Class XII Session 2023-24
Subject - Chemistry
Sample Question Paper - 7

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. Chlorobenzene is formed by the reaction of chlorine with benzene in the presence of $AlCl_3$. Which of the following species attacks the benzene ring in this reaction? **[1]**

a) $AlCl_3$ b) $[AlCl_4]^-$

c) Cl^+ d) Cl^-

2. Cheilosis is caused by deficiency of **[1]**

a) Vitamin B_6 b) Vitamin B_2

c) Vitamin C d) Vitamin B_{12}

3. Phenol on distillation with zinc dust gives **[1]**

a) benzaldehyde b) benzophenone

c) benzene d) benzonic acid

4. The compound formed as a result of oxidation of ethyl benzene by $KMnO_4$ is **[1]**

a) Acetophenone b) Benzoic acid

c) Benzophenone d) Benzyl alcohol

5. Name the order of reaction which proceeds with a uniform rate throughout. **[1]**

a) Third order b) Second order

c) First order d) Zero order

6. Match the items of column I with appropriate entries of column II. **[1]**

Column I	Column II
(a) For electrolyte $CaSO_4$	(i) i = 5
(b) For ideal Solution	(ii) i = 2
(c) For electrolyte $Al_2(SO_4)_3$	(iii) i = 4
(d) For electrolyte Na_3PO_4	(iv) i = 1

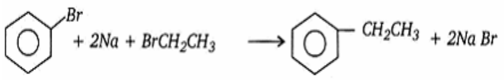
a) (a) - (iv), (b) - (i), (c) - (ii), (d) - (iii).

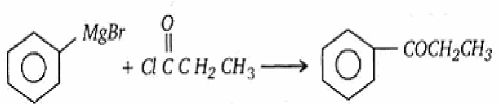
b) (a) - (i), (b) - (ii), (c) - (iii), (d) - (iv).

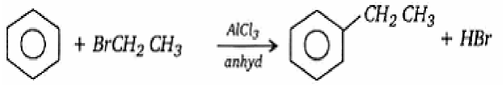
c) (a) - (iii), (b) - (ii), (c) - (iv), (d) - (i).

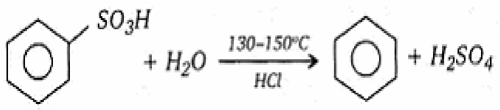
d) (a) - (ii), (b) - (iv), (c) - (i), (d) - (iii).

7. Which of the following is a Wurtz-Fitting reaction? **[1]**

a) 

b) 

c) 

d) 

8. Which is least soluble in water? **[1]**

a) AgBr

b) AgI

c) Ag_2S

d) AgCl

9. Following mechanism has been proposed for a reaction **[1]**

$2A + B \rightarrow D + E$

$A + B \rightarrow C + D$ (slow)

$A + C \rightarrow E$ (fast)

The rate law expression for the reaction is

a) $r = k[A]^2$

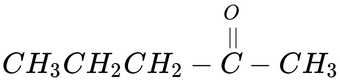
b) $r = k[A][B]$

c) $r = k[A][C]$

d) $r = k[A]^2[B]$

10. Nucleophilic addition will be most favoured in: **[1]**

a) CH_3CH_2CHO

b) 
$CH_3CH_2CH_2-\overset{O}{\overset{||}{C}}-CH_3$

c) CH_3CHO

d) $(CH_3)_2C = O$

11. Which of the following compounds will react with sodium hydroxide solution in water? **[1]**

a) $C_6H_5CH_2OH$

b) $(CH_3)_3COH$

c) C_2H_5OH

d) C_6H_5OH

12. In the nitration of benzene using a mixture of conc. H_2SO_4 and conc. HNO_3, the species which initiates the reaction is ________. **[1]**

a) NO_2^-

b) NO^+

c)

d) NO_2

$NO^+{}_2$

13. **Assertion (A):** A solution of sucrose in water is dextrorotatory but on hydrolysis in presence of little hydrochloric acid it becomes laevorotatory. **[1]**

Reason (R): Sucrose on hydrolysis gives unequal amounts of glucose and fructose as a result of which change in sign of rotation is observed.

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):** Aldol condensation is usually carried out in a dilute solution of a strong base. **[1]**

Reason (R): Concentrated solution of strong base involves Cannizzaro reaction.

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):** KCN reacts with methyl chloride to give methyl isocyanide. **[1]**

Reason (R): CN^- is an ambident nucleophile.

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):** Reimer-Tiemann reaction of phenol with $CHCl_3$ in NaOH at 340 K gives salicylic acid as the major product. **[1]**

Reason (R): The reaction occurs through the intermediate formation of $^+CHCl_2$.

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. How is stability of coordination compounds determined in aqueous solution? **[2]**

18. Although Zr belongs to 4d and Hf belongs to 5d transition series but it is quite difficult to separate them. Why? **[2]**

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

(i) Consider the equation $2NO(q) + 2H_2(g) \rightarrow N_2(g) + 2H_2O(g)$. The rate law for this equation is first order with respect to H_2 and second order with respect to NO. write the rate law for this reaction. **[1]**

(ii) Why does the rate of reaction not remain constant throughout the reaction process? **[1]**

20. Calculate the freezing point of a solution containing 0.520 g glucose ($C_6H_{12}O_6$) dissolved in 80.20 g of water. **[2]**

(For water K_f = 1.86 K kg mol^{-1})

OR

Show that when the mole fraction of the solvent in the solution is nearly unity, the molarity (C) and molality (m) of the solution are connected by the equation.

$C = \rho \times m$, where p = density of the solution

21. Define carbonyl group. **[2]**

Section C

22. Calculate the e.m.f at 25°c for the following cell: **[3]**

$Ni(s)|Ni^{2+}\,(0.01M)\,||Cu^{2+}\,(0.1M)\,|Cu(s)$

Given: $E^0_{Ni^{+2}/Ni}$ = - 0.25 V

$E^0_{Cu^{2+}/Cu} = +0.34V$

[1F = 96,500 $Cmol^{-1}$]. Calculate the maximum work that can be accomplished by the operation of this cell

23. The following data were obtained for the reaction: **[3]**

$A + 2B \longrightarrow C$

Experiment	**[A]/M**	**[B]/M**	**Initial rate of formation of C /M min^{-1}**
1	0.2	0.3	4.2×10^{-2}
2	0.1	0.1	6.0×10^{-3}
3	0.4	0.3	1.68×10^{-1}
4	0.1	0.4	2.40×10^{-2}

a. Find the order of reaction with respect to A and B.

b. Write the rate law and overall order of the reaction.

c. Calculate the rate constant (k).

24. How can diethyl ether be prepared from **[3]**

i. ethyl iodide

ii. ethyl alcohol?

Why is the boiling point of an ether lower than that of the isomeric alcohols.

OR

Predict the major product of acid catalysed dehydration of

i. 1-Methylcyclohexanol

ii. Butan-1-ol

25. Draw the structure of a carboxyl group and indicate clearly **[3]**

i. The hybridized state of carbon,

ii. The σ and π bonds present and

iii. The electrophilic and nucleophilic centres in it

26. Calculate $E^o(Ni^{2+}|Ni)$, if emf of the cell, $Ni(s)|Ni^{2+}(0.01M)\,||\,Cu^{2+}(0.1M)|Cu(s)$ is 0.059 V. [Given, $E^\circ_{Cu^{2+}/Cu}$ = + 0.34 V]. **[3]**

27. Predict the major product formed when HCl is added to isobutylene. Explain the mechanism involved. **[3]**

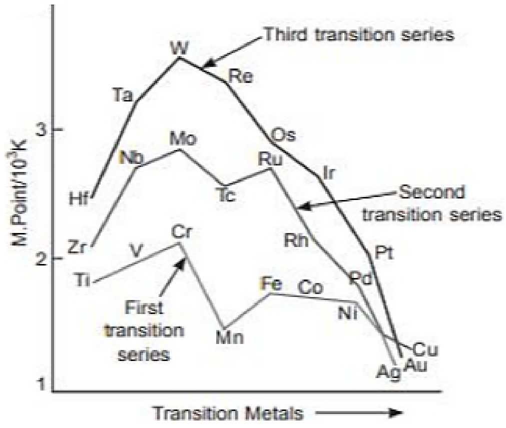
28. Estimate the minimum potential difference needed to reduce Al_2O_3 at 500°C. The free energy charge for the decomposition reaction. **[3]**

$\frac{2}{3}Al_2O_3 \rightarrow \frac{4}{3}Al + O_2$ is $\Delta G = +960KJ$ (1 F = 96500 $Cmol^{-1}$)

Section D

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

Observe the graph of transition metal and their melting points



(i) Why does W (tungsten) has highest melting point?

OR

Why are transition metals less electropositive than ‘s’-block elements?

(ii) Which element in 3d series has lowest enthalpy of atomisation and why?

(iii) Why is mercury liquid?

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

Aariv Sharma is very fond of a special drink made by his grandmother using different fruits available in their hometown. It has an outstanding taste and also provide great health benefits of natural fruits. He thought of utilizing his grandmother recipe to create a new product in the beverage market that provide health benefits and also contain fizziness of various soft drinks available in the market.

(i) How he can add fizz to the special drink made by his grandmother?

(ii) What is the law stated in the chapter that can help Aariv to make his drink fizzy?

(iii) What precautions he should take while bottling so that his product does not lose fizz during storage and handling across long distances?

OR

The mole fraction of helium in a saturated solution at 20^{o}C is 1.2×10-6. Find the pressure of helium above the solution. Given Henry’s constant at 20^{o}C is 144.97 kbar.

Section E

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

(i) Why cannot vitamin C be stored in our body? **[1]**

(ii) What are the products of hydrolysis of sucrose? **[1]**

(iii) What type of substance is phenylanine hydroxylate? Write its importance. **[1]**

(iv) Which monosaccharide units are present in starch, cellulose and glycogen and which linkages link these units? **[1]**

(v) Write the products obtained after hydrolysis of lactose. **[1]**

(vi) Classify the following into monosaccharides and disaccharides : **[1]**
Ribose, 2-deoxyribose, maltose, galactose, fructose and lactose

(vii) Write a reaction which shows that all the carbon atoms in glucose are linked in a straight chain. **[1]**

32. $[NICl_4]^{2-}$ is paramagnetic while $[Ni(CO)_4]$ is diamagnetic though both are tetrahedral. Why? **[5]**

OR

Indicate the types of isomerism exhibited by the following complexes and draw the structures for these isomers:

i. k $[Cr(H_2O)_2(C_2O_4)_2]$

ii. $[Co(en)_3]\ Cl_3$

iii. $[Co(NH_3)_5\ (NO_2)\ (NO_3)_2]$

iv. $[Pt(NH_3\ (H_2O)\ Cl_2$

33. Arrange the following compounds in a decreasing order of basic strength in their aqueous solutions. **[5]**

NH_3, CH_3NH_2, $(CH_3)_2NH$, $(CH_3)_3N$

OR

i. Write the structure of main products when aniline reacts with the following reagents :

  a. Br_2 water

  b. HCl

  c. $(CH_3CO)_2O$/pyridine

ii. Arrange the following in the increasing order of their boiling point: $C_2H_5NH_2$, C_2H_5OH, $(CH_3)_3N$

iii. Give a simple chemical test to distinguish between the following pair of compounds : $(CH_3)_2NH$ and $(CH_3)_3N$.

Solution

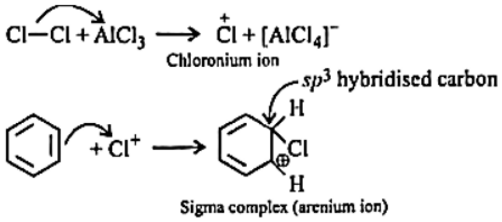
Section A

1.

(c) Cl^+

Explanation:

Aluminum chloride ($AlCl_3$) is a Lewis acid catalyst and works in the same way as $FeCl_3$ does. Benzene(C_6H_6)is converted into chlorobenzene by chlorination of benzene in the presence of $AlCl_3$. The reaction occurs by an electrophilic substitution reaction. Cl_2 forms a coordination complex with $AlCl_3$, forming $Cl^+AlCl_4^-$ complex, which gives a slight positive charge to Cl, and $AlCl_4^-$ is negatively charged. This Cl^+ then reacts with the aromatic double bond of the benzene ring to form an additional product, followed by deprotonation to form chlorobenzene and $AlCl_3$ and HCl as the side products.



2.

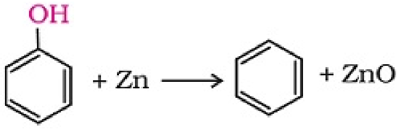
(b) Vitamin B_2

Explanation: Deficiency of Vitamin B_2 (Riboflavin) results in Cheilosis (fissuring at corners of mouth and lips).

3.

(c) benzene

Explanation: Phenol is reduced to benzene when it is distilled with zinc dust or its vapour is passed over granules of zinc at 400°C.

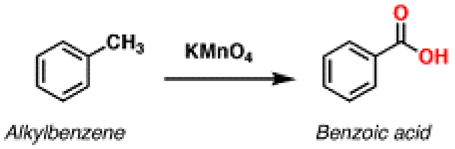


4.

(b) Benzoic acid

Explanation: Oxidation of aromatic alkanes with KMnO4 to give carboxylic acids.

Description: Treatment of an alkylbenzene with potassium permanganate results in oxidation to give the benzoic acid.



Key bonds formed	Key bonds broken
C-O(π)	C-H
C-O	C-H
C-OH	C-H

5.

(d) Zero order

Explanation: Zero order reaction proceeds with a uniform rate throughout.

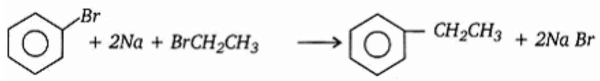
rate $=k[A]^0=k=$ constant.

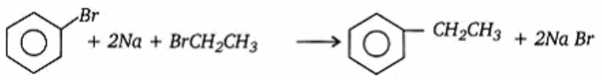
The rate of the reaction is independent of the reactant concentration.

6.

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

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

7. **(a)** 

Explanation: 

A mixture of an alkyl halide and aryl halide gives an alkylarene when treated with sodium in dry ether and is called Wurtz-Fittig reaction. In above reaction ethyl bromide and bromobenzene react with sodium in dry ether to give ethyl benzene.

8.

(c) Ag_2S

Explanation: Ag_2S is least soluble in water. It's K_{sp} (solubility product) in water is 6×10^{-51}. K_{sp} value indicates how soluble a compound is.

9.

(b) r = k[A][B]

Explanation: Rate of reaction is determined by slowest step.

10.

(c) CH_3CHO

Explanation: Aldehydes are more reactive toward nucleophilic addition reaction than ketones because of two main reasons:

i. steric hindrance - ketones are more sterically hindered than aldehydes thus aldehydes are more reactive towards nucleophilic addition reaction.

ii. Ketones have two alkyl groups that show +I effect and decrease the electron density on C and hence the rate of nucleophilic addition decreases in ketones compared to aldehydes.

If we have to compare aldehydes reactivity towards nucleophilic addition reaction then, steric hindrance has to be considered as steric hindrance increases, the reactivity of aldehydes decreases. So in the given question answer will be CH_3CHO.

11.

(d) C_6H_5OH

Explanation: Phenol is more soluble in NaOH than in water is because phenol is slightly more acidic than alcohols. The Ka for phenol in water is 1e-10 which is not very strong. But by mixing with NaOH, it causes the phenol to release the H+ to form sodium phenoxide.

12.

(c) NO^+_2

Explanation: NO^+_2 Nitronium ion electrophile initiates the process of nitration of benzene. It is obtained as:

$$\mathrm{H_2SO_4(conc.)} \longrightarrow \mathrm{H^+} + \mathrm{HSO_4^-}$$
$$\mathrm{H^+} + \mathrm{HNO_3} \longrightarrow \mathrm{H_2NO_3^+}$$
$$\mathrm{H_2NO_3^+} \longrightarrow \mathrm{NO_2^+} + \mathrm{H_2O}$$

13.

(c) A is true but R is false.

Explanation: A is true but R is false.

14.

(c) A is true but R is false.

Explanation: Aldol condensation is usually carried out in a dilute solution of a strong base.

The correct reason for the assertion is that for Cannizzaro reaction, a lack of α−H is necessary.

15.

(d) A is false but R is true.

Explanation: Haloalkanes react with AgCN to form alkyl isocyanides as the main product while KCN forms alkyl cyanides as the chief product.

16.

(c) A is true but R is false.

Explanation: Intermediate formed is dichlorocarbene.

Section B

17. The stability of coordination compound is measured in terms of stability constant.

Thus if we have a reaction of the type

$M + 4L \rightleftharpoons\ ML_4$

$\beta_4 = \frac{[ML_4]}{[M][L]^4}$

18. Zr, a member of the 4d series and Hf, a member of the 5d series, belong to the same group. Their chemical and physical properties are so similar that their separation is difficult. This is due to the fact that both have the same atomic size due to lanthanide contraction. The atomic radii of these elements are 160 pm(Zr) and 159 pm(Hf).

19. Answer the following:

(i) The rate law is R = k $[NO]^2$ $[H_2]$

(ii) Rate of reaction depends upon the concentration of reactant. As the reaction proceeds in forward direction concentration of reactant decreases, so rate of reaction decreases with respect to time.

20. M_B =Molecular mass of glucose, $C_6H_{12}O_6$

$= (6 \times 12) + (12 \times 1) + 6 \times 16) = 180\, g\, mol^{-1}$

w_B = mas of glucose = 0.520g

W_A = mass of water = 80.20g

K_f = 1.86KKg/mol

$\Delta T_f = \frac{K_f \times w_B \times 1000}{M_B \times w_A} = \frac{1.86 \times 0.520 \times 1000}{180 \times 80.20}$

= 0.0669

OR

Molarity = $C\ mol\ L^{-1}$ of the solution

Molality = $m\ mol\ kg^{-1}$ of the solvent

Dividing molarity by molality, the result

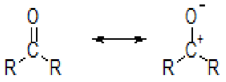
$\frac{C\, mol\, L^{-1} of\, the\, solution}{m\, mol\, kg^{-1}\ of\, the\, solution} = \frac{c}{m} kg$ of the solvent $L^{-1}$of the solution.

As mole fraction of the solvent is nearly unity, this means that the solution is very dilute and we can take mass of the solvent to be nearly equal to the mass of the solution. Hence, the above result.

$= \frac{c}{m} kg$ of the solution L^{-1} of the solution = density of the solution(p)

Hence, $\frac{c}{m} = \rho\, or\, c = \rho \times m$

21. A carbonyl group is an organic functional group composed of a carbon atom double-bonded to an oxygen atom. It is represented as > C = O. The simplest carbonyl groups are aldehydes and ketones. The carbonyl carbon is prone to additions and nucleophilic attack because or carbon's positive charge and oxygen's negative charge, as shown in its resonating structures:



Section C

22. Cell reaction is

$Ni(s)|Ni^{2+}\,(0.01M)\,||Cu^{2+}\,(0.1M)\,|Cu(s)$

At anode : $Ni(s) \rightarrow Ni^{2+}(aq) + 2e^-$

At cathode: $Cu^{2+}(aq) + 2e \rightarrow Cu(s)$

Net cell reaction

$Ni(s) + Cu^{2+}(aq) \rightarrow Ni^{2+}(aq) + Cu(s)$

$E_{cell} = E^0_{cell} - \frac{0.0591}{2} \log \frac{[Ni^{2+}]}{[Cu^{2+}]}$

$= [+0.34V - (-0.25V)] - \frac{0.0591}{2} \log \frac{1}{10}$

$= 0.59V - \frac{0.0591}{2} \times -1$

= 0.59 + 0.0295

= 0.6195V

$\Delta G = -nEF$

$= -2 \times 0.6195V \times 96500C/mol$

= -119563.5J/mol

$\Delta G = -119.5635KJ/mol$

$-\Delta G = W_{\text{max}} = 119.5635KJ/mol$

23. Rate = k$[A]^p$ $[B]^q$

On solving

a. Order with respect to A=2 , B=1

b. Rate = k[A]2 [B]1 ; overall order = 3

c. Experiment 1 : 4.2×10^{-2} = k $(0.2)^2$ (0.3) ; k=3.5

Experment 2 : 6.0×10^{-3} = k $(0.1)^2$ (0.1) ; k=6

24. i. $\underset{ethanol\ (excess)}{2CH_3CH_2OH} \xrightarrow[413K]{Conc.H_2SO_4} \underset{ethoxyethane}{CH_3CH_2-O-CH_2CH_3} + H_2O$

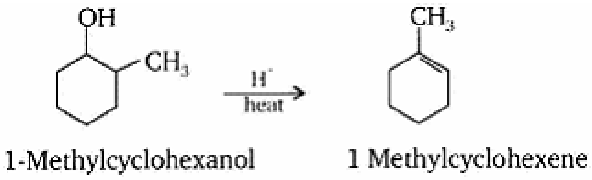
ii. $\underset{Alcohol}{2R'-OH} + 2Na \rightarrow 2R'-O-Na^+ + H_2$

iii. $R'-O^-Na^+ + R-X \xrightarrow{S_N2} R'-\underset{Ether}{O}-R + Na^+X^-$

Boiling points: Ethers are isomeric with monohydric alcohols but their boiling points are much lower than those of the isomeric alcohols. This is due to the reason that unlike alcohols, ethers do not form hydrogen bonds. As a result ethers do not show molecular association and hence have lower boiling point than corresponding alcohols.

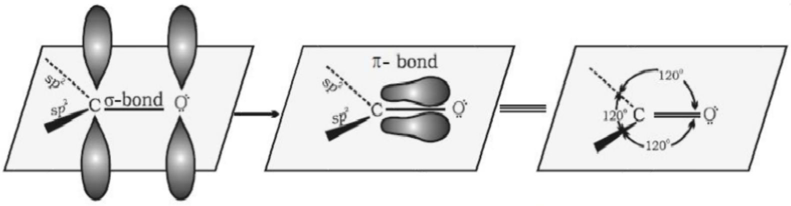
OR

i.



ii. $CH_3CH_2CH_2CH_2OH \xrightarrow{H^-} CH_3CH_2CH_2\overset{\oplus}{C}H_2 \leftrightarrow CH_3CH_2\overset{\oplus}{C}HCH_3 \xrightarrow{HSO_4^-} \underset{But-2-ene}{CH_3-CH=CH-CH_3}$

25. **Orbital diagram for the formation of carbonyl group:**

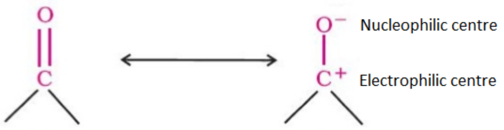


Orbital diagram for the formation of carbonyl group

i. **and**

ii. The carbonyl carbon atom is sp^2-hybridised and forms three sigma bonds. The fourth valence electron of carbon remains in its p-orbital and forms a pi-bond with oxygen by overlap with p-orbital of an oxygen. In addition, the oxygen atom also has two non bonding electron pairs. Thus the carbonyl carbon and the three atoms attached to it lie in the same plane and the pi-electron cloud is above and below this plane.

iii. The carbon-oxygen double bond is polarised due to higher electronegativity of oxygen relative to carbon. Hence, the carbonyl carbon is an electrophilic (Lewis acid) centre and carbonyl oxygen, a nucleophilic (Lewis base) centre.



26. Given, E_{cell} = 0.059 V: $E^\circ_{Cu^{2+}/Cu}$ = +0.34 and E^o (Ni^{2+}|Ni) = ?

$[Ni^{2+}]$ = 0.01M and $[Cu^{2+}]$ = 0.1M

By applying Nernst equation, We have

$E_{cell} = E^\circ_{cell} - \frac{0.059}{n} \log \frac{[Ni^{2+}(aq)]}{[Cu^{2+}(aq)]}$

$0.059 = E^{\circ}_{\text{cell}} - \frac{0.059}{2}\log\frac{(0.01)}{0.1}$ (∵ n = 2)

$0.059 = E^{\circ}_{\text{cell}} - \frac{0.059}{2}\log\frac{1}{10}$ [∵ $\log 10^{-1} = -1$]

∴ $0.059 = E^{\circ}_{\text{cell}} + 0.0295 \times 1$

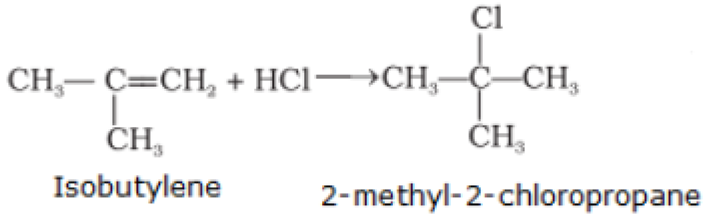
$E^{\circ}_{\text{cell}} = 0.059 - 0.0295 = 0.0295\ \text{V} \approx 0.03\ \text{V}$

Also, We have, $E^{\circ}_{\text{cell}} = E^{0}_{\text{cathode}} - E^{0}_{\text{anode}}$

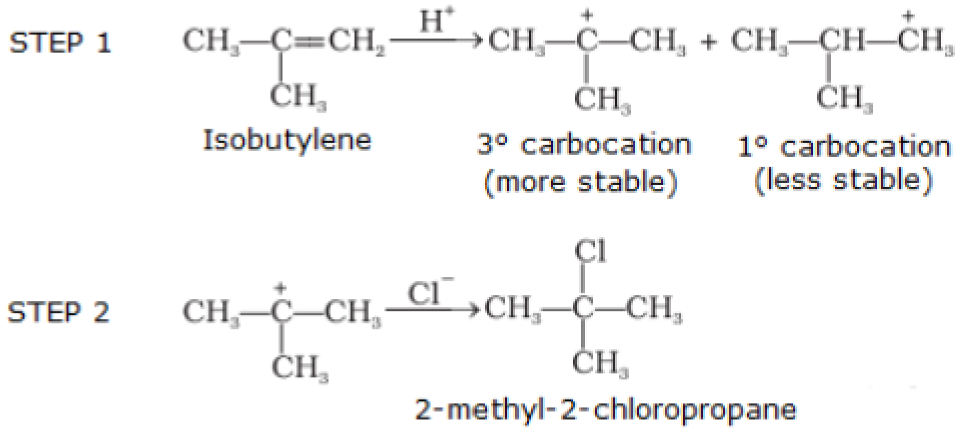
$0.03 = 0.34 - E^{0}_{\text{anode}}$

or $E^{0}_{\text{anode}} = E^{\circ}_{\text{Ni}^{2+}/\text{Ni}} = 0.34 - 0.03 = 0.31\ \text{V}$

27. The reaction of HCl with isobutylene gives 2-methyl-2-chloropropane:



The mechanism of this reaction is given as follows:



28. Applying the formula

$\Delta G^0 = -nE^0F$

$\Delta G^0 = +960KJ = 960 \times 10^3 J$

E° = ?

F = 96500 Cmol^{-1}

$\frac{4}{3}Al^{3+} + 4e^- = \frac{4}{3}Al$

$\Delta G^0 = -nE^0F$

$960 \times 10^3 J = -4 \times E^0 \times 96500$

$E^0_{cell} = \frac{-960 \times 10^3}{4 \times 96500}$

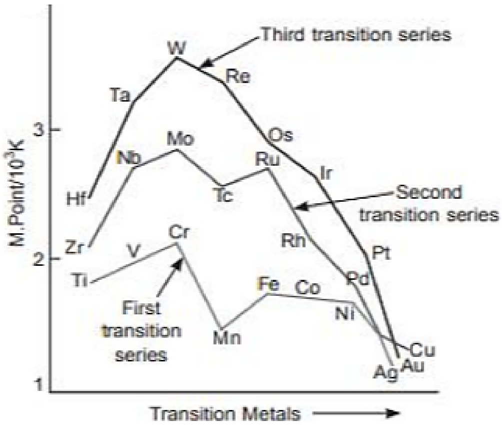
$E^0_{cell} = \frac{-9600}{3860}$

= - 2.48 V

Section D

29. **Read the text carefully and answer the questions:**

Observe the graph of transition metal and their melting points



(i) It is due to presence of most number of unpaired electrons and there is more frequent metal-metal bonding in 5d series than 3d and 4d series.

OR

It is due to smaller atomic size and higher ionisation enthalpies.

(ii) Zinc has lowest enthalpy of atomisation due to weak metallic bond which is due to absence of unpaired electrons.

(iii) It is due to larger size, absence of unpaired electron and weak interatomic attraction and weaker metallic bond.

30. **Read the text carefully and answer the questions:**

Aariv Sharma is very fond of a special drink made by his grandmother using different fruits available in their hometown. It has an outstanding taste and also provide great health benefits of natural fruits. He thought of utilizing his grandmother recipe to create a new product in the beverage market that provide health benefits and also contain fizziness of various soft drinks available in the market.

(i) Carbondioxide is a gas which provide fizz and tangy flavour. He can dissolve Carbondioxide gas in the drink.

(ii) Henry’s law which states that solubility of a gas in liquid is directly proportional to partial pressure of the gas.

(iii) Bottles should be sealed under high pressure of CO_2 and capping should be done perfectly to avoid leakage of CO_2 as any loss of partial pressure will result into decrease in solubility.

OR

$p_{He} = K_{Hx} \times X_{He}$

$= (144.97 \times 10^3 \text{ bar}) (1.2 \times 10^{-6})$

$= 0.174$ bar

Section E

31. Attempt any five of the following:

(i) Vitamin C cannot be stored in our body because it is water soluble. As a result, it is readily excreted in the urine.

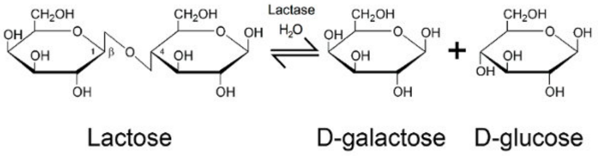
(ii) Sucrose on dydrolysis gives equimolar mixture of D-glucose and D-fructose.

$$\underset{Sucrose}{C_{12}H_{22}O_{11}} + H_2O \xrightarrow{H^+} \underset{Glu\cos e}{C_6H_{12}O_6} + \underset{Fructose}{C_6H_{12}O_6}$$

(iii) It is an enzyme whose deficiency causes mental redardation.

(iv) In starch α-glucose units are present, in cellulose β -D glucose units are present. In starch and glycogen glycosidic α-linkage is present between C1-C4 and in cellulose glycosidic β -linkage is present between glucose units.

(v) Hydrolysis of Lactose gives D-galactose and D-glucose.



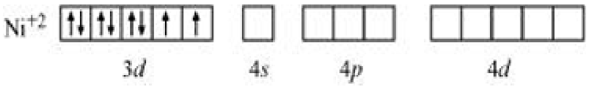
(vi) Monosaccharides: Ribose, 2-deoxyribose, galactose, fructose

Disaccharides: Maltose, lactose

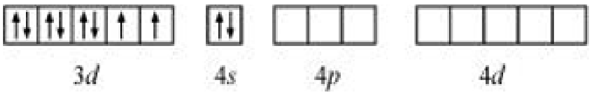
(vii) On prolonged heating with HI, glucose gives n-hexane which suggest that all the six carbon atoms in glucose are linked linearly.

$$\underset{Glu\cos e}{HOH_2C(CHOH)_4CHO} + HI \xrightarrow{\Delta} \underset{n-hexane}{CH_3(CH_2)_4CH_3}$$

32. Though both $[NICl_4]^{2-}$ and $[Ni(CO)_4]$ are tetrahedral, their magnetic characters are different. This is due to a difference in the nature of ligands. CN^- is a weak field ligand and it does not cause the pairing of unpaired 3d electrons. Hence, $[NICl_4]^{2-}$ is paramagnetic.



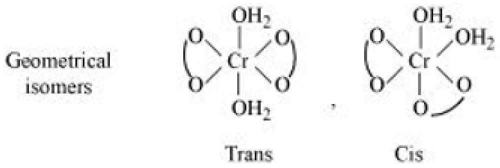
In $[Ni(CO)_4]$,Ni is in the zero oxidation state i.e., it has a configuration of $3d^8 4s^2$.



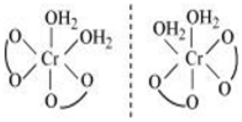
But CO is a strong field ligand. Therefore, it causes the pairing of unpaired 3d electrons. Also, it causes the 4s electrons to shift to the 3d orbital, thereby giving rise to sp^3hybridization. Since no unpaired electrons are present in this case, $[Ni(CO)_4]$ is diamagnetic.

OR

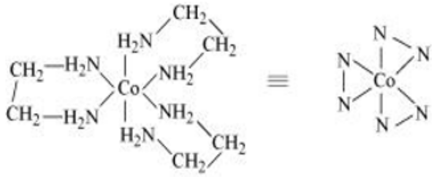
i. Both geometrical (cis-, trans-) isomers for k $[Cr(H_2O)_2(C_2O_4)_2]$ can exist. Also, optical isomers for cis-isomer exist.



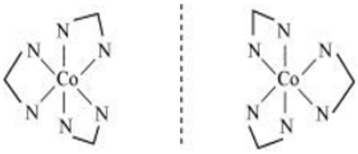
Trans-isomer is optically inactive. On the other hand, cis-isomer is optically active.



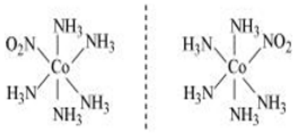
ii. Two optical isomers for $[Co(en)_3]Cl_3$ exist.



Two optical isomers are possible for this structure.

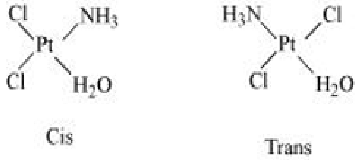


iii. $[CO(NH_3)_5(NO_2)](NO_3)_2$ $[Co(NH_3)_5(NO_2)(NO_3)_2]$ A pair of optical isomers:



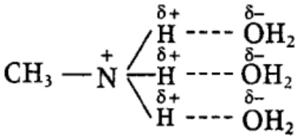
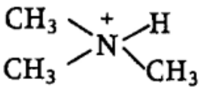
It can also show linkage isomerism. $[Co(NH_3)_5(NO_2)(NO_3)_2]$ and $[CO(NH_3)_5(ONO)](NO_3)_2$ It can also show ionization isomerism. $[Co(NH_3)_5(NO_2)(NO_3)_2]$ $[CO(NH_3)_5(NO_3)](NO_3)(NO_2)$

iv. Geometrical (cis-, trans-) isomers of $[Pt(NH_3(H_2O)Cl_2$ can exist.



33. The relative strength of CH_3NH_2, $(CH_3)_2NH$ and $(CH_3)_3N$ depends upon the stabilisation of their conjugate acids which depend on the number of factors like H-bonding, steric hindrance and +I-effect of the alkyl groups. All these factors are favourable for 2^o amines, therefore $(CH_3)_2NH$ is a stronger base than CH_3NH_2 and $(CH_3)_3N$. Since, $(CH_3)_3N$ does not have H-atom linked to N-

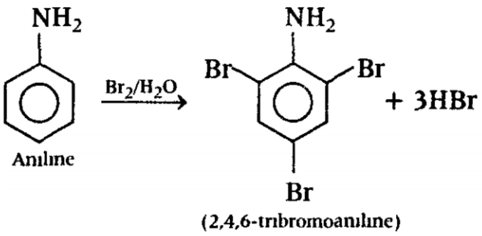
atom, therefore, the stabilisation of the conjugate acid-derived from CH_3NH_2 due to H-bonding is greater than that of the conjugate acid derived from $(CH_3)_3N$.

 is more stable than  .

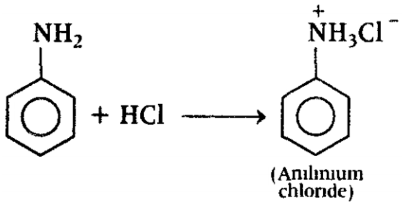
Further, in NH_3 no +I- group is linked to N-atom thus, it is least basic among all the given amines. Hence, the order would be: $(CH_3)_2NH > CH_3NH_2 > (CH_3)_3N > NH_3$.

OR

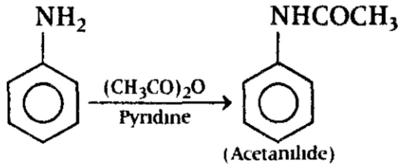
i. a.



b.



c.



ii. Increasing order of boiling point $(CH_3)_3N < C_2H_5NH_2 < C_2H_5OH$ Alcohols have a higher boiling point as compared to that of amines because oxygen being more electronegative forms stronger hydrogen bond as compared to that of nitrogen. In tertiary amine, there is no hydrogen bond formation due to the absence of H-atoms and hence, has the lowest boiling point.

iii. $(CH_3)_2NH$ and $(CH_3)_3N$ are secondary and tertiary amines respectively. These are distinguished by Hinsberg's reagent which gives sulphonamide with secondary amines and no reaction with tertiary amines. $(CH_3)_2NH$ reacts with benzene sulphonyl chloride to give N, N-dimethyl benzene sulphonamide, which is insoluble in alkali. The reaction is as follows: