COMMON PRE-BOARD EXAMINATION 2022-23

Subject: CHEMISTRY (043)

MARKING SCHEME

SECTION A

1.	(c) Benzene	1
2.	(b) $[Cr(H_2O)_5Cl]Cl_2.H_2O$	1
3.	(a)0. 404g	1
4.	(d) 2-methylpropan-2-ol	1
5.	(c) Second order	1
6.	(b) K_2MnO_4, MnO_2, O_2	1
7.	(a) 2, 2-Dimethylpropane	1
8.	(b)$C_6H_5NH_2 < C_6H_5CH_2NH_2 < (CH_3)_3N < CH_3NH_2 < (CH_3)_2NH$	1
9.	(c)2-Methoxypropane	1
10.	(c)$[Fe(C_2O_4)_3]^{3-}$	1
11.	(b) k/2.303	1
12.	(a)CH_3CHO	1
13.	(c)$4.5x10^{-2}$ $molL^{-1}s^{-1}$	1
14.	(c) m-Nitrobenzaldehyde	1
15.	(b) Both A and R are true, and R is not the correct explanation of A.	1
16.	(c) A is true but R is false.	1

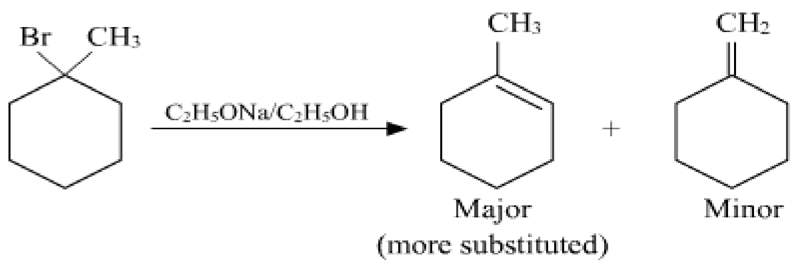
17. (a) Both A and R are true, and R is the correct explanation of A. 1

18. (c) A is true but R is false. 1

SECTION B

19. (a) Racemic mixture will be given by 2-Chlorobutane as it is an optically active compound. ½ + ½

(b) 1/2



1/2

1-methylcyclohexene is the major product.

20. The energy difference between the lower and higher orbitals obtained due to the splitting of d orbitals is called as Crystal field splitting energy. 1

Electronic Configuration - $t_{2}g^{4}\ eg^{0}$ 1

OR

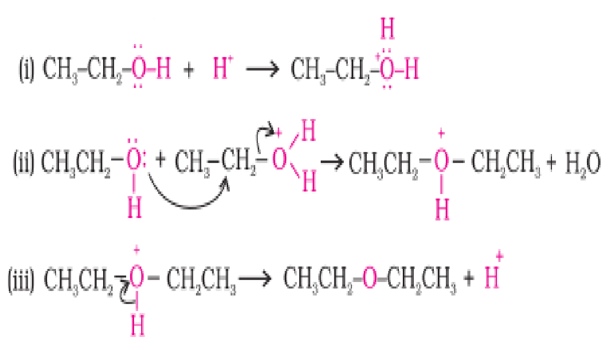
Ionisation isomerism. ½

Isomer: $[CO(NH_3)_5SO_4]Br$ ½

$BaCl_2$ test -Aqueous solution of $[CO(NH_3)_5Br]SO_4$ will give a white ppt of $BaSO_4$ ½ + ½

21. Ethoxyethane is formed. ½

Mechanism: 3 steps ½ x3 = 1 ½



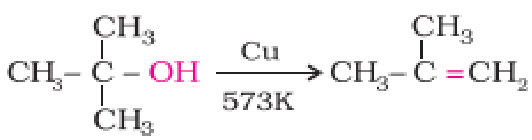
22. i)A reaction of higher order follows first order kinetics under special conditions, it is said to be a pseudo first order reaction. 2

ii)An elementary reaction is a chemical reaction in which one or more chemical species react directly to form products in a single reaction step.

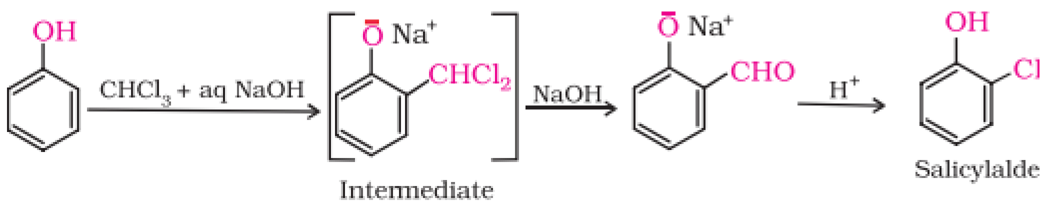
23. (a) Gluconic acid. Presence of aldehyde group. ½ + ½
(b)Amylose and Amylopectin ½ + ½

24. 1

i)



ii)



1

25. K = 0.693/t ½ ½
= 0.693/ 37.9 = 0.0183min^{-1}

$t = \frac{2.303}{K} \log \frac{[R]_0}{[R]}$ ½

$t = \frac{2.303}{0.0183} \log \frac{100}{25}$ ½

$t = \frac{2.303}{0.0183} \log 4$

$t = \frac{2.303}{0.0183} \times 0.6021$

T = 75.77 min. ½

OR

$$\log_{10} \frac{k_2}{k_1} = \frac{E_a}{R \times 2.303} \left[\frac{T_2 - T_1}{T_1 T_2}\right]$$ ½

Given: $\frac{k_2}{k_1} = 3; R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}; T_1 = 20 + 273 = 293 \text{ K}$

and $T_2 = 50 + 273 = 323$ K ½

Substituting the given values in the Arrhenius equation,

$$\log_{10} 3 = \frac{E_a}{8.314 \times 2.303} \left[\frac{323 - 293}{323 \times 293}\right]$$ ½

$$E_a = \frac{2.303 \times 8.314 \times 323 \times 293 \times 0.477}{30}$$

$$= 28811.8 \text{ J mol}^{-1} = 28.8118 \text{ kJ mol}^{-1}$$

½

SECTION C

26. (i)Alkaline medium inhibits the rusting of iron, because of the non-availability of H^+ ions which reduces oxidation of Fe to Fe^{+2} ions. 1

(ii)Oxidation of water requires overvoltage hence Cl^- is oxidized instead of water. 1

(iii) The cell potential remains constant during its life as the overall reaction does not involve any ion in solution whose concentration can change during its life time. 1

27. (a) A- CH_3CH_2COOH B- $CH_3CH_2CONH_2$ C- $CH_3CH_2NH_2$ D- CH_3CH_2OH ½ x4=2

(b) Methylamine and Dimethylamine can be distinguished by the Carbylamine test. Methylamine on heating with chloroform and ethanolic KOH forms a foul smelling isocyanides but dimethylamine does not. 1

28. (a) The bonds between chloroform molecules and molecules of acetone are dipole-dipole interactions but on mixing, the chloroform and acetone molecules, they start forming hydrogen bonds which are stronger resulting in the release of energy. This gives rise to an increase in temperature. 1

(b) Minimum Boiling azeotrope. Eg. A mixture of 95% ethanol and 5% water by volume. ½ + ½

(C) Mercuric iodide forms a complex with potassium iodide, the number of particles in the solution decreases resulting in the decrease in the value of ΔT_f, as a result the freezing point will increase. 1

OR

(a) i) $\Delta H_{mix} = 0$ ii) $\Delta V_{mix}=0$ iii)Do not form azeotropy. (any 2) 2x½ = 1

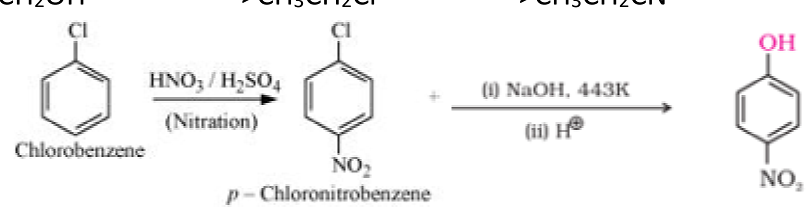
(b) Solubility of gases in liquids decreases with rise in temperature.
When dissolved, the gas molecules are present in liquid phase and the process of dissolution can be considered similar to condensation and heat is evolved in this process. As dissolution is an exothermic process, the solubility should decrease with increase of temperature. ½ ½

(b) To avoid bends, as well as, the toxic effects of high concentrations of nitrogen in the blood, the tanks used by scuba divers are filled with air diluted with helium. 1

29. (a)The stereoisomers related to each other as non-superimposable mirror images are called
Enantiomers. 1

(b)i) $CH_3CH_2OH \xrightarrow{SOCl_2} CH_3CH_2Cl \xrightarrow{KCN} CH_3CH_2CN$ 1

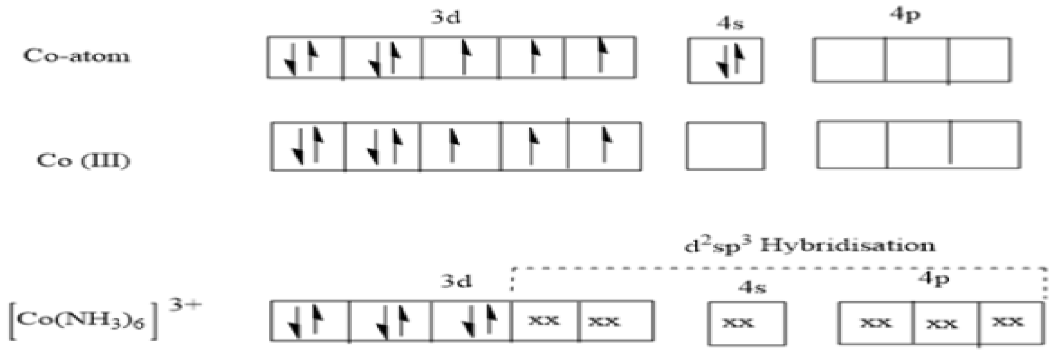
ii)



1

30. (a) $K_2[Ni(CN)_4]$ 1

b)



1

Octahedral , Diamagnetic ½ +½

OR

(a) Tetraamminechloridonitrito-Ncobalt(III) chloride 1

(b) In $[Co(NH_3)_6]^{3+}$, the oxidation state of Co is +3. 3d orbital has 6 electrons. NH_3 being a strong ligand causes pairing. Therefore Co can undergo d^2sp^3 hybridisation. Hence it is an inner orbital complex. 1

In $[Ni(NH_3)_6]^{2+}$, the oxidation state of Ni is +2. 3d orbital has 8 electrons. NH_3 being a strong ligand causes pairing, then only one d orbital is empty. Therefore it cannot undergo d^2sp^3 hybridisation. Therefore it undergoes sp^3d^2. Hence it is an outer orbital complex. 1

SECTION D

31. (a) Proteins are unstable at high temperature and polymers are of poor solubility. ½ +½

(b) Reverse osmosis occurs – The solvent molecules move from a region of higher concentration to a region of lower concentration. 1

(c)

$\pi = 8.21\text{atm}, \quad T = 273 + 37 = 310\text{K}$

We know, ½

$\pi = CRT$

$$8.21 = \frac{m}{M \times 1} \times 0.082 \times 310$$ ½

$$m = \frac{8.21 \times 180}{0.082 \times 310}$$ ½

$m = 58.13\text{g}$ ½

OR

(c) $\alpha = \dfrac{i - 1}{n - 1}$ ½

$\dfrac{90}{100} = \dfrac{i-1}{2-1}$ ½

i = 1.9

$\pi = \dfrac{i \times w_2 \times 1000 \times R \times T}{M_2 \times V \text{ in ml}}$ ½

½

$\pi = 1.9 \times \dfrac{0.85 \times 1000}{85 \times 100} \times 0.0821 \times 300$

= 4.674 atm

32. (a) Glycine 1

(b) Hydrogen bonds 1

(c) The specific sequence in which the α amino acids are arranged in a protein is the primary structure of protein 1

The secondary structure of protein refers to the shape in which a long polypeptide chain can exist. 1

OR

(c)The amino acids, which can be synthesised in the body, are known as non-essential amino acids. Eg. Alanine 1

Amino acids which cannot be synthesised in the body and must be obtained through diet, are known as essential amino acids Eg. Valine 1

SECTION E

33. a)

$$\underset{\text{'A'}}{C_6H_5CHO} \xrightarrow{NaOH} \underset{\substack{\text{'B'} \\ (C_7H_8O)}}{C_6H_5CH_2OH} + \underset{\substack{\text{'C'} \\ \text{(Sodium salt of} \\ \text{benzoic acid)}}}{C_6H_5COONa}$$ 1

$$\underset{\text{'B'}}{C_6H_5CH_2OH} \xrightarrow{CrO_3} \underset{\text{'A'}}{C_6H_5CHO}$$ 1

$$\underset{\text{'C'}}{C_6H_5COONa} \xrightarrow[\Delta]{NaOH/CaO} \underset{\substack{\text{'D'} \\ \text{(Benzene)} \\ \text{(Aromatic)}}}{C_6H_6} + Na_2CO_3$$ 1

b) i) $CH_3CH{=}CH\ CH_2CN \xrightarrow[\text{ii)} H_2O]{\text{i)DIBAL-H}} CH_3CH{=}CH\ CH_2CHO$ 1

ii) $C_6H_5CHO + CH_3CH_2CHO \xrightarrow{\text{Dil. NaOH}} C_6H_5CH(OH)\text{-}CH(CH_3)CHO$ 1

OR

(a)

$$CH_3CH(OH)CH_2CH_2CH_3 \xrightarrow{CrO_3} CH_3COCH_2CH_2CH_3$$ 1

Pentan-2-ol (A) Pentan-2-one (B) 1

$$CH_3COCH_2CH_2CH_3 \xrightarrow{NaOI} CHI_3 + CH_3CH_2CH_2CH_2COONa$$ 1

Iodoform

$$CH_3COCH_2CH_2CH_3 \xrightarrow{Zn\text{-}Hg/HCl} CH_3CH_2CH_2CH_2CH_3$$ 1

Pentane (C)

(b) i) Due to the presence of lone pair of electrons on the oxygen atom of the OH group the carboxylic acids are stabilized by resonance. As a result, the double bond character of the C= O bond in carboxylic acids is greatly reduced as compared to that in aldehydes and ketones. 1

ii)It is to prevent the further oxidation of benzaldehyde to benzoic acid.

34. (a) Electrons flow from Cu to Zn and current flows from Zn to Cu. ½

Zinc is deposited at the Zn electrode and copper dissolves at copper electrode. ½

(b) Metal A with the negative electrode potential will liberate hydrogen gas from dilute sulphuric acid. 1

(c) E^0_{cell} = -0.45 + 0.75 = 0.30V ½

$$E_{cell} = E^0_{cell} - \frac{0.059}{n} \log \frac{[Cr^{3+}]^2}{[Fe^{2+}]^3}$$ ½

$$= 0.30 - \frac{0.059}{6} \log \frac{(0.1)^2}{(0.01)^3}$$ ½

= 0.30 – 0.0098x 4 log 10

= 0.30 – 0.0392 ½

= 0.2608V

$\Delta G^0 = -nFE^0_{cell}$ ½

= -6 x96500 x 0.30

= - 173700 J ½

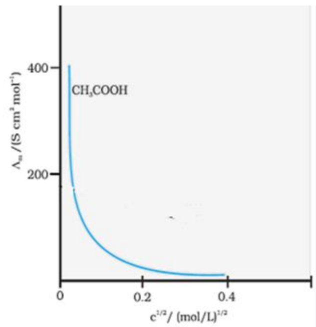
OR

(a) Molar conductivity is defined as the conductance of the solution containing one gram mole of the electrolyte, such that the entire solution is placed between two parallel electrodes 1cm apart. 1

(b) Variation of molar conductivity for a weak electrolyte:

* A weak electrolyte is one which ionizes partially in solution and thus have low value of molar conductivity.
* On dilution the degree of ionization of weak electrolyte increases and the number of ions furnished by the electrolyte increases. 1

Hence molar conductivity of weak electrolyte increases largely on dilution



(b) $\Lambda^0_m NH_4OH = \Lambda^0_m NH_4Cl + \Lambda^0_m NaOH - \Lambda^0_m NaCl$

$= 129.8 + 217.4 - 108.9$

$= 238.3\ Scm^2mol^{-1}$ 1

$\Lambda^c_m NH_4OH = \dfrac{k \times 1000}{M}$

$= \dfrac{9.33 \times 10^{-5} \times 1000}{0.01}$ 1

$= 9.33 Scm^2mol^{-1}$

$\alpha = \dfrac{\Lambda^c_m}{\Lambda^0_m} = \dfrac{9.33}{238.3}$

$= 0.039$ 1

% dissociation = 3.90%

35. (a) i) $Cr_2O_7^{2-} + 2OH^- \rightarrow 2\ CrO_4^{2-} + H_2O$ 1

ii) $2MnO_4^- + 5C_2O_4^{2-} + 16H^+ \rightarrow 2Mn^{2+} + 10CO_2 + 8H_2O$ 1

(b) i) Mn^{3+} easily accepts electrons to form stable d^5 configuration in Mn^{2+}, whereas Cr^{2+} loses an electron to attain half -filled t_{2g} 3configuration. 1

ii) In aqueous medium, Cu^{2+} is more stable than Cu^+. This is because although energy is required to remove an electron from Cu^+, high hydration energy of Cu^{2+} compensates for it. Therefore, Cu^+ ion is unstable in aqueous solution. It disproportionates to give Cu^{2+} and Cu. 1 1

(c) $2MnO_2 + 4KOH + O_2 \rightarrow 2K_2MnO_4 + 2H_2O$