NAVODAYA VIDYALAYA SAMITI - HYDERABAD REGION

SECOND PRE BOARD EXAMINATION, 2022-23

CLASS -**XII**

SUBJECT- **CHEMISTRY THEORY (043)**

SET : 1

MARKING SCHEME

Section A (1m each)

1. A
2. C
3. C
4. B
5. A
6. D
7. A
8. D
9. D
10. B
11. D
12. B
13. C
14. B
15. D
16. C
17. B
18. C

Section B

19. O-Nitro phenol is steam volatile …….. 1m
    Reason : Intra molecular hydrogen bonding ……. 1m

20. : 

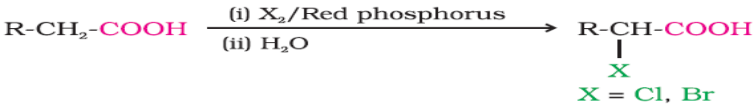
reacts faster by S_N1 mechanism.....1m
    it is a tertiary halide and it produces a stable tertiary carbocation….1m

21. $t_{99\%} = \frac{2.303}{k} \log (100/0.1)$ ------(1) 1/2m

    $t_{1/2} = \frac{0.693}{k}$ ------(2) 1/2m

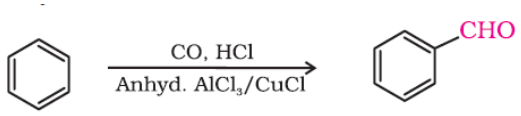
    $t_{99\%} / t_{1/2} = 6.909/0.693 = 10$ 1m

22. A (i)



..... 1m

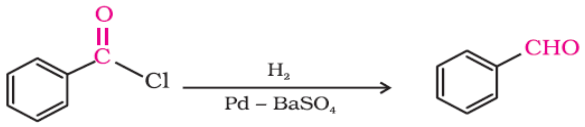
(ii)



.....1m

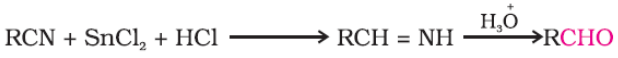
or

B. (i)



.....1m

(ii)



.....1m

23. According to Arrhenius equation,

$\log k = \log A - \frac{E_a}{2.303\,RT}$ 1/2m

$\log k = 14.34 - 1.25 \times 10^4 K/T$

comparing both the equations:

$\frac{E_a}{2.303\,R} = 1.25 \times 10^4$ 1/2m

$E_a = 2.303 \times 8.314 \times 1.25 \times 10^4$

$= 239.34$ kJ/mol.....1m

24

$2Al_{(s)} + 3Cu^{2+}_{(aq)} \longrightarrow 2Al^{3+}_{(aq)} + 3Cu_{(s)}$

$2Al \longrightarrow 2Al^{3+} + 6e^-$

or, $3Cu^{2+} + 6e^- \longrightarrow 3\,Cu$

1 M

Hence, $n = 6$

$\Delta G^0 = -nFE^0_{Cell}$

$\Delta G^0 = -6 \times 96500 \times 2.02 = -1169580\ J\ mol^{-1}$

$\therefore \quad \Delta G^0 = \mathbf{-116.958\ KJ\ mol^{-1}}$

1 M

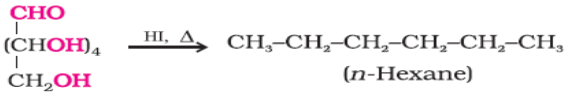
Now, $\Delta G^0 = -2.303\,RT \log K_c$

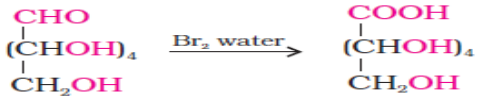
$\log K_c = \frac{-\Delta G^0}{2.303RT} = \frac{1169580}{2.308 \times 8.314 \times 298}$

$= \frac{1169580}{5705.84}$

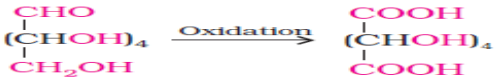
$\therefore \quad \log K_c = \mathbf{205.009}$

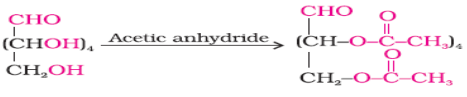
1 M

25. A (i)  1m

(ii)  1m

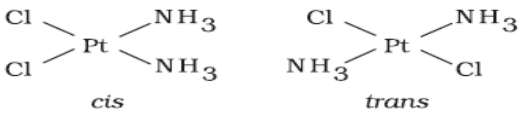
OR

B. (i)  1m

(ii)  1m

Section C

26. (i) structures of cis and trans isomers (½ m each)



(ii) Electronic configuration for d^4 ion if $\Delta_0 < P$ is $t_{2g}^3 e_g^1$ (high spin complex is formed).....1m

(iii) $[Ni(H_2O)_6]^{2+}$ is an outer orbital complex due to weak field ligand H_2O and the presence of unpaired electrons undergoes d—d transition (by absorbing red light and shows green colour) while $[Ni(CN)_4]^{2-}$ is an inner orbital complex and has no unpaired electrons hence colourless… 1m

27. Since $MgS0_4$ is an ionic compound, so undergoes complete ionisation in the following way:

$MgS0_{4(aq)} \rightarrow Mg^{2+}_{(aq)} + SO_4^{2-}{}_{(aq)}$

$i = \frac{\text{no. of particles after dissociation}}{\text{no. of particles before dissociation}} = 2/1 = 2$ 1m

$\Delta T_b = i K_b m = i K_b \frac{W_2 \times 1000}{M_2 \times W_2} = 2 \times 0.52 \times \frac{4 \times 1000}{120 \times 100} = 0.346K$ 1m

Boiling point of water = 373.15 K

$T_b = T_b° + \Delta T_b = 373.15 K + 0.346 = 373.496 K$.....1m

28. (a) Chlorobenzene has lower dipole moment than cyclohexyl chloride due to lower magnitude of -ve charge on the Cl atom and shorter C – Cl distance. Due to greater S-character, a sp^2-hybrid carbon is more electronegative than a sp^3-hybrid carbon. Therefore, the sp^2-hybrid carbon of C – Cl bond in chlorobenzene has less tendency to release electrons to Cl than a sp^3 hybrid carbon of cyclohexyl chloride. **1m**

(b) Alkyl halides and polar molecules are held together by dipole-dipole interaction. The molecules of H_2O are held together by H- bonds. Since the new forces of attraction between water and alkyl halide molecules are weaker than the forces of attraction already existing between alkyl halide-alkyl halide molecules and water- water molecules, therefore alkyl halides are immiscible (not soluble) with water. 1m

(c) n-Butyl bromide has higher boiling point than 3^0-Butyl bromide because it has larger surface area hence have more VanderWaals' forces. 1m

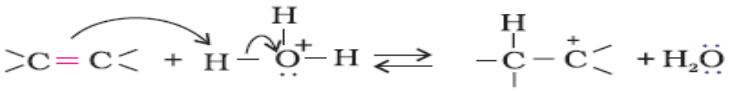
29. a. $CH_3—NH_2$ has higher boiling point than $(CH_3)_3N$. (1/2m)
Reason: $CH_3—NH_2$ shows strong intermolecular H bonding whereas $(CH_3)_3N$ has weak dipole dipole forces. 1/2m

b. A = CH_3-CH_2-CN, …….1/2 m
Propanenitrile …….½m
B = CH_3-CH_2- CH_2- NH_2, ……1/2 m
Propanamine …..½ m

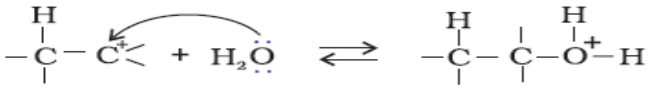
30.

Step 1: Protonation of alkene to form carbocation by electrophilic attack of H_3O^+.

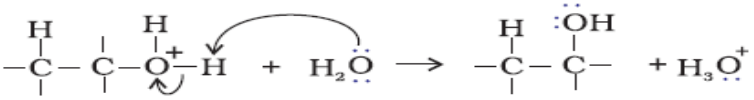
$H_2O + H^+ \rightarrow H_3O^+$



Step 2: Nucleophilic attack of water on carbocation.



Step 3: Deprotonation to form an alcohol.



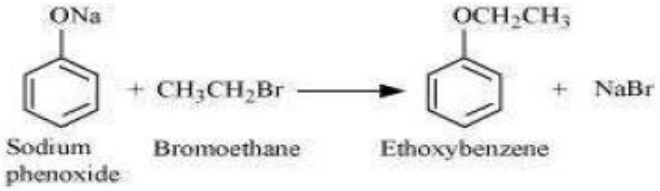
mechanism with three steps: 1m for each step

OR

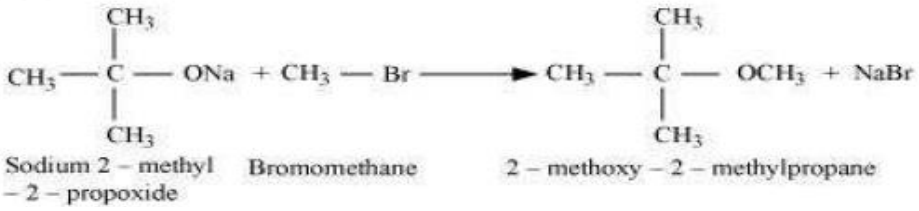
$CH_3CH_2CHONa + CH_3CH_2CH_2Br \longrightarrow C_2H_5CH_2-O-CH_2C_2H_5 + NaBr$

(i) Sodium propoxide 1-Bromopropane 1- Propoxypropane

(ii)



(iii)



Three equations : 1m for each

31. 1 (b) 2 (d) 3 (a) 4(c) …….. 4m

32. 1 (a) 2(b) 3(d) 4(d) ……4m

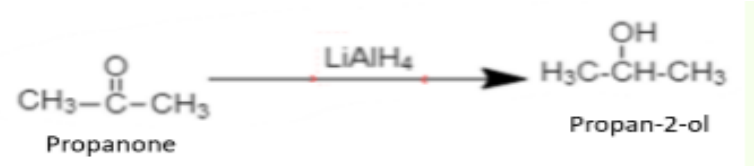
33. A. a. The only o-substituted aromatic aldehyde having molecular formula which show the given reactions is **$C_9H_{10}O$ is o-ethyl benzaldehyde** or 2-Ethyl benzaldehyde …1m

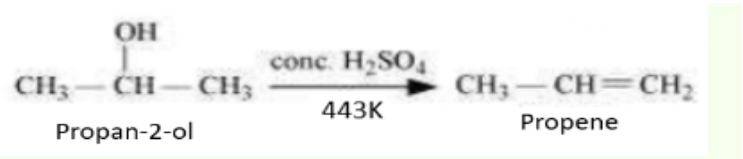
Eqn for reaction with Tollen's reagent 1/2m

Eqn for reaction with 2,4-DNP 1/2m

Eqn for Cannizaro reaction of the identified compound 1m

b. (i) Propanone to Propene





……1m

(ii) Benzoic acid to Benzaldehyde

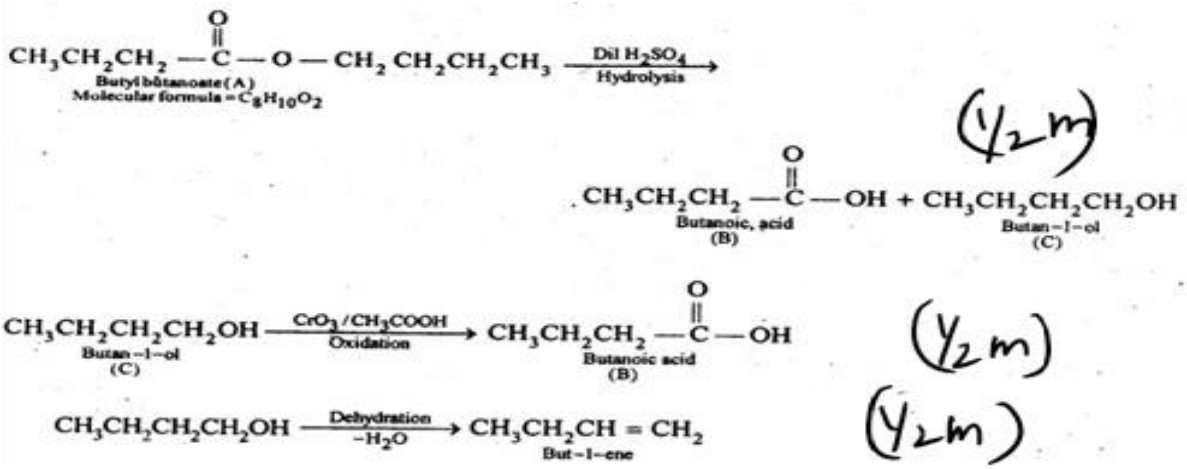
.....1m

OR

B. **: a. A -** Butyl butanoate $CH_3CH_2CH_2COOC_4H_9$ ….1/2 m

B - Butanoic acid C_3H_7COOH ….1/2 m

C - But-l-ene $CH_3CH_2CH{=}CH_2$ ….1/2 m



b. (i) Iodoform test :Propanal has an aldehydic functional group and propanone is a methyl ketone. Propanal on reaction with sodium hypoiodite does not form a yellow coloured precipitate. But propanone on reaction with sodium hypoiodite form a yellow coloured precipitate ……. ½ m

Relevant Chemical equation …….1/2 m

Or Tollen's reagent, Bennedict solution and Fehling solution are all used to distinguish between aldehydes and ketones. Propanal(CH_3CH_2CHO) is an aldehyde and thus gives positive test with all the three reagents whereas propanone(CH_3COCH_3) is a ketone and thus does not give any results with the three reagents……..1/2 m

Relevant chemical equation ……..1/2 m

(ii) Phenol gives violet colour with neutral $FeCl_3$ while benzoic acid gives buff colured ppt. Benzoic acid react with $NaHCO_3$ and form CO_2 gas ,But does not react with $NaHCO_3$…….1/2 m

Relevant chemical equation ……1/2 m

34 a. m = 1.5g, I = 1.5A, Molar mass = 108 g/mol,

1F = 96500C/mol

m = zIt 1/2

$$1.5 = \frac{m}{1 \times 96500} \times 1.5 \times t$$ 1m

t = 893s ..... 1/2 m

b. $Fe \longrightarrow Fe^{2+} + 2e$

$2H^+ + 2e \longrightarrow H_2$

$Fe + 2H^+ \longrightarrow Fe^{2+} + H_2$

n = 2 ..... 1/2m

$E^0_{cell} = 0.00 - (-0.44) = 0.44V$ 1/2m

$E_{cell} = E^0_{cell} - \frac{0.0591}{2} \log\frac{[Fe^{2+}]}{[H^+]^2}$ 1/2m

$= 0.44 - \frac{0.0591}{2} \log\frac{[10^{-3}]}{[10^{-2}]^2}$

= 0.4105V ---------- 1/2m

c. Primary cell. It has more efficiency and its voltage remains constant over a longer period of time.1m

35. (a) In transition elements, there are large number of unpaired electrons in their atoms, thus they have a stronger inter atomic interaction and thereby stronger bonding between the atoms. Due to this they have high enthalpies of atomization..... 1m

(b) Due to variable valency and the availability of d-orbitals, they can easily form intermediate products which are converted to products. The sizes of transition metal atoms and ions are also favourable for transition complex formation with the reactants. They can adsorb reactants on their surface and catalyze reactions. 1m

(c) Divalent ion with atomic number

26 is Fe^{2+} Electronic conf of Fe^{2+} -

[Ar] $3d^6$

No. of unpaired electron (n) = 4

$\mu = \sqrt{(n+2)} = \sqrt{24} = 4.9$ BM.....1m

(d) (i) $2CrO_4^{2-} + 2H^+ \longrightarrow Cr_2O_7^{2-} + H_2O$

(ii) $2KMnO_4 \xrightarrow{\text{heat}}$

Pot. permanganate

$K_2MnO_4 + MnO_2 + O_2$

Pot. manganate

h

(II)

(a) $2MnO_2 + 4KOH + O_2 \longrightarrow K_2MnO_4 + 2H_2O$

'A' (blackish brown solid) 'B' (green)

$2K_2MnO_4 + H_2O + (O) \xrightarrow{\text{Electrolysis}} 2KMnO_4 + 2KOH$

'B' (Purple) 'C'

..... 3m

(b) (i) M(27) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^7$

M^{2+}(aq): [Ar] $4s^0\ 3d^7$ | ↑↓ | ↑↓ | ↑ | ↑ | ↑ |

$\mu = \sqrt{n(n+2)}$

$\mu = \sqrt{3 \times 5} = \sqrt{15} = 3.87$ BM.

.....1m

(ii) Cr is typically hard metal due to presence of large number of unpaired electrons, metal-metal interaction is strong whereas mercury does not have unpaired electrons and has large size, therefore, forms weak metallic bond. 1m

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