ANSWER-KEY
PRACTICE PAPER: 3
SUBJECT : CHEMISTRY(043)
SESSION:2020-21

SECTION: A

1. (i) a (ii) d (iii) b OR b (iv) d
2. (i) a (ii) c OR d (iii) b (iv) c
3. b OR a
4. c
5. b OR b
6. d OR d
7. b
8. c OR d
9. c
10. c
11. d
12. a
13. a
14. c
15. d
16. c

SECTION:B

17 (i) It is converted into colloidal state by preferential adsorption of Fe^{3+} ions.
(ii) Due to greater surface area in finely divided state.

OR

(i) Extent of both increases with increase in surface area.(or any other correct similarity)
(ii) $AlCl_3$ is more effective in causing coagulation of negatively charged sol as Al^{3+} ion has greater positive charge than Mg^{2+} ion.

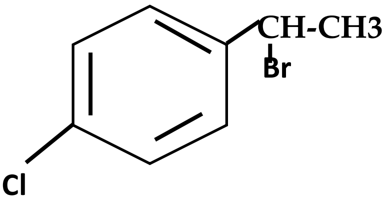
18. (i) $t_{2g}^4\ e_g^0$
(ii) Hybridisation= sp^3d^2 , Shape= Octahedral

19. (i) The electronic configuration of Mn^{2+} is $[Ar]3d^5$which is half filled and hence stable. So Mn^{2+} cannot lose third electron easily while Fe^{2+} has electronic configuration $[Ar]3d^6$. It tends to lose one electron to acquire stable $[Ar]3d^5$ electronic configuration.
(ii) Due to high electronegativity and oxidizing nature of oxygen.

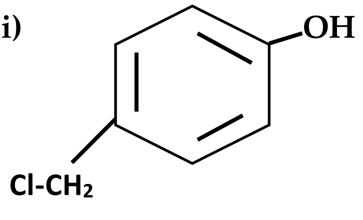
OR

(i) Because the sum of sublimation enthalpy and hydration enthalpy to convert Cu(s) to Cu^{2+}(aq) is so high that it is not balanced by its hydration enthalpy.
(ii) $\mu=\surd 5(5+2)$ BM= 5.92BM

20.(i)



(ii)



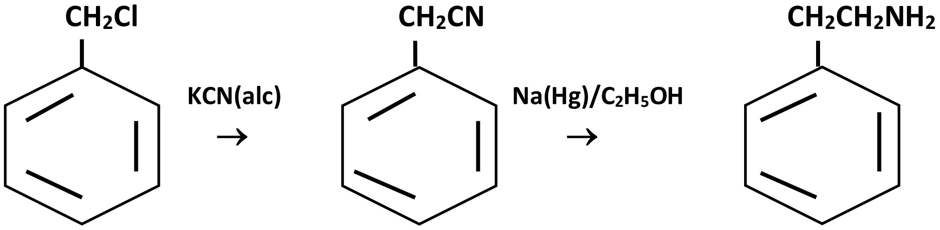
21. (i) The dehydration of alcohols occurs though the formation of carbocation intermediate. As the stability of carbocation decreases in the order, 3° >2° >1°, therefore the dehydration of alcohols follows the order 3° >2° >1°.
(ii) -R and -I effect of $-NO_2$ group decreases the electron density in O-H bond and make loss of proton easy in o-Nitrophenol whereas +R effect of $-OCH_3$ group increases the electron density in O-H bond and makes release of proton difficult in o-Methoxyphenol.

22. (i) $CH_3CH_2CH_3 < CH_3OCH_3 < CH_3CHO < CH_3CH_2OH$
(ii) Butanone< Propanone<Propanal<Ethanal

23. (i)

$$CH_3COOH \xrightarrow{NH_3,\Delta} CH_3CONH_2 \xrightarrow{Br_2/KOH} CH_3NH_2$$

(ii)

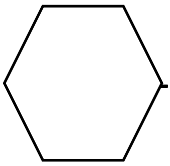


24. (i) In α-helix hydrogen bonding takes place within the same polypeptide chain while in β-pleated sheet H-bonding takes place between different polypeptide chains.
(ii) Phosphodiester linkage

OR

(i)The linkage between two monosaccharide units through oxygen atom in an oligosaccharide or a polysaccharide.
(ii) non-essential- Glycine, Alanine or any other
Essential – Valine, Lysine or any other

25. (i)



$-CH_2Cl$, as it is 1° alkyl halide.

(ii) The presence of $-NO_2$ group at o/p position in haloarenes helps in stabilization of resulting carbanion by -R and -I effects and hence increase the reactivity of haloarenes towards nucleophilic substitution.

SECTION:C

26. (i) $\pi = W_BRT/M_BV = CRT$, 4.98 = 36 X R X 300/180 X 1 = 60R – (i)
1.52=C X R X 300= 300CR – (ii)

Dividing (ii) by (i)
300CR/R = 1.52/4.98
C= 0.061M
(ii) Water will flow out of cell and they will shrink(exosmosis).

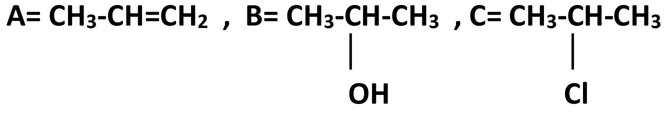
27. (i) $t= 2.303/k \log [R]_0/R$ (i)
$K=2.54 X 10^{-3} s^{-1}$, $[R]=[R]_0/4$
Substituting values in equation (i)
$t_{3/4} = 0.9066 X 10^3 \log 4 = 0.9066 X 10^3 X 0.6021 = 5.46 X 10^2$ s

(ii) When one of the reactant is present in large excess.

28. (i). This is due to filling of 4f before 5d orbitals, which have poor shielding effect or due to lanthanoid contraction.
(ii) As oxygen stabilizes higher oxidation states more than fluorine by forming multiple bonds.
(iii) Ti^{3+} has d^1 configuration so d-d transition can take place by absorbing light in visible region while Sc^{3+} has d^0 configuration so no d-d transition.

Or

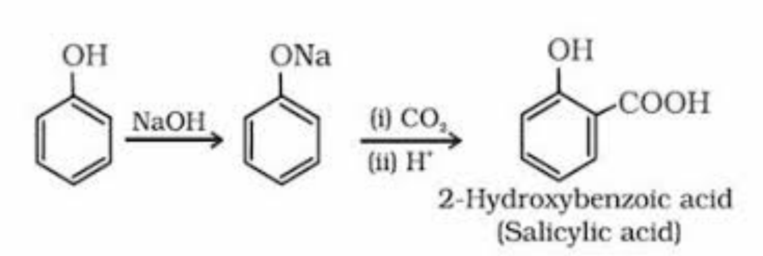
(i) This is because transition metals have strong metallic bonds as they have large number of unpaired electrons.
(ii) Due to their tendency to show variable oxidation states transition metals form unstable intermediate compounds and provide a new path for the reaction with lower activation energy.
(iii) Copper exhibits +2 oxidation state wherein it will have incompletely filled d-orbitals($3d^9$), hence it is a transition metal.

29. 

$$A = CH_3-CH=CH_2\ ,\ B = CH_3-\underset{\underset{OH}{|}}{CH}-CH_3\ ,\ C = CH_3-\underset{\underset{Cl}{|}}{CH}-CH_3$$

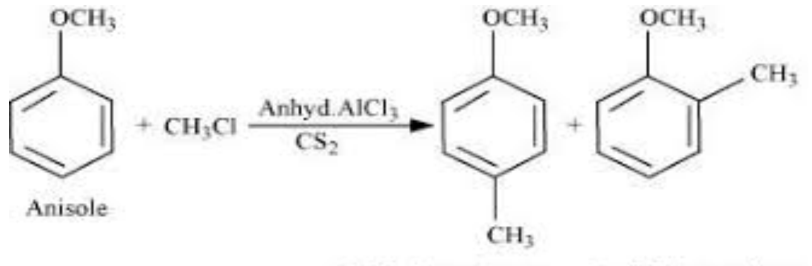
OR

(i)



2-Hydroxybenzoic acid
(Salicylic acid)

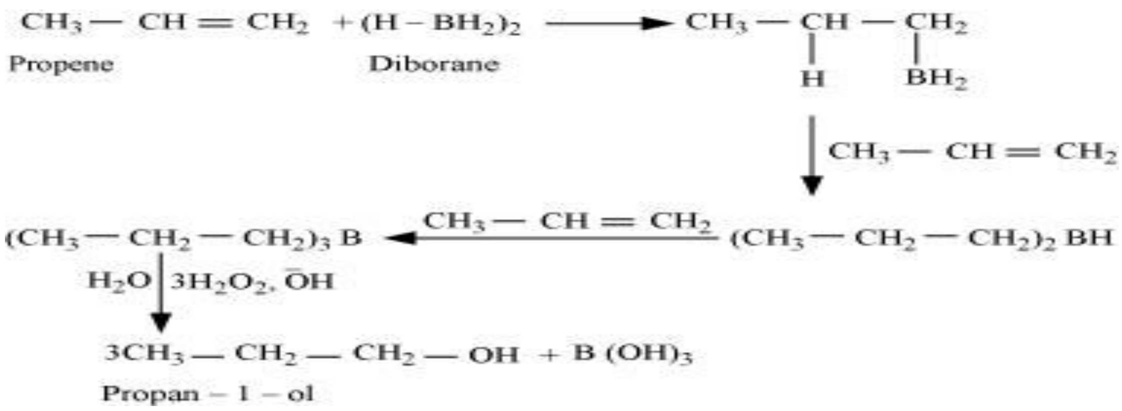
(ii)



4 – Methoxytoluene
(Major)

2 – Methoxytoluene
(Minor)

(iii)



30. (i) Due to resonance the lone pair of electrons on nitrogen of acetanilide gets delocalized towards carbonyl group. Hence the electrons are less available for donation to benzene ring so activation effect gets reduced.
(ii) In CH_3NH_2 , +I effect of -CH_3 group increases the electron density on the nitrogen atom making the lone pair more available for donation. While in aniline lone pair of electrons on nitrogen atom is delocalized over benzene ring due to resonance thus making it less available for donation.
(iii) This is because in strongly acidic medium aniline is protonated to give anilinium ion which is deactivating.

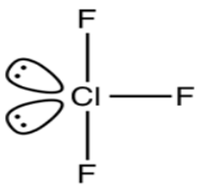
Section :D

31(a) (i) $HI < HBr < HCl < HF$
(ii) $H_2O < H_2S < H_2Se < H_2Te$
(b) (i) $X_2 = Cl_2$
(ii) $8NH_3 + 3Cl_2 \rightarrow 6NH_4Cl + N_2$
(iii) $8NaOH + Cl_2 \rightarrow NaCl + NaOCl + H_2O$

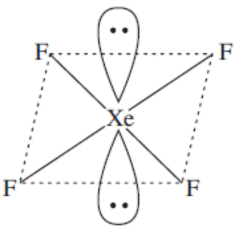
OR

(a) (i) The minimum oxidation state of Sulphur is -2 while its maximum oxidation state is +6. In SO_2, O.N. of Sulphur is +4 hence it can increase as well as decrese its oxidation number. So SO_2 can act as reducing as well as oxidizing agent. While in H_2S S has oxidation number of -2 so it can only increase its oxidation number by losing electron and hence acts only as a reducing agent.
(ii) Because water has multidimensional hydrogen bonding while in HF it is linear.
(iii) In vapour state Sulphur party exists as S_2 molecules which have two unpaired electrons in antibonding π* molecular orbitals like O_2.

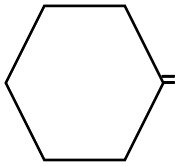
(b) (i)



(ii)



(ii)

32.(a) (i)  **=NOH**

(ii) C_6H_5COONa + $C_6H_5CH_2OH$

(iii) CH_2COOH
|
Cl

(b) (i) Benzoic acid decomposes $NaHCO_3$ to produce brisk effervescence due to evolution of CO_2 while phenol does not.

$C_6H_5COOH + NaHCO_3 \rightarrow C_6H_5COONa + CO_2\uparrow + H_2O$

(Or any other suitable chemical test)

(ii) Propanone gives iodoform test on treatment with NaOH and I_2 (sodium hypoiodite).

OR

(a)(i) Due to greater electronegativity of oxygen than carbon, the Carbon atom of the >C=O group aquires a partial positive charge in aldehydes and ketones and hence readily undergo nucleophilic addition reactions.

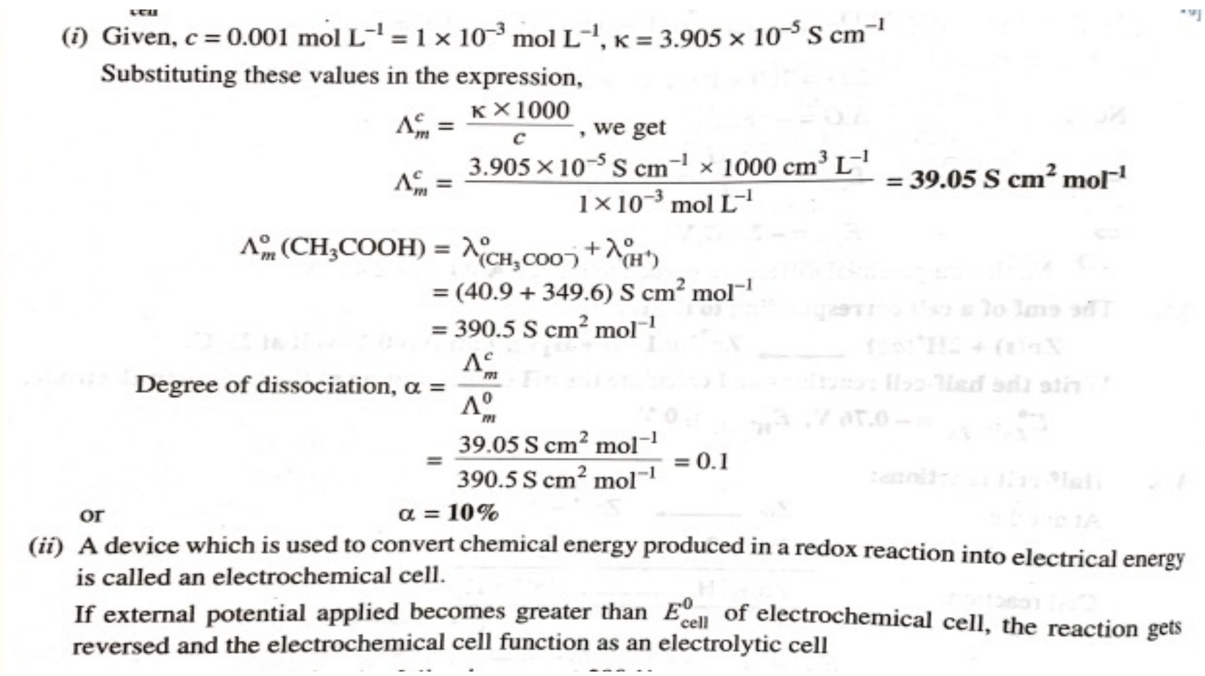
(ii)This is because for aldol condensation to take place at least one α-hydrogen should be available, which is not present in $(CH_3)_3C$-CHO.

(iii) This is due to more extensive association of carboxylic acid molecules through intermolecular hydrogen bonding. The hydrogen bonds do not break completely even in vapour phase.

(b) (i) Acetophenone gives iodoform test while benzophenone does not.

(ii) Ethanal gives iodoform test while benzaldehyde does not.

33.



(*i*) Given, $c = 0.001 \text{ mol L}^{-1} = 1 \times 10^{-3} \text{ mol L}^{-1}$, $\kappa = 3.905 \times 10^{-5} \text{ S cm}^{-1}$

Substituting these values in the expression,

$$\Lambda_m^c = \frac{\kappa \times 1000}{c}, \text{ we get}$$

$$\Lambda_m^c = \frac{3.905 \times 10^{-5} \text{ S cm}^{-1} \times 1000 \text{ cm}^3 \text{ L}^{-1}}{1 \times 10^{-3} \text{ mol L}^{-1}} = \mathbf{39.05 \text{ S cm}^2 \text{ mol}^{-1}}$$

$$\Lambda_m^o(CH_3COOH) = \lambda^o_{(CH_3COO^-)} + \lambda^o_{(H^+)}$$

$$= (40.9 + 349.6) \text{ S cm}^2 \text{ mol}^{-1}$$

$$= 390.5 \text{ S cm}^2 \text{ mol}^{-1}$$

$$\text{Degree of dissociation, } \alpha = \frac{\Lambda_m^c}{\Lambda_m^0}$$

$$= \frac{39.05 \text{ S cm}^2 \text{ mol}^{-1}}{390.5 \text{ S cm}^2 \text{ mol}^{-1}} = 0.1$$

or $\alpha = \mathbf{10\%}$

(*ii*) A device which is used to convert chemical energy produced in a redox reaction into electrical energy is called an electrochemical cell.

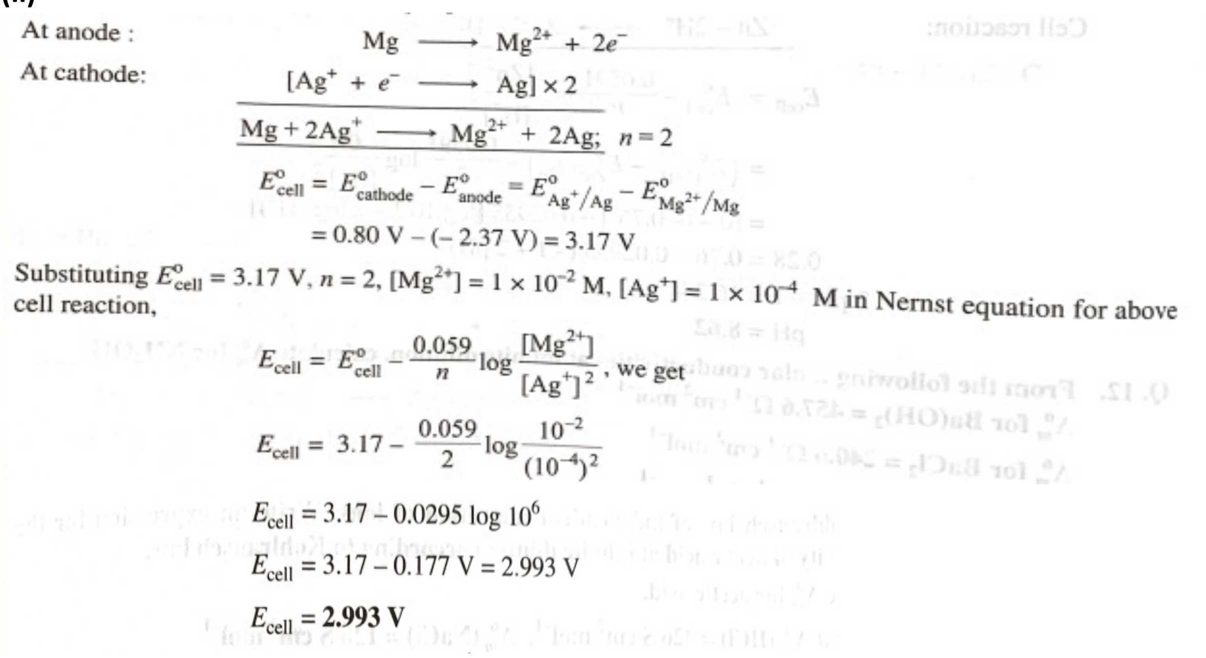
If external potential applied becomes greater than E^0_{cell} of electrochemical cell, the reaction gets reversed and the electrochemical cell function as an electrolytic cell

OR

(i) κ= 1/R X l/a , where κ= Conductivity, l/a= cell constant, R= resistance

Λ_m= κ x 1000/M , where Λ_m = Molar conductivity , κ= Conductivity, M= Molarity of solution

(ii)



At anode : $\mathrm{Mg} \longrightarrow \mathrm{Mg^{2+}} + 2e^-$

At cathode: $[\mathrm{Ag^+} + e^- \longrightarrow \mathrm{Ag}] \times 2$

$$\mathrm{Mg} + 2\mathrm{Ag^+} \longrightarrow \mathrm{Mg^{2+}} + 2\mathrm{Ag};\quad n = 2$$

$$E^\circ_{\text{cell}} = E^\circ_{\text{cathode}} - E^\circ_{\text{anode}} = E^\circ_{\mathrm{Ag^+/Ag}} - E^\circ_{\mathrm{Mg^{2+}/Mg}}$$

$$= 0.80\ \mathrm{V} - (-2.37\ \mathrm{V}) = 3.17\ \mathrm{V}$$

Substituting $E^\circ_{\text{cell}} = 3.17$ V, $n = 2$, $[\mathrm{Mg^{2+}}] = 1 \times 10^{-2}$ M, $[\mathrm{Ag^+}] = 1 \times 10^{-4}$ M in Nernst equation for above cell reaction,

$$E_{\text{cell}} = E^\circ_{\text{cell}} - \frac{0.059}{n}\log\frac{[\mathrm{Mg^{2+}}]}{[\mathrm{Ag^+}]^2}\text{, we get}$$

$$E_{\text{cell}} = 3.17 - \frac{0.059}{2}\log\frac{10^{-2}}{(10^{-4})^2}$$

$$E_{\text{cell}} = 3.17 - 0.0295\log 10^6$$

$$E_{\text{cell}} = 3.17 - 0.177\ \mathrm{V} = 2.993\ \mathrm{V}$$

$$E_{\text{cell}} = \mathbf{2.993\ V}$$