ST. JOSEPH PUBLIC SCHOOL

Kota Barrage Road, Kota-6 (Raj.)

C.B.S.E. New Delhi, **CHEMISTRY**	**SOLUTIONS**
Class: **XII**	**2025-26**
MM: **70**	

Section A

1. **(a)** gem-dihalide

   Explanation:

   Gem-dihalides are dihaloalkanes that have two halogen atoms of the same type attached to the same carbon atom in a molecule. The common naming system of gem-dihalides (geminal halide) is alkylidene dihalides. Ethylidene dichloride thus is a gem-dihalide. The chemical formula of ethylidene dichloride is $C_3H_6Cl_2$.

2. **(d)** Uracil

   Explanation:

   DNA contains four bases viz. adenine (A), guanine (G), cytosine (C) and thymine (T). So Uracil is not present in DNA.

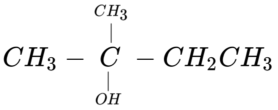
3. **(b)** higher aldehydes

   Explanation:

   Higher aldehydes like aldehyde C-10 etc. are used in floral blends like rose, jasmine, etc.

4. **(b)** 2-Methylbutan-2-ol

   Explanation:

   The correct IUPAC name of  $CH_3 - \overset{\overset{CH_3}{|}}{\underset{\underset{OH}{|}}{C}} - CH_2CH_3$ is 2-Methylbutan-2-ol

5. **(c)** remains constant

   Explanation:

   remains constant

6. **(d)** (a) - (ii), (b) - (iii), (c) - (iv), (d) - (i)

   Explanation:

   (a) - (ii), (b) - (iii), (c) - (iv), (d) - (i)

7. **(b)** 3

   Explanation:

   CH_3NH_2 can act as a nucleophile to cause substitution reaction. $(CH_3)_4N^+$ this is formed when 3 moles of CH_3NH_2 reacts with methyl halide.

8. **(c)** ethyl alcohol

   Explanation:

   The nitrous acid thus produced reacts with ethyl amine and produces ethyl alcohol and nitrogen gas

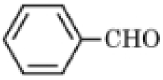
9.

(d) Very fast

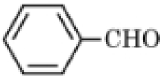
Explanation:

Ionic reactions occur instantaneously. Therefore, ionic reactions are very fast reactions.

10.

(b) 

Explanation:



11.

(b) benzyl alcohol

Explanation:

Monochlorination of toluene gives benzylchloride.

$C_6H_5CH_3 + Cl_2 + hv \rightarrow C_6H_5CH_2Cl$

benzyl chloride on reaction with aq. NaOH will give benzyl alcohol by substitution reaction.

$C_6H_5CH_2Cl + NaOH(aq) \rightarrow C_6H_5CH_2OH$

12. **(a)** Ethanamine

Explanation:

$$\underset{\text{Propanamide}}{CH_3CH_2CONH_2} + Br_2 + 4NaOH \xrightarrow{\Delta} \underset{\text{Ethanamine}}{CH_3CH_2NH_2} + 2NaBr + Na_2CO_3 + 2H_2O$$

This is Hoffman Bromamide reaction.

13. **(a)** Both A and R are true and R is the correct explanation of A.

Explanation:

Both A and R are true and R is the correct explanation of A.

14. **(a)** Both A and R are true and R is the correct explanation of A.

Explanation:

Both A and R are true and R is the correct explanation of A.

15.

(d) A is false but R is true.

Explanation:

Halobenzenes become reactive to nucleophilic substitution reactions when electron-withdrawing groups (nitro, cyano) are present at ortho/para position. This is evident from the milder conditions required for hydrolysis in 2,4-dinitrochlorobenzene than chlorobenzene.

16. **(a)** Both A and R are true and R is the correct explanation of A.

Explanation:

In the reaction of the alcohol with $SOCl_2$, HCl is produced and tertiary amine promotes the reaction by reacting with HCl.

Section B

17. $\mathrm{E_{cell}} = \mathrm{E^{\theta}_{cell}} - \frac{0.0591}{n}\log\frac{\left[\mathrm{Sn}^{2+}\right][\mathrm{Zn}^{2+}]}{\left[\mathrm{Sn}^{4+}\right][\mathrm{Zn}]}$

$= 0.89 - \frac{0.0591}{2}\log\frac{0.5\times2}{1.5\times1}$

$= 0.89 - \frac{0.0591}{2}\log\frac{1}{1.5}$

= 0.895 V

On increasing the concentration of Sn^{4+}, EMF of the cell will increase.

OR

Mercury cell is a primary cell suitable for low current devices like hearing aids, electronic watches etc. It consists of zinc – mercury amalgam as anode and a paste of HgO and carbon as the cathode. The electrolyte is a paste of ZnO and KOH.
The cell process is given below:

At anode:

$\mathrm{Zn(Hg)} + 2\mathrm{OH}^- \rightarrow \mathrm{ZnO(s)} + \mathrm{H_2O} + 2e^-$

At cathode:

$\mathrm{HgO(s)} + \mathrm{H_2O} + 2e^- \rightarrow \mathrm{Hg(l)} + 2\mathrm{OH}^-$

Overall reaction:

$\mathrm{Zn(Hg)} + \mathrm{HgO(s)} \rightarrow \mathrm{ZnO(s)} + \mathrm{Hg(l)}$

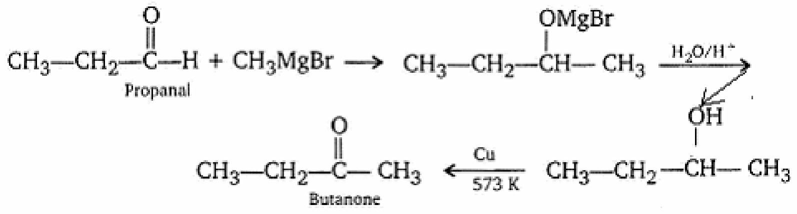
The voltage of a mercury cell remains constant (approximately 1.35V) during its life as the overall reaction does not involve any ion in solution whose concentration can change its lifetime.

18. A...B interaction is more than A...A and B....B interaction. So there is increased attractive forces between molecules of A and B. Hence there is a sight reduction in volume and so the mixture shows negative deviation from Raoult's law.

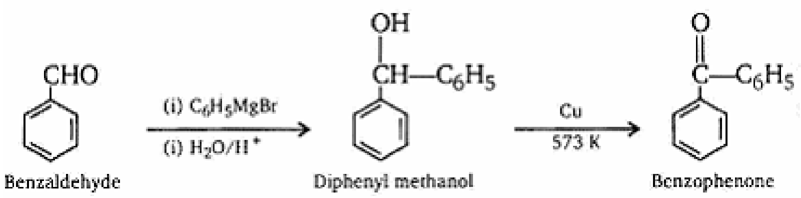
19. According to n + 1 rule: For 3d = n + 1 = 5
4s = n + 1 = 4
Therefore, the electron will enter in 4s orbital first and then in 3d orbitals. ionization enthalpy is responsible for the ionization of atom. The electron present in 4s orbital are loosely held by the nucleus. So electrons are removed from 4s orbital prior to 3d orbital.

20. Answer the following:
    (i) No, the rate of a reaction is not always constant. It depends on factors such as concentration, temperature etc.
    (ii) Rate of disappearance of hydrogen$= -\frac{1}{3}\frac{d[H_2]}{dt}$

21. i. Propanal to Butanone



ii. Benzaldehyde to Benzophenone



iii. Benzoyl Chloride to Bezonitrile

$$\underset{Benzoyl\ chloride}{C_6H_5COCl}\xrightarrow[heat]{NH_3}\underset{Benzamide}{C_6H_5CONH_2}\xrightarrow[heat]{P_2O_5}\underset{Benzonitrile}{C_6H_5C=N}$$

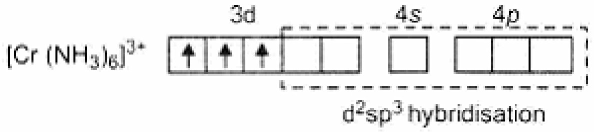
Section C

22. $\Omega = \frac{kg\ m^2}{s^2A^2}$

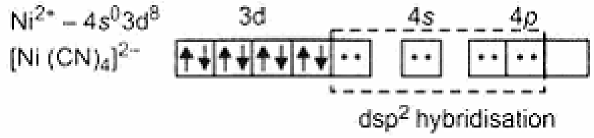
Derivation: $\Omega = \frac{V}{I} = \frac{\text{work per unit charge}}{I}$

$= \frac{\text{Work}}{\text{Charge}} \times \frac{1}{I}$

$= \frac{F\times l}{I\times t} \times \frac{1}{I} = \frac{m\times a\times l}{I^2\times t} = \frac{kg\times ms^{-2}\times m}{A^2\times s} = \frac{kg\ m^2}{s^2A^2}$

23. 

It is paramagnetic due to the presence of unpaired electrons.



It has square planar structure diamagnetic due to absence of unpaired electrons.

24. i. Acidified potassium dichromate or neutral acidic or alkaline potassium permanganate (followed by hydrolysis with dil.HCl.)

ii. Pyridinium chlorochromate (PCC). $C_2H_5\overset{+}{N}HClCrO_3^-$ in CH_2Cl_2 OR

Pyridinium dichromate (PDC), $(C_5H_5\overset{+}{N}H)_2Cr_2O_3^{2-}$ IN CH_2Cl_2

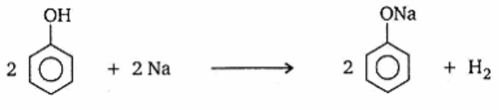
iii. Aqueous bromine, i.e. Br_2/H_2O

iv. Acidified or alkaline potassium permanganate (followed by hydrolysis with dil.HCl)

v. conc. H_2SO_4 at 433 - 443 K or 85% phosphoric acid at 443 K.

vi. Ni/H_2 or N_aBH_4 or $LiAIH_4$

OR

i. 

ii. 

Phenol is more acidic than ethanol because phenoxide ion is more stable than ethoxide ion.

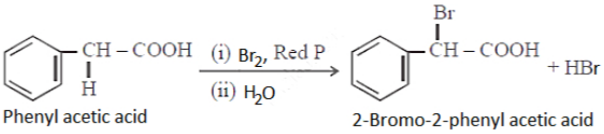
25. i. Cannizzaro reaction

$$2R-\overset{\overset{O}{||}}{C}-H \xrightarrow{NaOH} R-CH_2OH+R-\overset{\overset{O}{||}}{C}-ONa$$

ii. Aldol condensation

$$\underbrace{CH_3-\underset{\underset{H}{|}}{\overset{\overset{O}{||}}{C}}+\overset{\overset{H}{|}}{C}H_2-\underset{\underset{H}{|}}{\overset{\overset{O}{||}}{C}}}_{2\ molecules\ of\ acetaldehyde} \xrightarrow{Dil.\ NaOH} CH_3-\underset{\underset{\underset{Acetaldol}{H}}{|}}{\overset{\overset{OH}{|}}{C}}-CH_2-\overset{\overset{O}{||}}{C}-H$$

iii. Hell-Volhard-Zelinsky reaction



26. $\left[Zn^{2+}\right] = 0.1 \times \frac{95}{100} = 0.095M$

$Zn^{2+} + 2e^- \rightarrow Zn$

$E_{(Zn^+/Zn)} = E^0_{(Zn^+/Zn)} - \frac{0.0591}{2}\log\frac{1}{[Zn^{2+}]}$

$= -0.76V - \frac{0.0591}{2}\log\frac{1}{0.095}$

$= -0.76V - \frac{0.0591}{2}[\log 1000 - \log 95]$

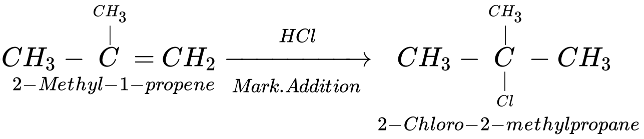
$= -0.76 - \frac{0.0591}{2}[3.000 - 1.9777]$

$= -0.76V - \frac{0.0591}{2} \times 1.0223$

$= -0.76V - \frac{0.0604}{2} = 0.76 - 0.0302$

= - 0.7902 V

27. i. 2-Methyl-1-propene to 2-chloro-2-methylpropane



$$\underset{2-Methyl-1-propene}{CH_3-\overset{\overset{CH_3}{|}}{C}=CH_2}\xrightarrow[Mark.Addition]{HCl}\underset{2-Chloro-2-methylpropane}{CH_3-\underset{\underset{Cl}{|}}{\overset{\overset{CH_3}{|}}{C}}-CH_3}$$

ii. Ethyl chloride to propanoic acid

$$\underset{Ethyl\ chloride}{CH_3CH_2Cl}\xrightarrow[(Nucleophilic\ substitution)]{KCN,EtOH-H_2O}\underset{\Pr opanentrite}{CH_3CH_2CN}\xrightarrow[Hydrolysis]{H^+/H_2O}\underset{\Pr opanoic\ acid}{CH_3CH_2COOH}$$

iii. But-1-ene to n-butyliodide

$$\underset{But-1-ene}{CH_3CH_2CH=CH_2}\xrightarrow[Anti-Mark\ \ Addition]{HBr/RCOOR}CH_3CH_2CH_2CH_2Br\xrightarrow[Finkelstein\ reaction]{Nal.acetone}\underset{n-Butyliodide}{CH_3CH_2CH_2CH_2I}$$

28. Here t = 40 min.

Let a = 100x = 30% of 100 = 30

Using the formula

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

$40=\frac{2.303}{K}\log\frac{100}{100-30}$

$40=\frac{2.303}{K}\log\frac{100}{70}$

$40=\frac{2.303}{K}(\log 10-\log 7)$

$40=\frac{2.303}{K}(1-0.8451)$

$40=\frac{2.303}{K}\times 0.1549$

$K=\frac{2.303\times 0.1549}{40}$

$=\frac{0.357}{40}=0.0089\,\text{min}^{-1}$

$t_{1/2}=\frac{0.693}{K}$

$=\frac{0.693}{0.0089}$ = 77.86 min

Section D

29. i. Phospholipids form a thin layer on the surface of an aqueous medium due to the simultaneous presence of both polar and non-polar groups in the molecule. As a result, the phospholipid molecules may arrange themselves in a double-layered membrane in aqueous media.

ii. Primary structure remain intact during the denaturation process.

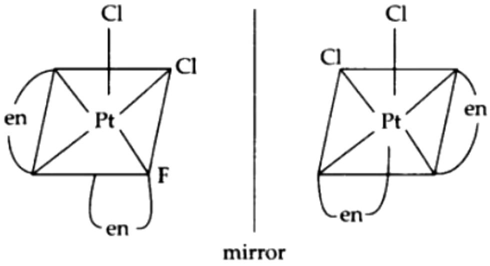
iii. secondary structure

OR

Secondary structure refers as regular folding patterns of continuous portions of the polypeptide chain

30. i. Optical isomers are mirror images that cannot be superimposed on one another. While the molecules or ions that cannot be superimposed are called chiral.

ii.



iii. Thiocyanate ligand, NCS^- is present which can bind through the nitrogen to give M–NCS or through sulphur to give M–SCN.

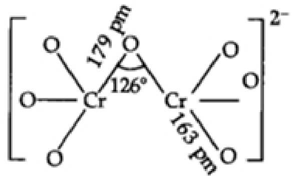
OR

The molecular shape of $[Ni(CO)_4]$ is tetrahedral because this complex nickel involves sp^3 hybridisation. In $[Ni(CN)_4]^{2-}$, nickel involves dsp^2 and its shape is square planer.

Section E

31. Attempt any five of the following:

(i)



(ii) Compounds formed by small atoms like H, C, or N which get trapped inside the crystal lattices of metals are called interstitial compounds. A large number of interstitial compounds are formed by transition metals. Transition metals react will small atoms like C, H, N or B to form such compounds. For eg. TiC etc. The vacant spaces inside the crystal lattice of transition elements are filled by these small atoms. These compounds are hard and rigid. The chemical properties of parent transition elements are not changed by the formation of interstitial compounds but physical properties of transition metal changes like malleability, ductility etc.

(iii) Reactivity of an element is dependent on the value of ionization enthalpy. In moving from Sc, the first element to Cu, the ionization enthalpy increases regularly. Therefore, the reactivity decreases as we move from Sc to Cu.

(iv) The electronic configuration of chromium and zinc are respectively:

$Cr(24) = [Ar]\ 3d^5 4s^2$

$Zn(30) = [Ar] 3d^{10} 4s^2$

It is easy to remove electron from 4 s^1 -orbital (unpaired) rather than from $4s^2$ -orbital (paired). Therefore, first ionisation enthalpy of Cr is less than Zn.

(v) Because many of the actinoids are radioactive and have the ability to exist in different oxidation states.

(vi) The overall decrease in atomic and ionic radii from lanthanum to lutetium is a unique feature in the chemistry of the lanthanoids. The cumulative effect of the contraction of size of lanthanide elements is known as lanthanoid contraction. It causes the radii of the members of the third transition series to be very similar to those of the corresponding members of the second series. For example radii of Zr (160 pm) and Hf (159 pm) are almost identical.

(vii) i. Due to comparable radii/comparable size.

ii. In Mn_2O_3, Mn is in +3 (lower) oxidation state while in Mn_2O_7, Mn is in higher oxidation state (+7)

32. i. Loss of a proton from an amine gives RNH^- ion while the loss of a proton from alcohol gives RO- ion as shown below :

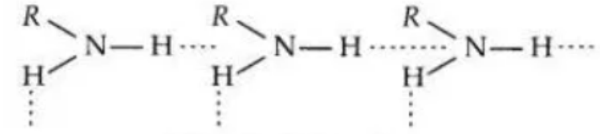
$R - NH_2 \rightarrow R - NH^- + H^+$

$R - O - H \rightarrow R - O^- + H^+$

As O is more electronegative than N, RO^- can accommodate the negative charge more easily than the RNH^- can.

As, RO^- is more stable than RNH^- the former is formed more. As a result, amines are less acidic than alcohols.

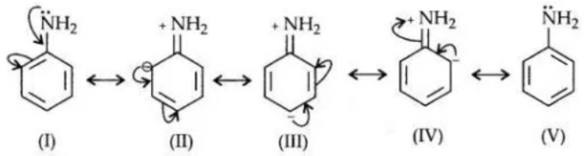
ii. A primary amine is engaged in intermolecular association due to hydrogen bonding between the nitrogen of one nad hydrogen of other while tertiary amine does not have intermolecular association due to the absence of hydrogen atom therefore the boiling point of primary amine is more than tertiary amine.



H-bonding in 1° amines

iii. a. The basic nature of amines is a result of the presence of l.p. of electron on the N atom. Also, the electron density is increased on N due to the +I effect of the alkyl group.

b. In aryl amines, the l.p. on N is involved in resonance with the benzene ring and hence less available for protonation.

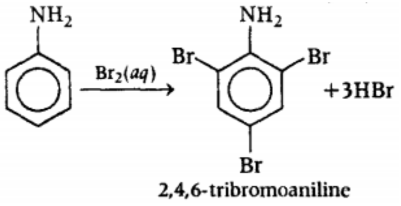


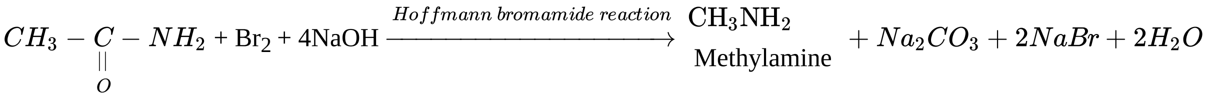
c. In aliphatic amines, there is no such delocalisation and hence it is more basic.

OR

i. $C_6H_5N_2^+Cl^- \xrightarrow{H_3PO_2 + H_2O} C_6H_6 + N_2 + H_3PO_3 + HCl$

ii.



iii. 

$CH_3-\underset{\underset{O}{||}}{C}-NH_2$ + Br$_2$ + 4NaOH $\xrightarrow{Hoffmann\ bromamide\ reaction}$ $\underset{\text{Methylamine}}{\mathrm{CH_3NH_2}}$ $+ Na_2CO_3 + 2NaBr + 2H_2O$

33. Mass of ethanol = 60 g

Molecular mass of ethanol (C_2H_5OH) = (12 × 2) + (1 × 5) + 16 + 1= 46

$\therefore$ Number of moles of ethanol $= \frac{60}{46} = 1.304$

Given mass of methanol = 40 g

Molecular mass of methanol (CH_3OH) = (12 × 1) + (1 × 3) + 16 + 1 = 32

$\therefore$ Number of moles of methanol $= \frac{40}{32} = 1.250$

Mole fraction of ethanol $= \frac{1.304}{1.304+1.250} = 0.51$

Mole fraction of methanol = 1 - 0.51 = 0.49

Vapour pressure of pure ethanol $p^{o}_{\mathrm{C_2H_3OH}}$ = 44.5 mm

Vapour pressure of pure methanol $p^{\circ}{}_{\mathrm{CH_3OH}} = 88.7\ \mathrm{mm}$

Vapour pressure due to ethanol

$p_{\mathrm{C_2H_3OH}} = p^{\circ}_{\mathrm{C_2H_3OH}} \times 0.51$

= 44.5 mm × 0.51 = 22.69 mm

Vapour pressure due to methanol,

$p_{\mathrm{CH_3OH}} = p^{\circ}_{\mathrm{CH_3OH}} \times 0.49$

= 88.7 mm × 0.49 = 43.46 mm

Total Vapour pressure

$= p_{\mathrm{C_2H_3OH}} + p_{\mathrm{CH_3OH}}$

= 22.69 + 43.46 = 66.15 mm

Mole fraction of methanol in the vapour state

$= \frac{p_{\mathrm{CH,OH}}}{\text{Total vapour pressure}} = \frac{43.46}{66.15}$ = 0.657

OR

i. mass of solute = 19.5g

molar mass of solute (F- Cl$_2$ - COOH) = 78 g mol^{-1}

mass of solvent i.e water = 500g; k$_f$ value for water = 1.86 k kg mol^{-1}

depression in freezing point = 1 C

degree of dissociation of solute = ?

No. of moles solute = $\frac{19.5}{78}$ = 0.25

molality is the no. of moles of solute in 1 kg solvent

molality = $\frac{0.25}{\frac{500}{1000}}$ = 0.50 m

Calculated depression in freezing point;

$\Delta T_f = K_f \times m$

= 1.86 × 0.50 = 0.93 K

i = $\frac{\text{Observed freezing point}}{\text{Calculated freezing point}}$

i = $\frac{1.0}{0.93}$ = 1.0753

Let, C is the initial conc. of bluoroacetic acid and α be its degreee of dissociation.

$\underset{C(1-\alpha)}{CH_2FCOOH} \rightarrow \underset{C\alpha}{CH_3FCOO^-} + \underset{C\varepsilon}{H^+}$

Total number of moles = C(1 - α) + Cα + Cα

= C(1 + 2)

1.0753 = 1 + α

α degree of dissociation of solute= 0.0753

ii. a. KCl dissociates in the solution and forms ions K$^+$ and Cl$^-$ and glucose does not dissociate. Since the boiling point is a colligative property and depends on the number of particles. Therefore, 0.1 M KCl has a higher boiling point than the 0.1 M glucose.

b. Meat is preserved for a longer time by salting so that it can be protected against bacterial action for longer.