Class XII Session 2025-26
Subject - Chemistry
Sample Question Paper - 1

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

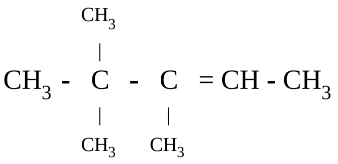
General Instructions:

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. Name the following compound as per the IUPAC system **[1]**



$$CH_3 - \underset{CH_3}{\overset{CH_3}{C}} - \underset{CH_3}{C} = CH - CH_3$$

a) 3, 4, 4 - trimethylpent - 2 - ene b) 2, 2, 3 - trimethylpent - 4 - ene

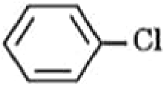
c) 4 diethyl, 2 - ethyl pentene d) 2 diethyl, 3 - ethyl pentene

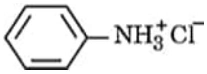
2. On hydrolysis, which of the following carbohydrates gives only glucose? **[1]**

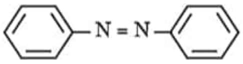
a) Lactose b) Starch

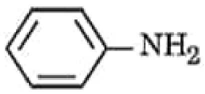
c) Sucrose d) Fructose

3. When nitrobenzene is heated with tin and concentrated HCl, the product formed is: **[1]**

a) 

b) 

c) 

d) 

4. What kind of compounds undergo Cannizaro reactions? **[1]**

a) Aldehydes with no α- hydroge b) Ketones with no α- hydrogen

c) Carboxylic acids with α- hydrogen d) Aldehydes with α- hydrogen

5. The rate law for a particular reaction is given as rate = $k[A][B]^2$. **[1]**

How is the rate of reaction affected if we double the concentration of B?

a) becomes half $\left(\frac{1}{2}\right)$

b) four times

c) three times

d) two times

6. Match the types of solutions given Column I to the examples given in Column II. **[1]**

Column I	Column II
(a) Solution of gas in gas	(i) Brass
(b) Solution of solid in solid	(ii) Air
(c) Solution of liquid in gas	(iii) Zinc amalgam
(d) Solution of liquid in solid	(iv) Chloroform in Nitrogen

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

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

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

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

7. Carbon tetrachloride has a dipole moment: **[1]**

a) μ = 0

b) μ = 1

c) μ = 4

d) μ = 2

8. The interstitial compounds of transition metals are **[1]**

a) more ductile

b) softer

c) harder

d) more metallic

9. Consider the reaction **[1]**

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

The equality relation between $\frac{d[NH_3]}{dt}$ and $\frac{-d[H_2]}{dt}$ is:

a) $\frac{d[NH_3]}{dt} = -\frac{3}{2}\frac{d[H_2]}{dt}$

b) $\frac{d[NH_3]}{dt} = -\frac{1}{3}\frac{d[H_2]}{dt}$

c) $\frac{d[NH_3]}{dt} = -\frac{2}{3}\frac{d[H_2]}{dt}$

d) $\frac{d[NH_3]}{dt} = -\frac{d[H_2]}{dt}$

10. Benzaldehyde and acetone can be best distinguished by using: **[1]**

a) Sodium hydroxide solution

b) 2, 4 – DNP reagent

c) Hydrazine

d) Tollen's reagent

11. Williamson's synthesis is used for the preparation of **[1]**

a) ethers

b) alkyl halides

c) aldehydes

d) alcohols

12. Which of the following would not be a good choice for reducing nitrobenzene to aniline? **[1]**

a) Sn and HCl

b) LiA/H_4

c) H_2/Hi

d) Fe and HCl

13. **Assertion (A):** Vitamin C cannot be stored in our body. **[1]**

Reason (R): Vitamin C is water soluble and readily excreted in urine.

a) Both A and R are true and R is the correct

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

c) A is true but R is false.
d) A is false but R is true.

14. **Assertion (A):** Isobutanal does not give the iodoform test. **[1]**

Reason (R): It does not have alpha-hydrogen.

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):** In monohaloarenes, further electrophilic substitution occurs at ortho and para positions. **[1]**

Reason (R): Halogen atom is a ring deactivator.

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 boiling point of ethanol is higher than that of dimethyl ether. **[1]**

Reason (R): Ethanol molecules are associated through hydrogen bonding whereas in dimethyl ether, it is not possible.

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. Visha took two aqueous solutions — one containing 7·5 g of urea (Molar mass = 60 g/mol) and the other containing 42.75 g of substance Z in 100 g of water, respectively. It was observed that both the solutions froze at the same temperature. Calculate the molar mass of Z. **[2]**

OR

Why are aquatic species more comfortable in cold water in comparison to warm water?

18. What is the basis of formation of spectro-chemical series? **[2]**

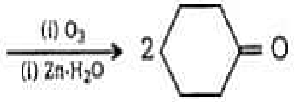
19. Transition metals can act as catalysts because these can change their oxidation state. How does Fe(III) catalyze the reaction between iodide and persulphate ions? **[2]**

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

(a)
a. In a reaction, if the concentration of reactant **X** is tripled, the rate of reaction becomes twenty-seven times. What is the order of the reaction? **[1]**
b. State a condition under which a bimolecular reaction is kinetically a first-order reaction. Give an example of such a reaction.

(b) For which type of reactions, order and molecularity have the same value? **[1]**

21. Complete the synthesis by giving missing starting material. **[2]**



Section C

22. In the button cell widely used in watches and other devices the following reaction takes place: **[3]**

$Zn(s) + Ag_2O(s) + H_2O(l) \rightarrow Zn^{2+}(aq) + 2Ag(s) + 2OH^-(aq)$

Determine $\Delta_r G^{(-)}$ and $E^{(-)}$ for the reaction

Given $Zn \rightarrow Zn^{2+} + 2e^-$, E^0 = 0.76V

Given $Ag \rightarrow Ag^+ + 2e^-$, E^0 = 0.344V

23. A reaction is first order in A and second order in B. **[3]**

a. Write the differential rate equation.
b. How is the rate affected on increasing the concentration of B three times?
c. How is the rate affected when the concentrations of both A and B are doubled?

24. A compound 'A' with molecular formula $C_4H_{10}O$ on oxidation forms compound 'B' gives positive iodoform test and on reaction with CH_3MgBr followed by hydrolysis gives (c). Identify A, B & C. **[3]**

OR

How can you convert the following?

i. Phenol to o-hydroxybenzaldehyde.
ii. Methanal to ethanol
iii. Phenol to phenyl ethanoate.

25. i. Illustrate the following reaction giving suitable chemical equations: Cannizzaro reaction. **[3]**

ii. How would you bring about the following conversions? Write the complete equations in each case.

a. Ethanal to 3-hydroxybutanal
b. Benzaldehydeto benzophenone

26. Calculate the potential of hydrogen electrode in contact with a solution whose PH is 10. **[3]**

27. Tert-Butylbromide reacts with aq. NaOH by S_N1 mechanism while n-butylbromide reacts by S_N2 mechanism. Why? **[3]**

28. Consider the reaction: **[3]**

$$Cr_2O_7^{2-} + 14H^+ + 6e^- \rightarrow 2Cr^{3+} + 7H_2O$$

What is the quantity of electricity in coulombs needed to reduce 1 mol of $Cr_2O_7^{2-}$?

Section D

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

Transition metals have incomplete d-subshell either in neutral atom or in their ions. The presence of partly filled d-orbitals in their atoms makes transition elements different from that of the non-transition elements. With partly filled d-orbitals, these elements exhibit certain characteristic properties such as display of a variety of oxidation states, formation of coloured ions and entering into complex formation with a variety of ligands. The transition metals and their compounds also exhibit catalytic properties and paramagnetic behaviour. The transition metals are very hard and have low volatility. An examination of the $E^o_{\frac{M^{2+}}{M}}$ values shows the varying trends:

$E^o_{\frac{M^{2+}}{M}}$	
V	-1.18
Cr	-0.91
Mn	-1.18
Fe	-0.44
Co	-0.28

Ni	-0.25
Cu	+0.34
Zn	-0.76

Answer the following questions:

a. On what basis can we say that Cu is a transition element but Zn is not? (Atomic number: Cu = 29, Zn = 30) **(1)**

b. Why do transition elements show variety of oxidation states? **(1)**

c. i. Why do $E^{o}_{\frac{M^{2+}}{M}}$ values show irregular trend from Vanadium to Zinc?

ii. How is the variability in oxidation states of transition metals different from that of the non-transition elements? **(2$\times$1 = 2)**

OR

i. Of the d^4 species, Cr^{2+} is strongly reducing while Mn^{3+} is strongly oxidizing. Why? (Atomic number: Cr = 24, Mn = 25)

ii. Complete the following ionic equation: **(2$\times$1 = 2)**

$2MnO_4^- + H_2O + I^- \longrightarrow$

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

The colligative properties of electrolytes require a slightly different approach than the one used for the colligative properties of non-electrolytes. The electrolytes dissociate into ions in solution. It is the number of solute particles that determines the colligative properties of a solution. The electron solutions, therefore, show abnormal colligative properties. To account for this effect we define a quantity called the van't Hoft factor, given by

i = $\frac{Actual\ number\ of\ particles\ in\ solution\ after\ dissociation}{Number\ of\ formula\ units\ initially\ dissolved\ in\ solution}$

i = 1 (for non-electrolytes);

i > 1 (for electrolytes, undergoing dissociation)

i < 1 (for solutes, undergoing association).

i. 0.1M $K_4[Fe(CN)_6]$ is 60% ionized. What will be its van't Hoff factor? (1)

ii. When a solution of benzoic acid dissolved in benzene such that it undergoes in molecular association and its molar mass approaches 244. In which form Benzoic molecules will exist? (1)

iii. How does van't Hoff factor **i** and degree of association **a** are related if benzoic acid undergoes dimerisation in benzene solution? (i = $1\frac{-\alpha}{2}$ or i = 1 + α) (2)

OR

What do you mean by colligative properties of solutions? (2)

Section E

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

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

(b) α-Helix is a secondary structure of proteins formed by twisting of the polypeptide chain into right-handed screw like structures. Which type of interactions is responsible for making the α-helix structure stable? **[1]**

(c) Which polymer is stored in the liver of animals? **[1]**

(d) Amino acids can be classified as $\alpha-, \beta-, \gamma-, \delta-$ and so on depending upon the relative position of **[1**] the amino group with respect to the carboxyl group. Which type of amino acids forms a polypeptide chain in proteins?

(e) Deficiency of which vitamin causes night-blindness. **[1]**

(f) Name the vitamin whose deficiency causes convulsions. **[1]**

(g) Name the base that is found in nucleotide of RNA only. **[1]**

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

OR

a. Write IUPAC name for each of the following complexes:
   i. $[Ni(NH_3)_6]CI_2$
   ii. $K_3[Fe(CN)_6]$
   iii. $[Co(en)_3]^{3+}$

b. Draw one of the geometrical isomers of the complex $[Pt(en)_2CI]^{2+}$ which is optically inactive. Also write the name of this entity according to the IUPAC nomenclature.

33. i. Give one chemical test to distinguish between ethylamine and aniline. **[5]**

ii. Describe a method for the identification of primary, secondary and tertiary amines. Also, write chemical equations of the reactions involved.

OR

a. Give plausible explanation for each of the following:
   i. Why are amines less acidic than alcohols of comparable molecular masses?
   ii. Why are primary amines highest boiling than tertiary amines?
   iii. Why are aliphatic amines stronger bases than aromatic amines?

b. Complete the following reactions:
   i. $C_6H_5N_2Cl + C_2H_5OH \rightarrow$
   ii. $C_6H_5NH_2 + (CH_3CO)_2O \rightarrow$

Solution

Section A

1. **(a)** 3, 4, 4 - trimethylpent - 2 - ene

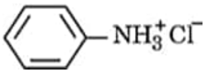
   Explanation:

   The longest chain contains a double bond and five carbon i.e pent-2-ene and 2 methyl is attached to the 4th carbon and one is attached to 3rd carbon. Therefore IUPAC name is 3, 4, 4 - trimethylpent - 2 - ene.

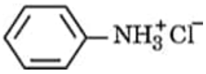
2. **(b)** Starch

   Explanation:

   Starch is a polymer of D-glucose units, thus on hydrolysis it only gives glucose.

3. **(b)** 

   Explanation:

4. **(a)** Aldehydes with no α- hydroge

   Explanation:

   Aldehydes with no α-hydrogen undergo Canizzaro reaction.

5. **(b)** four times

   Explanation:

   four times

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

   Explanation:

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

7. **(a)** μ = 0

   Explanation:

   CCl_4 is a symmetrical molecule. Hence, the dipole moment is zero.

8. **(c)** harder

   Explanation:

   A number of interstitial compounds are formed by the transition metals. Transition metals react with elements such as hydrogen, carbon, nitrogen, boron etc. to form interstitial compounds. As vacant spaces of the transition metals are filled up by small atoms, these compounds are hard and rigid.

9. **(c)** $\frac{d[NH_3]}{dt} = -\frac{2}{3}\frac{d[H_2]}{dt}$

   Explanation:

   For the given reaction,

   $rate = -\frac{1}{2}\frac{d[N_2]}{dt} = -\frac{1}{3}\frac{d[H_2]}{dt} = \frac{1}{2}\frac{d[NH_3]}{dt}$

10.

(d) Tollen's reagent

Explanation:

Tollen's Test is used to distinguish between aldehyde and ketone. It uses the fact that aldehydes are easily oxidised to their corresponding acids while ketones are not.

Tollen's reagent is aqueous ammonical silver nitrate solution which reacts with aldehydes as shown.

$RCHO + 2Ag^+ + 2OH^- \rightarrow RCOO^- + Ag + H_2O$.

$RCOR + 2Ag^+ + 2OH \rightarrow$ No reaction

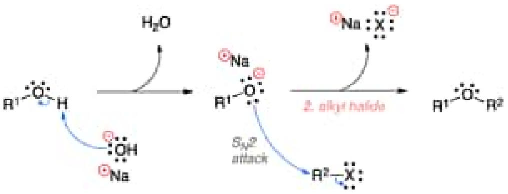
If this test is carried in a glass tube, the Ag formed forms a mirror on the sides of the test tube so the test is also known as the silver mirror test.

Aldehydes show Tollen’s test while acetone which is a ketone does not give Tollen’s test.

11. **(a)** ethers

Explanation:

The Williamson ether synthesis is an organic reaction, forming an ether from an organohalide and deprotonated alcohol (alkoxide). This reaction was developed by Alexander Williamson in 1850. Typically it involves the reaction of an alkoxide ion with a primary alkyl halide via an $S_N{}^2$ reaction.



12.

(b) LiA/H_4

Explanation:

LiA/H_4

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.

(c) A is true but R is false.

Explanation:

Isobutanal does not give an iodoform test because it does not have the $-COCH_3$ group.

15.

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

Explanation:

Halogens are ortho-para directing due to (+M) or (+R) effect. Moreover, they are deactivating due to high electronegativity.

16. **(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.

Section B

17. $\triangle T_f$ = molality $\times$ K_f

Since $\triangle T_f$ is same for both solutions,

i.e. $\triangle T_{f_1} - \Delta T_{f_2}$ (given)

molality$_{(urea)} \times K_f$ = molality$_{(x)} \times K_f$

$$\frac{\frac{7}{60}\times 1000}{100} = \frac{\frac{42}{M_{w(x)}}\times 1000}{100}$$

$M_W = \frac{42\times 60}{7}$ = 360 gm

Hence, molar mass of Z = 360gm.

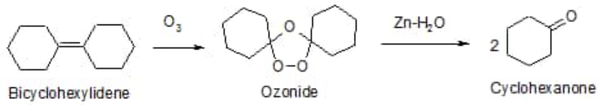
OR

At a given pressure the solubility of oxygen in water increases with a decrease in temperature. Therefore, the concentration of oxygen in the sea is more in cold water and thus the presence of more oxygen at a lower temperature makes the aquatic species more comfortable in cold water.

18. **Spectrochemical series:** The arrangements of ligands in order of their increasing field strength, i.e. increasing crystal field splitting energy (CFSE) value is called spectrochemical series.
Crystal field splitting energy is the basis of formation of the spectrochemical series.

19. Transition metals can act as catalysts because these can change their oxidation state. The reaction between iodide and persulphate ions catalyzes by Fe is as follows:
$2I^- + S_2O_8^{2-} \xrightarrow{Fe(III)} I_2 + 2SO_4^{2-}$
Role of Fe(III) ions:
$2Fe^{3+} + 2I^- \longrightarrow 2Fe^{2+} + I_2$
$2Fe^{2+} + S_2O_8^{2-} \longrightarrow 2Fe^{3+} + 2SO_4^{2-}$

20. Answer the following:
    (i) a. Rate = $k[X]^p$
    27 Rate = $k[3X]^p$
    $\therefore 27 = 3^p$
    $(3)^3 = 3^p$
    p = 3 Third order
    b. When one of the reactants is in excess.
    Example: Hydrolysis of ester/ sucrose
    (ii) Elementary reactions have the same value of order and molecularity because the elementary reaction proceeds in a single step.

21.


Section C

22. Zn is oxidized and Ag_2O is reduced (as Ag^+ions change to Ag)
$E^0_{cell} = E^0[Ag_2O/Ag](red) + E^0[Zn/Zn^{2+}](ox)$
= 0.344 + 0.76
= 1.104 V
$\Delta_r G^0 = -nFE^0 cell = -2 \times 96500 \times 1.104 J$
$= -2.13 \times 10^5 J$

23. It is given that a reaction is first order in A and second order in B.
    a. The differential rate equation will be
    $-\frac{d[R]}{dt} = k[A][B]^2$
    b. If the concentration of B is increased three times, then
    $-\frac{d[R]}{dt} = k[A][3B]^2 = 9.k[A][B]^2$
    Therefore, the rate of reaction will increase 9 times.
    c. When the concentrations of both A and B are doubled,
    $-\frac{d[R]}{dt} = k[A][B]^2 = k[2A][2B]^2 = 8.k[A][B]^2$
    Therefore, the rate of reaction will increase 8 times.

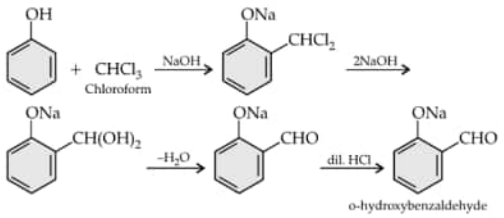
24. The compound 'B' is obtained by oxidation of $C_4H_{10}O$ and gives positive iodoform test and also reacts with CH_3MgBr,it must be methyl Ketone , it must be methyl ketone having four carbon atoms i.e, $CH_3COCH_2CH_3$ This can be obtained by oxidation of 2 –

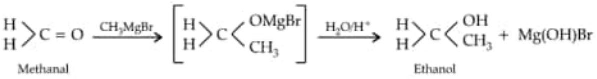
butanol i.e , $CH_3\underset{\underset{HO}{|}}{CH}\ CH_2CH_3$ Therefore , the reactions are.

$$H_3C-CH_2-\underset{\underset{OH}{|}}{CH}-CH_3 \xrightarrow[oxidation]{(o)} CH_3CH_2\,CH_3CH_2-\underset{\underset{O}{||}}{C}-CH_3 \xrightarrow[H_2O/H^+]{CH_3MgBr} CH_3CH_2-\overset{\overset{CH_3}{|}}{\underset{\underset{OH}{|}}{C}}-CH_3$$

OR

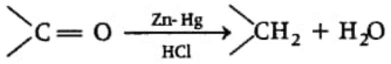
i. By Reimer-Tiemann reaction:

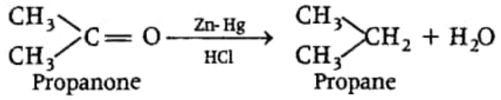


ii. Methanal to ethanol 

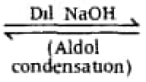
iii. Phenol to phenyl ethanoate.$C_6H_5OH + \underset{Acetic\ anhydride}{(CH_3CO)_2O} \to \underset{Phenylethanoate}{CH_3COOC_6H_5} + CH_3COOH$

25. i. **Clemmensen reduction** The carbonyl group of aldehydes and ketones is reduced to -CH_2 group on treatment with zinc-amalgam and concentrated hydrochloric acid. This reaction is known as Clemmensen reduction.

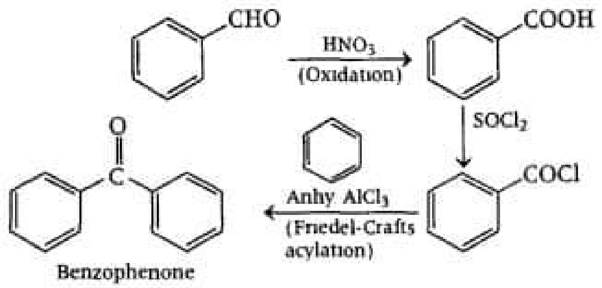


e.g.  .

ii. a. **Ethanal to 3-hydroxybutanal**

$\underset{Ethanal}{2CH_3-CHO}$  $\overset{4}{C}H_3 - \underset{\underset{\underset{3-hydroxybutanal}{OH}}{|}}{\overset{3}{C}}\ H - \overset{2}{C}H_2 - \overset{1}{C}HO$

b. **Benzaldehyde to benzophenone**



26. For hydrogen electrode:

$H^+ + e^- \to \frac{1}{2}H_2$

Applying Nernst equation:

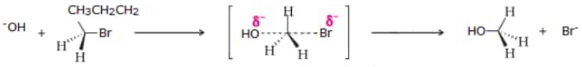
$E = E^0 - \frac{0.0591}{n}\log\frac{1}{[H^+]}$

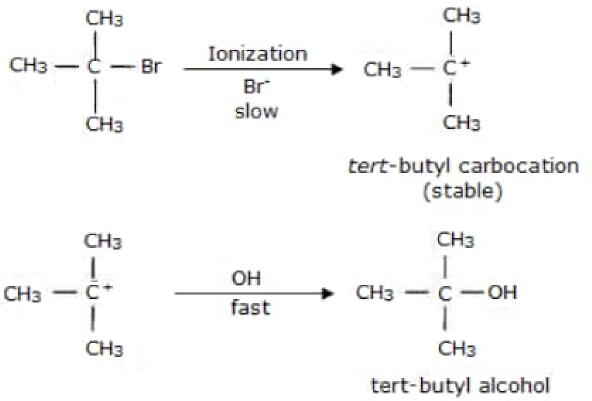
$= 0 - \frac{0.0591}{1}\log\frac{1}{10^{-10}}$ [pH = 10 means $[H^+]$

$= 10^{-10}M$

$= -0.0591 \times 10 = -0.591V$

27. Tert-butylbromide undergoes substitution by S_N1 unimolecular substitution mechanism because it is able to form a stable carbocation in the first step after cleavage of the halide group. The carbocation then reacts with the nucleophile OH^-. On the other hand, primary halide n-butylbromide cannot form a stable carbocation so it undergoes S_N2 bimolecular substitution mechanism, which is a one-step substitution that involves the attack of OH^- and simultaneous leaving of X^- to form n-butyl alcohol.





28. From the given reaction
    1 mol of $Cr_2O_7^{2-}$ ions requires
    $6F = 6 \times 96500\ C$
    = 579000 C of electricity for reduction of Cr^{3+}.

Section D

29. a. Cu has incomplete d-orbital in +2 oxidation state whereas Zn has fully filled d-orbital in ground state as well as in +2 oxidation state.
    b. Because both (n-1)d and ns subshell electrons take part in the bond formation due to their comparable energies/ due to the presence of unpaired electrons in d-orbitals.
    c. i. Because of irregular values of $(\triangle_i H_1 + \triangle_i H_2)$ and sublimation enthalpies.
       ii. In transition metals, oxidation states differ by +1 whereas in non-transition metals differ by +2.

OR

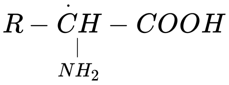
i. Because Cr^{2+} will be converted to Cr^{3+} which has more stable half filled t_{2g} configuration while Mn^{3+} changes to Mn^{2+} which has more stable half-filled d^5 configuration.
ii. $2MnO_4^- + H_2O + I^- \longrightarrow 2\ MnO_2 + 2\ OH^- + IO_3^-$

30. i. We know, x = $\frac{i-1}{n-1}$
    Where, n = 5 and x = 0.6 ($\because$ 60% = $\frac{60}{100}$ = 0.6 ionized)
    So, 0.6 = $\frac{i-1}{5-1}$
    $0.6 \times 4 = i - 1$
    2.4 = i - 1
    2.4 + 1 = i
    i = 3.4
    ii. Benzoic molecules exist as a dimer.
    iii. i = $1\frac{-\alpha}{2}$

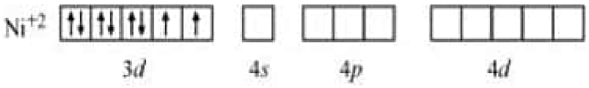
OR

The properties of solutions that depend on the ratio of the number of solute particles to the number of solvent molecules in a solution and not on the nature of the chemical species is termed as colligative properties.

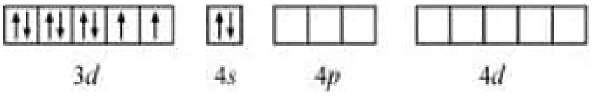
Section E

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) In α-helix structure of the protein, a polypeptide chain is stabilized by the formation of intramolecular H-bonding by twisting into right-handed screw with -NH- group of amino acids in one turn with the >C = O groups of amino acids belonging to adjacent turn.
    (iii) Glycogen is stored in liver of animals. In the liver, glycogen can make up 5-6% of the organ's fresh weight, and the liver of an adult, weighing 1.5 kg, can store roughly 100-120 grams of glycogen.
    (iv) α-Amino acid,  $R - \underset{NH_2}{\underset{|}{\dot{C}H}} - COOH$ forms a polypeptide chain in the proteins.
    (v) Vitamin A
    (vi) B_6 / Pyridoxine
    (vii) Uracil.

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 $3d^8 4s^2$.

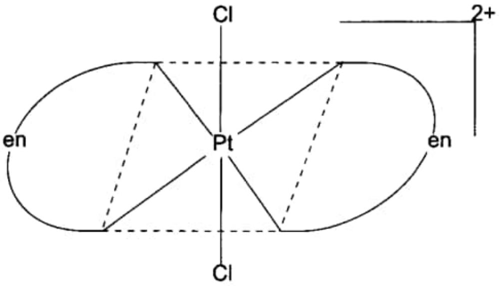


But CO is a strong field ligand. Therefore, it causes the pairing of unpaired 3d electrons. Also, it causes the 4s electrons to shift to the 3d orbital, thereby giving rise to sp^3hybridization. Since no unpaired electrons are present in this case, $[Ni(CO)_4]$ is diamagnetic.

OR

a. i. Hexaaminenickel (II) chloride
   ii. Potassium hexacyanidoferrate (III)
   iii. Tris(ethane-1,2-diamine)cobalt (III) ion

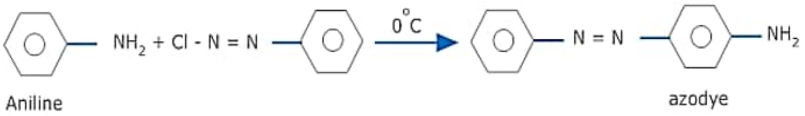
b.

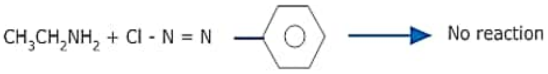


trans-$[Pt(en)_2Cl_2]^{2+}$

IUPAC Name of the entity:
Dichloridobis (ethane-1,2-diamine platinum

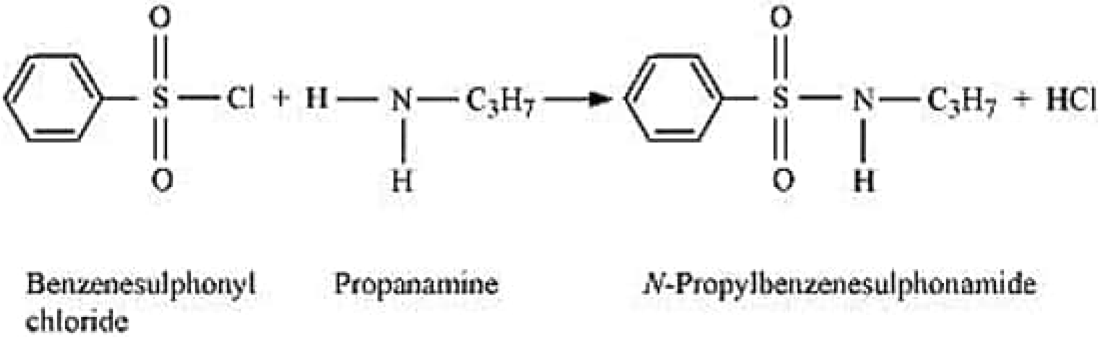
33. i. Ethylamine and aniline can be distinguished by the azo-dye test. On treating aniline with a benzene diazonium salt, orange or red coloured azo-dye is formed which is not formed with ethylamine.



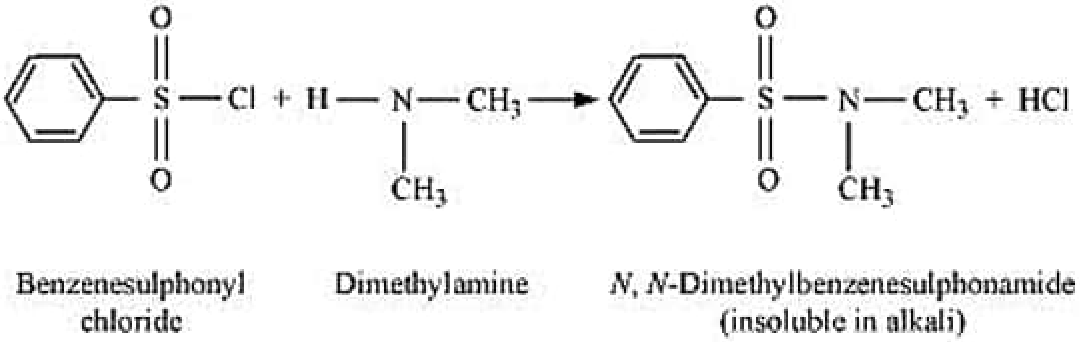


ii. Primary, secondary and tertiary amines can be identified and distinguished by Hinsberg's test. In this test, the amines are allowed to react with Hinsberg's reagent (benzene sulphonyl chloride $C_6H_5SO_2Cl$).

a. Primary amines react with benzene sulphonyl chloride to form N-alkyl benzene sulphonamide which is soluble in alkali.



b. Secondary amines react with Hinsberg's reagent to form N, N-dialkyl benzene sulphonamide which is insoluble in alkali.



c. Tertiary amines do not react with Hinsberg's reagent.

OR

a. i. Loss of proton from amines give ion whereas loss of a proton from alcohol gives an alkoxide ion.

Since O is more electronegative than N, therefore, RO^- can accommodate the -ve charge more easily than RNH^-.

Consequently, RO^- is more stable than RNH^-. Thus, alcohols are more acidic than amines.

ii. Primary amines (RNH_2) have two hydrogen atoms on the N atom and therefore, form intermolecular hydrogen bonding.

Tertiary amines (R_3N) donot have hydrogen atoms on the N atom and therefore, these donot form hydrogen bonds. As a result of hydrogen bonding in primary amines, they have higher boiling points than tertiary amines of comparable molecular mass.

iii. Both arylamines and alkylamines are basic in nature due to the presence of lone pair on N-atom. But arylamines are less basic than alkylamines.

b. i. $C_6H_5N_2Cl + C_2H_5OH \xrightarrow{Reduction} \underset{Benzene}{C_6H_6} + \underset{Ethanal}{CH_3CHO} + N_2 + HCl$

ii. $C_6H_5NH_2 + (CH_3CO)_2O \xrightarrow{CH_3COOH} \underset{Ace\tan ilide}{C_6H_5CONHCH_3} + CH_3COOH$