_c$

When $K_c < 1$, taking log, gives a negative value.

For example:

$E^{\theta}_{cell} = \frac{0.059}{n} \log 0.01$

$= - 2 \times 0.059/n$ (negative value)

Thus, E^{θ}_{cell} is negative if the equilibrium constant $K_c < 1$.

If $E^{\theta}_{cell} = 0$

Then $0 = \frac{0.059}{n} \log K_c$

$\log K_c = 0$

$K_c = \text{Antilog}(0)$

$\Rightarrow K_c = 1$

18.

Given:

Rate constant K = $200\ s^{-1}$

The half-life of the first-order reaction is

$t_{1/2} = \frac{0.693}{K} = \frac{0.693}{200} = 3.46 \times 10^{-3}$ sec.

19.

(a) Cl_2O:

$2x - 2 = 0$

$2x = 2$

$x = +1$

(b) $KBrO_3$:

$1 + x - 6 = 0$

$x = 6 + 1$

$x = 7$

20. On adding I2 and NaOH to both ethanol and methanol, ethanol will give a yellow ppt. of iodoform, while methanol will not.

$$C_2H_5OH + 4I_2 + 6NaOH \rightarrow \underset{\text{Yellow}}{CHI_3} + 5NaI + 5H_2O + HCOONa$$

$$CH_3OH + I_2 + NaOH \rightarrow \text{no yellow ppt.}$$

21.

(a) Methyl-2-aminobutanoate

(b) N-methylbenzenamine

Or

(a) Ambident nucleophile

(i) $C_2H_5Cl + KCN \longrightarrow C_2H_5CN + KCl$

(ii) $C_2H_5Cl + AgCN \longrightarrow C_2H_5\text{-}N \equiv C + AgCl$

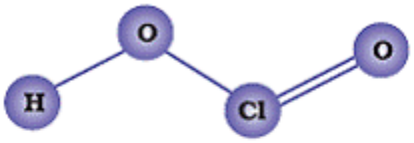
From the above reactions, it is clear that CN^- is an ambident nucleophile.

(b) Hoffmann bromamide degradation: Primary amines can be prepared from amides by treatment with Br_2 and KOH. Amine contains one carbon atom less than the parent amide.

$$R - \underset{\underset{O}{\|}}{C} - NH_2 + Br_2 + 4NaOH \longrightarrow R - NH_2 + Na_2CO_3 + 2NaBr + 2H_2O$$

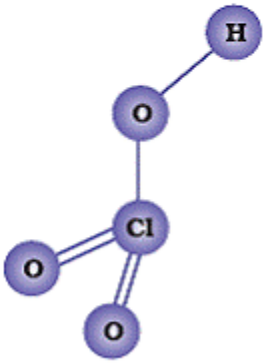
22.

(i)



Chlorous acid

(ii)



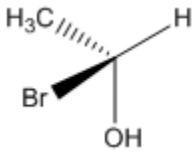
Chloric acid

23.

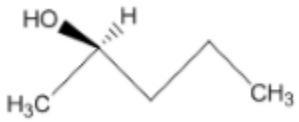
Smaller the size of particles of the adsorbent, larger will be the surface area and greater will be the extent of adsorption. At constant temperature, the extent of adsorption increases with increase in pressure—rapidly in the beginning, relatively slow at moderate pressure, attains equilibrium at high pressure and then ultimately becomes independent of pressure. In physical adsorption, it decreases with increase in temperature, but in chemisorption, it first increases and then decreases.

24.

(a)



(b)



25.

(a) In the decreasing order of pK_b values:
$C_6H_5NH_2 > C_6H_5NHCH_3 > C_2H_5NH_2 > (C_2H_5)_2NH$

(b) In the increasing order of basic strength:
$C_6H_5NH_2 < C_6H_5NHCH_3 < CH_3NH_2 < (C_2H_5)_2NH$

Section-C

26.

(a) Amylose is a straight chain polysaccharide having α-D-(+)-glucose units joined together by α-glycosidic linkages between C-1 of one glucose and C-4 of the next glucose. It has 200–1000 α-D-(+)-glucose units.

(b) Cellulose is a straight chain polysaccharide composed of β-D-glucose units which are joined by glycosidic linkage between C1 of one glucose unit and C4 of the next glucose unit.

(c) Milk is an emulsion which contains the protein casein as an emulsifier. On adding lemon juice, the pH changes, thus protein gets denatured, leading to the coagulation of milk.

27.

(a) Observing the graph, there is a decrease in the concentration of A in the time period of four hours from 1 hr to 5 hr, i.e. 0.5 – 0.3 = 0.2 M.
In this same period of time, an increase in the concentration of B is twice the decrease in concentration of A. Thus, n = 2.

(b) $k = \frac{[B_{eq}]^2}{[A_{eq}]} = \frac{(0.6)^2}{(0.3)} = 1.2$

(c) Initial rate of conversion of A = change in conc. of A during 1 hour

$= \frac{0.6 - 0.5}{1} = 0.1\,\text{mol litre}^{-1}\,\text{hour}^{-1}$

28.

(a) Vapour pressure is the pressure of the vapour at the equilibrium state when the rate of evaporation becomes equal to the rate of condensation. Equilibrium constant does not change at a particular temperature, and therefore, the vapour pressure remains constant.

(b) As the solution becomes cool, heat gets absorbed; hence, enthalpy change is positive. Thus, the solution shows positive deviation.

(c) B will show greater lowering of vapour pressure because $\frac{P^0 - P^s}{P^0} = \frac{w_2 M_1}{w_1 M_2}$

29.

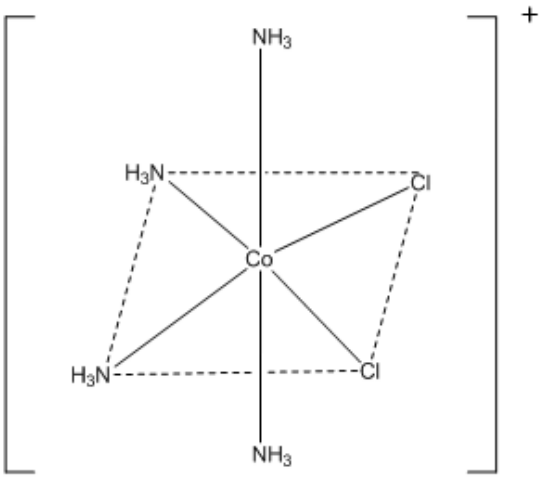
(a) Ambidentate ligand: A unidentate ligand which can bind to the central metal atom through any of the two donor atoms present in it is called ambidentate ligand.
Example: NO_2^-, SCN^-

$M \leftarrow SCN$	$M \leftarrow NCS$
Thiocynato	Isothiocynato

(b)

(i) Potassium trioxalatochromate (III)
(ii) Diamminedichloridoplatinum (II)

(c)



30.

(a) The acidic character of alcohols is due to the polar nature of the O–H bond. An electron-releasing group increases electron density on oxygen tending to decrease the polarity of the O–H bond. This decreases the acid strength. Hence, alcohols act as weak acids.

(b) Due to the electron-withdrawing inductive effect of the phenyl group, the C–O bond in phenol is less polar, whereas due to the electron-releasing inductive effect of the alkyl group, the C–O bond in alcohols is more polar. Hence, phenol has a smaller dipole moment than alcohols.

(c) Alcohols react with sodium metal leading to the evolution of H_2 gas, while ethers do not react with sodium metal.

$$C_2H_5OH + Na \rightarrow C_2H_5ONa + \frac{1}{2}H_2$$

$$\left(C_2H_5\right)_2 O + Na \rightarrow \text{No reaction}$$

Section D

31.

(i) $CH_3COOH \xrightarrow[2.H_2O]{1.Cl_2/\text{red P}} ClCH_2COOH$

Hell Volhard Zelinsky reaction

(ii) $2HCHO \xrightarrow{\text{conc. KOH}} HCOOK + CH_3OH$

Cannizaro reaction

(iii) $C_6H_6 + CH_3COCl \xrightarrow{\text{anhy.}AlCl_3} C_6H_5COCH_3$

Friedel Crafts acylation

(iv) $RCN + SnCl_2 + HCl \rightarrow RCH = NH \xrightarrow{H_3O^+} RCHO$

Stephen reduction

Or

(i) $C_6H_5CONH_2 \xrightarrow[\Delta]{H_3O^+} C_6H_5COOH + NH_3$

(ii) $C_6H_5COOCOCH_3 \xrightarrow{\text{Heat}} C_6H_5COOH + CH_3COOH$

(iii) $CH_3COCl + H_2O \rightarrow CH_3COOH + HCl$

(iv) $CH_3CN + 2H_2O \xrightarrow{H^+} CH_3COOH + NH_3$

(v) $C_6H_5COO^-NH_4^+ \xrightarrow{\text{heat}} C_6H_5CONH_2 + H_2O$

(1 mark for each part)

32.

(a)

(i)

$$CH_3CHO \xrightarrow{\text{Dil. NaOH}} CH_3\underset{OH}{\underset{|}{C}}H - CH_2CHO \xrightarrow[\Delta]{H^+} CH_3CH = CH - CHO$$

Crotonaldehyde

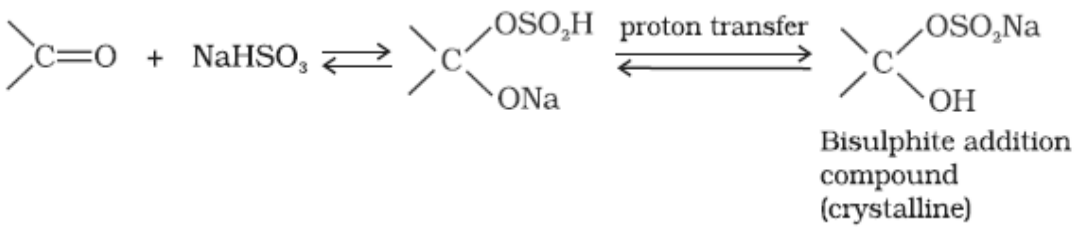
(ii)

$$CH_3CH_2COOH \xrightarrow[H^+]{Br_2, P} CH_3\underset{Br}{\underset{|}{C}}H - COOH \xrightarrow{aq.\,KOH} CH_3\underset{OH}{\underset{|}{C}}H - COOH$$

(b)

$$H - \overset{O}{\overset{\|}{C}} - H + CH_3OH \rightarrow HO - \underset{H}{\overset{OCH_3}{\overset{|}{\underset{|}{C}}}} - H$$

(c) Carbonyl compounds react with $NaHSO_3$ to give a crystalline bisulphite addition product which on hydrolysis with dilute acid gives the original carbonyl compound.



Bisulphite addition compound (crystalline)

33.

(a) $HClO_4$ is a stronger acid than H_2SO_4 due to the higher electronegativity of Cl than S making the O–H bond in $HClO_4$ more polar.

(b) Noble gases contain a fully filled p-subshell. This leads to interelectronic repulsions leading to an increase in size. Therefore, noble gases are larger in size than the corresponding halogens.

(c) In the solid state, PCl_5 exists as $[PCl_4]^+ [PCl_6]^-$, thus exhibiting ionic character.

(d) Due to very small size of O, addition of an electron leads to interelectronic repulsions, hence lowering the value of electron gain enthalpy.

Due to the $N \equiv N$ triple bond, N_2 is chemically inert. Flushing packaged foods with high purity nitrogen retards oxidative deterioration by typically reducing the oxygen level in packaged foods. Hence, it is used in food packaging.