Class XII Session 2025-26
Subject - Chemistry
Sample Question Paper - 2

Time Allowed: 3 hours **Maximum Marks: 70**

General Instructions:

Read the following instructions carefully.

1. There are **33** questions in this question paper with internal choice.
2. SECTION A consists of 16 multiple-choice questions carrying 1 mark each.
3. SECTION B consists of 5 very short answer questions carrying 2 marks each.
4. SECTION C consists of 7 short answer questions carrying 3 marks each.
5. SECTION D consists of 2 case-based questions carrying 4 marks each.
6. SECTION E consists of 3 long answer questions carrying 5 marks each.
7. **All questions are compulsory.**
8. **Use of log tables and calculators is not allowed.**

Section A

1. Ethylidene chloride is a/an _____. **[1]**

   a) gem-dihalide b) vic-dihalide

   c) vinylic halide d) allylic halide

2. Which of the following bases is not present in DNA? **[1]**

   a) Adenine b) Cytosine

   c) Thymine d) Uracil

3. Many naturally occurring aldehydes and ketones are used in the blending of perfumes and flavouring agents. But the preferred ones are_____. **[1]**

   a) lower ketones b) higher aldehydes

   c) lower aldehydes d) higher ketones

4. The correct IUPAC name of $CH_3 - \overset{\overset{CH_3}{|}}{\underset{\underset{OH}{|}}{C}} - CH_2CH_3$ is **[1]**

   a) 2,2-Dimethylpropanol b) 2-Methylbutan-2-ol

   c) tert-butyl alcohol d) 3-Methylbutan-3-ol

5. When a catalyst increases the rate of a chemical reaction, then the rate constant (k): **[1]**

   a) increases b) may increase or decrease depending on the order of the reaction

c) remains constant

d) decreases

6. Match the items given in column I with that in column II: **[1]**

Column I	Column II
(a) Ω^{-1} cm^2mol^{-1}	(i) Mercury Cell
(b) $\alpha_{dissoiation}$ is low	(ii) λ_m
(c) Decreases with dilution	(iii) Weak Electrolyte
(d) Electrolyte is a paste of KOH/ZnO	(iv) Conductivity

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

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

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

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

7. Maximum number of molecules of CH_3I that can react with a molecule of CH_3NH_2 is: **[1]**

a) 4

b) 3

c) 1

d) 2

8. The action of nitrous acid on ethylamine gives mainly: **[1]**

a) ethyl nitrite

b) ethane

c) ethyl alcohol

d) nitroethane

9. Rate of ionic reactions are generally **[1]**

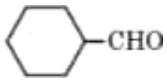
a) Very slow

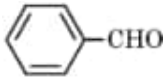
b) Moderate

c) Slow

d) Very fast

10. Which of the following does not give aldol condensation reaction? **[1]**

a) 

b) 

c) CH_3COCH_3

d) CH_3 - CHO

11. Monochlorination of toluene in sunlight followed by hydrolysis by aq. NaOH yields **[1]**

a) m-cresol

b) benzyl alcohol

c) o-cresol

d) 2,4-dihydroxytoluene

12. Propanamide on reaction with bromine in aqueous NaOH gives: **[1]**

a) Ethanamine

b) Propanenitrile

c) Propanamine

d) N-Methyl ethanamine

13. **Assertion (A):** Except glycine, all naturally occurring α-amino acids are optically active. **[1]**

Reason (R): All α-amino acids occurring naturally except glycine has at least one asymmetric carbon.

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

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

14. **Assertion (A):** Benzoic acid does not give Friedel-Crafts reaction. **[1]**

Reason (R): The carboxyl group is deactivating and gets bonded to Lewis acid $AlCl_3$.

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

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

15. **Assertion (A):** Electron withdrawing groups in aryl halides decrease the reactivity towards nucleophilic substitution. **[1]**

Reason (R): 2,4 -Dinitrochlorobenzene is more reactive than chlorobenzene.

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

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

16. **Assertion (A):** The reaction of the alcohol with $SOCl_2$ is catalyzed by the presence of a tertiary amine (R_3N). **[1]**

Reason (R): Tertiary amine promotes the reaction by reacting with the by-product HCl.

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

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

Section B

17. Calculate the potential of the following cell Sn^{4+} (1.5 M) + Zn $\longrightarrow$ Sn^{2+} (0.5 M) + Zn^{2+} (2M). **[2]**

Given : $\mathbf{E}^0_{Sn^{4+}/Sa^{2+}} = 0.13V, E^0_{Zn^{2+}/Zn} = -0.76V$

Will the cell potential $\uparrow$ or $\downarrow$ if the concentration of Sn^{4+} is increased?

OR

Write the anode and cathode reactions occurring in a commonly used mercury cells. How is the overall reaction represented?

18. 10 ml of liquid A was mixed with 10 ml of liquid B. The volume of the resulting solution was found to be 19.9 ml what do you conclude? **[2]**

19. While filling up of electrons in the atomic orbitals, the 4s orbital is filled before the 3d orbital but the reverse happens during the ionization of the atom. Explain why? **[2]**

20. **Answer the following:** **[2]**

(a) Is rate of reaction always constant? **[1]**

(b) Express the rate of the following reaction in terms of disappearance of hydrogen in the reaction. **[1]**

$3H_2(g) + N_2(g) \rightarrow 2NH_3(g)$

21. How would you bring about the following conversions (any two): **[2]**

i. Propanal to butanone?

ii. Benzaldehyde to benzophenone?

iii. Benzyl chloride to benzonitrile?

Section C

22. How is 'ohm' expressed in terms of dimensions in SI unit? How do you arrive at this conversion? **[3]**

23. $[Cr(NH_3)_6]^{3+}$ is paramagnetic while $[Ni(CN)_4]^{2-}$ is diamagnetic. Explain why? **[3]**

Cr(24) = $[Ar]4s^1 3d^5$

Cr^{3+}(24) : $[Ar]4s^0\ 3d^3$

24. Name the reagents in the following reactions: **[3]**

i. Oxidation of a primary alcohol to a carboxylic acid

ii. Oxidation of a primary alcohol to an aldehyde

iii. Bromination of phenol to 2, 4, 6-tribromophenol

iv. Benzyl alcohol to benzoic acid

v. Dehydration of propan 2-ol-tio propene

vi. Butan -2-one to butan - 2- ol.

OR

Give two reactions that show the acidic nature of phenol. Compare acidity of phenol with that of ethanol.

25. Write the equations involved in the following reactions: **[3]**

i. Cannizzaro reaction

ii. Aldol condensation

iii. Hell-Volhard-Zelinsky reaction

26. Zinc rod is dipped in 0.1 M solution of $ZnSO_4$ **[3]**

The salt is 95% dissociated at is dilution at 298 K . Calculate the electrode potential. Given:

$E^0(Zn^{2+}/Zn) = -0.76$

27. How the following conversions can be carried out? **[3]**

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

ii. Ethyl chloride to propanoic acid

iii. But-1-ene to n-butyliodide

28. A first order decomposition reaction takes 40 minutes for 30% decomposition, calculate $t_{1/2}$ value for it. **[3]**

Section D

29. **Read the following text carefully and answer the questions that follow:** **[4]**

When a protein in its native form, is subjected to physical changes like change in temperature or chemical changes like change in pH, the hydrogen bonds are disturbed. Due to this, globules unfold and helix gets uncoiled and protein loses its biological activity. This is called the denaturation of protein.

The denaturation causes change in secondary and tertiary structures but primary structures remain intact. Examples of denaturation of protein are coagulation of egg white on boiling, curdling of milk, formation of cheese when an acid is added to milk.

i. Phospholipids form a thin layer on the surface of an aqueous medium. Give reason. (1)

ii. Which structure(s) of proteins remains(s) intact during the denaturation process? (1)

iii. What type of structure is α-helix and β-pleated structures of proteins? (2)

OR

Secondary structure of a protein refers to (2)

30. **Read the following text carefully and answer the questions that follow:** **[4]**

Isomers are two or more compounds that have the same chemical formula but a different arrangement of atoms. Due to the different arrangements of atoms, they differ in one or more physical or chemical properties. Two principal types of isomerism are known among coordination compounds. Stereoisomerism includes geometrical isomerism, optical isomerism while Structural isomerism consists of linkage isomerism, coordination isomerism, Ionisation isomerism and Solvate isomerism. Isomerism arises in heteroleptic complexes due to different possible geometric arrangements of the ligands. In a square planar complex of formula $[MX_2L_2]$ X and L are unidentate, the two ligands X may be arranged adjacent to each other in a cis isomer, or opposite to each other in

a trans isomer. Solvate form of isomerism is known as 'hydrate isomerism' in the case where water is involved as a solvent. This is similar to ionisation isomerism.

i. Optical isomers are called chiral. Explain (1)

ii. Draw one of the geometrical isomers of the complex $[Pt(en)_2Cl_2]^{2+}$ which is optically active. (1)

iii. Why thiocyanate is an ambidentate ligand? (2)

OR

Why molecular shape of $Ni(CO)_4$ is not the same as that of $[Ni(CN)_4]^{2-}$? (2)

Section E

31. **Attempt any five of the following:** **[5]**

(a) Give the structure of dichromate ion. **[1]**

(b) What are interstitial compounds. Give two examples **[1]**

(c) Reactivity of transition elements decreases almost regularly from Sc to Cu. Explain. **[1]**

(d) Why first ionisation enthalpy of Cr is lower than that of Zn? **[1]**

(e) The chemistry of the actinoids is more complex as compared to lanthanoids. Why? **[1]**

(f) State a consequence of lanthanide contraction shown by transition elements. **[1]**

(g) Give reasons for the following: **[1]**

i. Transition metals form alloys.

ii. Mn_2O_3 is basic whereas Mn_2O_7 is acidic.

32. Give plausible explanation for each of the following: **[5]**

i. Why are amines less acidic than alcohols of comparable molecular masses?

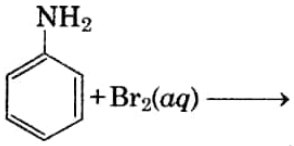
ii. Why do primary amines have higher boiling point than tertiary amines?

iii. Why are aliphatic amines stronger bases than aromatic amines?

OR

Write the main products of the following reactions:

i. $C_6H_5N_2^+Cl^- \xrightarrow{H_3PO_2 + H_2O}$

ii. 

iii. $CH_3 - \underset{\underset{O}{||}}{C} - NH_2 \xrightarrow{Br_2 + NaOH}$

33. The vapour pressures of ethanol and methanol are 44.5 mm Hg and 88.7 mm Hg respectively. An ideal solution is formed at the same temperature by mixing 60 g of ethanol with 40 g of methanol. Calculate the total vapour pressure of the solution and the mole fraction of methanol in the vapour. **[5]**

OR

i. When 19.5 g of $F - CH_2 - COOH$ (Molar mass = 78 g mol^{-1}) is dissolved in 500 g of water, the depression in freezing point is observed to be 1^oC. Calculate the degree of dissociation of $F - CH_2 - COOH$.

[Given: K_f for water = 1.86 K kg mol^{-1}]

ii. Give reasons:

a. 0.1 M KCl has higher boiling point than 0.1 M Glucose.

b. Meat is preserved for a longer time by salting.

Solution

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

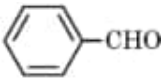
9.

(d) Very fast

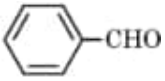
Explanation:

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:

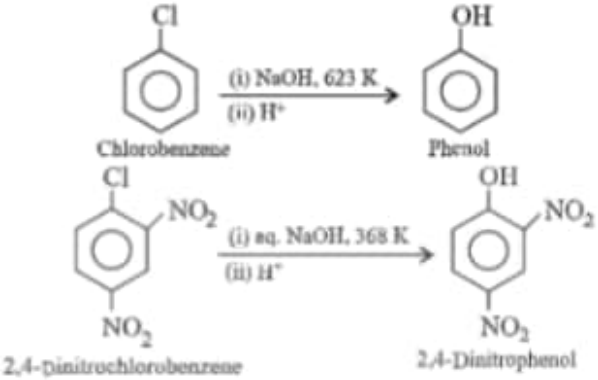
Both A and R are true and R is the correct explanation of A.

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

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

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

= 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:

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

At cathode:

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

Overall reaction:

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

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

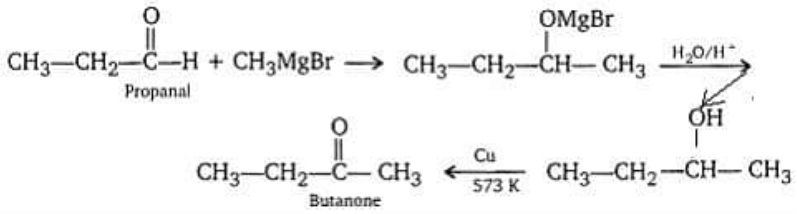
Therefore, the electron will enter in 4s orbital first and then in 3d orbitals. ionization enthalpy is responsible for the ionization of atom. The electron present in 4s orbital are loosely held by the nucleus. So electrons are removed from 4s orbital prior to 3d orbital.

20. Answer the following:

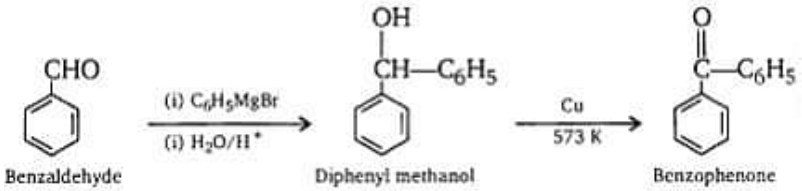
(i) No, the rate of a reaction is not always constant. It depends on factors such as concentration, temperature etc.

(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

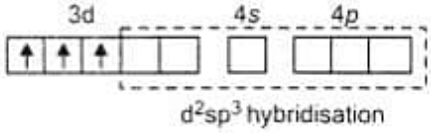
22. $\Omega = \frac{kg\ m^2}{s^2A^2}$

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

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

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

23. $[Cr(NH_3)_6]^{3+}$

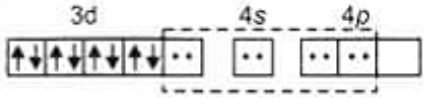


d^2sp^3 hybridisation

It is paramagnetic due to the presence of unpaired electrons.

$Ni^{2+} - 4s^0 3d^8$

$[Ni(CN)_4]^{2-}$



dsp^2 hybridisation

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 $LiAlH_4$

OR

i.

ii.

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

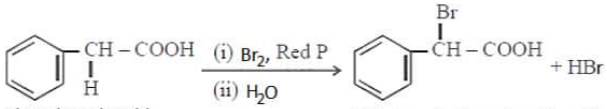
25. i. Cannizzaro reaction

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

ii. Aldol condensation

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

iii. Hell-Volhard-Zelinsky reaction



Phenyl acetic acid

2-Bromo-2-phenyl acetic acid

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

ii. Ethyl chloride to propanoic acid

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

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.

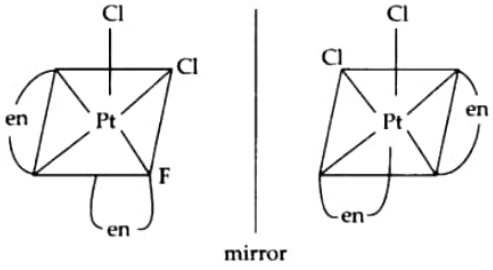
ii. Primary structure remain intact during the denaturation process.

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. 

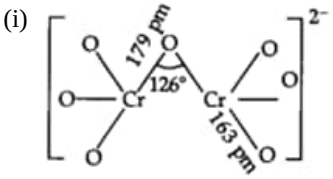
iii. Thiocyanate ligand, NCS^- is present which can bind through the nitrogen to give M–NCS or through sulphur to give M–SCN.

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 :

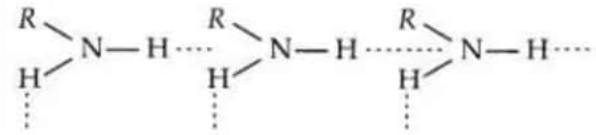
$R - NH_2 \rightarrow R - NH^- + H^+$

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

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.

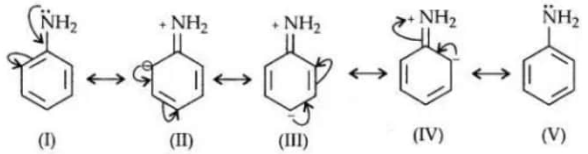
ii. A primary amine is engaged in intermolecular association due to hydrogen bonding between the nitrogen of one nad hydrogen of other while tertiary amine does not have intermolecular association due to the absence of hydrogen atom therefore the boiling point of primary amine is more than tertiary amine.



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.

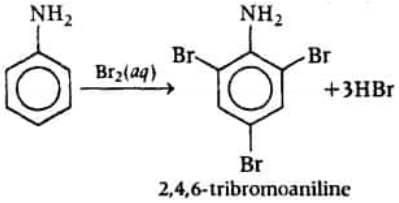


(I) (II) (III) (IV) (V)

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. 

2,4,6-tribromoaniline

iii. $CH_3-\underset{\underset{O}{||}}{C}-NH_2 + Br_2 + 4NaOH \xrightarrow{Hoffmann\ bromamide\ reaction} \underset{\text{Methylamine}}{CH_3NH_2} + Na_2CO_3 + 2NaBr + 2H_2O$

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 $p^{o}_{C_2H_3OH}$ = 44.5 mm

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

Vapour pressure due to ethanol

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

= 44.5 mm × 0.51 = 22.69 mm

Vapour pressure due to methanol,

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

= 88.7 mm × 0.49 = 43.46 mm

Total Vapour pressure

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

= 22.69 + 43.46 = 66.15 mm

Mole fraction of methanol in the vapour state

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