"Comprehensive Support Learning Material for Students in Chemistry subject seeking to Overcome Past Setbacks."

Subject: Chemistry(55)

Prepared by: State Council of Educational Research and Training,Maharashtra (SCERT- Pune)

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"Comprehensive Support Learning Material for Students in Chemistry Subject Seeking to Overcome Past Setbacks."

‘QUESTION BANK’

SUBJECT:- CHEMISTRY (55)

OBJECTIVES OF THE QUESTION BANK :

This **QUESTION BANK** is prepared for the help of the students who will be appearing for the Supplementary Examination to be held in July 2024 and thereafter too. It is prepared as such students could not score the minimum score to pass in the written examination or even to score marks required for eligibility in entrance examination.

This **QUESTION BANK** is designed to boost the confidence of the students. It will definitely help them to score good marks in the forthcoming examination. It will be a great support for the students who lack behind others.

It is prepared in a systematic and easiest way by the expert teachers. The students are aware of the textbook as well as the examination pattern (four different sections). Still, this **QUESTION BANK** elaborates every segment in detail. It considers the level of the students.

By preparing questions in the **QUESTION BANK**, we are quite sure that the students will be able to score good marks.

The main objectives can be summarized as under:

1) To facilitate the essential questions that will help students to understand similar questions in the examination.
2) To help every average and the below average student to achieve 100% success at the HSC Board Examination.
3) To motivate the below average students to score more than their expectation in the Chemistry Subject which they find as most difficult.
4) To help the teachers to reach out to students who struggle to pass in the Chemistry subject at the HSC Board Exam with the help of this material.
5) Sample papers based on each chapter with hints and answers are given.
6) Model question paper will definitely help students.

INTRODUCTION

Dear Students,

It does not matter if you did not score well in the regular examination held in February 2024. Remember, "every setback is a setup for a comeback." Your previous attempt must have taught you something valuable. We believe in your potential to overcome this hurdle and excel in your upcoming exams.

After a comprehensive analysis of the results, SCERT, Pune has taken an initiative for the upliftment of students who could not achieve the minimum passing score.

Use this QUESTION BANK, seek help when needed, and stay committed to your studies. Underline all answers in your textbook. This material will also prove to be extremely useful for teachers as they assist students in preparing for the supplementary examination. It will boost your confidence to appear for the exam once again. New students in the coming years can also benefit from this QUESTION BANK.

Best wishes for your journey ahead.

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PART-A

"Comprehensive Support Learning Material for Students in Chemistry Subject Seeking to Overcome Past Setbacks."

OBJECTIVES OF THE BOOKLET:

This booklet is prepared for the students to help, who will be appearing for the Supplementary HSC Examination to be held in July 2024 and thereafter too. It is prepared as such students could not get the minimum score (35 Marks) to pass in the written HSC examination held in February 2024..

This booklet is designed to enhance student's confidence and aid them in achieving high marks in the upcoming HSC examination. It will be especially beneficial for those who are currently lagging their peers.

Expert teachers have systematically and clearly prepared the content to ensure ease of understanding. While students are familiar with their textbook and the examination format (including Very Short Answer (VSA 1 Mark), Short Answer Type-I (2-Mark),and Short Answer Type-II (3-Mark)), this booklet provides detailed explanations for each section, tailored to the students level.

By following the study methods outlined in this booklet, we are confident that students will be able to practice extensively and achieve excellent results, paving their way to success.

The main objectives can be summarized as under:

1) Provide essential study materials to help students confidently face the HSC Board Examination.
2) Support every average and below-average student in achieving 100% success in the HSC Board Examination.
3) Motivate below-average students to exceed their expectations in Chemistry, a subject they find particularly challenging.
4) Include tools and exercises that allow students to assess their progress and identify areas for improvement.
5) Assist teachers in reaching students who struggle to pass Chemistry in the HSC Board Exam using this material.
6) Each chapter in the booklet summarizes important concepts.
7) Practice questions with answers are included.
8) Two practice Model question papers are included to further aid students.

Maharashtra State Board of Secondary and Higher Secondary Education, Pune
Sub. : Chemistry (55)
Std. XII

Chapterwise Distribution Of Marks				
Area	Topic No.	Unit	Weightage of Unit Without Option	Weightage of Units With Option
Physical Chemistry	1	Solid State	3	5
	2	Solutions	4	6
	3	Ionic Equilibria	4	6
	4	Chemical Thermodynamics	6	8
	5	Electrochemistry	5	7
	6	Chemical Kinetics	4	6
			26	**38**
Inorganic Chemistry	7	Elements of Group 16,17 & 18	6	8
	8	Transition & Inner Transition Elements	6	8
	9	Coordination Compounds	5	7
			17	**23**
Organic Chemistry	10	Halogen Derivatives	5	7
	11	Alcohols , Phenols and Ethers	4	6
	12	Aldehydes , Ketones and Carboxylic acids	6	8
	13	Amines	3	4
			18	**25**
Applied Chemistry	14	Biomolecules	3	4
	15	Introduction to Polymer Chemistry	3	4
	16	Green Chemistry and Nano Chemistry	3	4
			09	**12**
			70	**98**

Question Paper format for HSC Board Examination

General Instructions: The question paper is divided into ***four*** sections

1.Section A: **Q.No.1** contains ***Ten*** Multiple Choice Questions carrying **One** mark each.

Q.No.2 contains ***Eight*** very short answer type of questions carrying **One** mark each.

2. **Section B: Q.No.3 to Q.No.14** contains ***Twelve*** short answer type of questions carrying **Two** marks each. (*Attempt* ***any Eight***)

3. **Section C: Q.No.15 to Q.No.26** contains ***Twelve*** short answer type of questions carrying **Three** marks each. (*Attempt* ***any Eight***)

4. **Section D: Q.No. 27 to 31** contains ***Five*** long answer type of questions carrying ***Four*** marks each. (*Attempt* ***any Three***)

5. Use of a log table is allowed. Use of a calculator is **not** allowed.

6. Figures to the right indicate full marks

7.For *multiple choice type of questions, Only the first attempt will be considered for evaluation.*

8. Start answer to each section on a new page.

9. Physical constants. 1.---------- 2.--------- 3.----------4.----------

Section A

Q. No. 1 Select and Write the correct answer: (10)

(i) to (x) MCQ (Two Numerical)

Q. No. 2 Answer the following: (08)

(i) to (viii) VSA (One Numerical)

Section B

Attempt any Eight: (16)

Q. No. 3 to Q. No. 14 SA - I (Two Numerical)

Section C

Attempt any Eight: (24)

Q. No.15 to Q. No. 26 SA - II (Two Numerical)

Section D

Attempt any Three: (12)

Q. No.27 to Q. No. 31 LA (One Numerical in sub question of 2 Marks)

Note: - Numerical should be of maximum (12 to 15 Marks).

Numerical should be included in each section.

PART-B

QUESTION BANK FOR REPEATER STUDENTS

1.Solid State **Marks-3 with option 5**

1.Differentiate between crystalline and amorphous solids . (2M)

Ans:

Crystalline Solids	**Amorphous Solids**
1.They have definite geometrical shape	1.They do not have definite geometrical shape
2.They have sharp melting points.	2. They melt over a range of temperatures.
3. They are anisotropic.	3. They are isotropic.
4. They are pure solids.	4. They are supercooled liquids.

2.Explain the terms: a) Isomorphism b) Polymorphism with examples.(2M)

Ans.: **a) Isomorphism**: Two or more substances having the same crystal structure are said to be isomorphous and this property of solid is called isomorphism.

In these substances the chemical composition has the same atomic ratio

e.g. NaF and MgO are isomorphous pairs and have the same atomic ratio 1:1

b) Polymorphism: A single substance that exists in two or more forms or crystalline structures is said to be polymorphous this property of solid is called polymorphism

Polymorphism occurs in elements called allotropy.

e.g. Carbon has three allotropes Diamond, Graphite and Fullerene.

3.Define: a) Diamagnetic solids b) Paramagnetic solids (Each 1 Mark)

Ans: **a) Diamagnetic Solids:** The substances with all electrons paired, are weakly repelled by magnetic fields. These substances are called diamagnetic substances.

b) Paramagnetic Solids:The substances with unpaired electrons are weakly attracted by magnetic fields .These substances are called paramagnetic substances.

4. What is Schottky defect.Write consequences of Schottky defect. (1+2M)

Ans.:**Schottky defect:** The defect in which an equal number of cations and anions are missing from their regular positions in the crystal lattice of an ionic solids and creating vacancies is called Schottky defect.

Consequences of Schottky defect:

- As the number of ions decreases mass decreases but volume remains the same hence the density of a substance decreases.
- The number of missing cations and anions is equal to the electrical neutrality of the compound is preserved.

  e.g. Defects found in NaCl, AgBr

5.What is Frenkel defect.Write consequences of the Frenkel defect. (1+2M)

Ans.: **Frenkel defect:**When an ion of an ionic compound is missing from its regular site and occupies interstitial position between lattice points then Frenkel defects arise.

Consequences of the Frenkel defect:

- As no ions are missing from the crystal lattice as a whole the density of solid and its chemical properties remain unchanged.
- As an equal number of cations and anions are present the crystal is electrically neutral.

6. Explain the following terms: (Each 1M)

a) Substitutional impurity defect b) Interstitial impurity defect.

Ans.: **a) Substitutional impurity defect:** In these defects the foreign atoms are found at the lattice sites in place of host atoms. The regular atoms are displaced from their lattice sites by impurity atoms.

Eg. Alloy of Cu and Zn . In this alloy Cu atoms are replaced by impurity of Zn atoms.

b) Interstitial impurity defect: In these defects the impurity atoms occupy interstitial spaces of lattice structure.

Eg. In steel Fe atoms occupy normal lattice sites while Carbon atoms are present at interstitial spaces.

7.Write the number of particles present in each of scc, bcc and fcc, unit cells. (Each 1 M)

Ans.:

Unit Cell	Number of Particles
Simple Cubic (sc)	1
Body Centered Cubic (bcc)	2
Face Centered Cubic (fcc)	4

8.Write the relationship between ‘a’ and ‘r’ for sc,bcc and fcc unit cells.(Each 1 M)

Ans.:

Unit Cell	Relation between ‘a’ and ‘r’
Simple Cubic (sc)	r= a/2
Body Centered Cubic (bcc)	r= $\sqrt{3}a/4$
Face Centered Cubic (fcc)	r= $\sqrt{2}a/4$

9. Write the Coordination number of atoms in sc,bcc and fcc crystal lattice.(Each 1 M)

Ans.:

Unit Cell	Coordination Number ’
Simple Cubic (sc)	6
Body Centered Cubic (bcc)	8
Face Centered Cubic (fcc)	12

10. Write the packing efficiency in sc,bcc and fcc crystal lattice.(Each 1 M)

Ans.:

Unit Cell	Packing efficiency
Simple Cubic (sc)	52.4 %
Body Centered Cubic (bcc)	68 %
Face Centered Cubic (fcc)	74 %

2.Solutions **Marks-4 with option 6**

1.Write Henry’s law.Write SI unit of Henry’s law constant.(2 M)

Ans.: It states that the solubility of a gas in a liquid is directly proportional to the pressure of the gas over the solution.

$S \propto P$ or $S = K_H P$

K_H, the proportionality constant is called Henry’s law constant.

Units : $K_H = \frac{S}{P} = \frac{mol\ L^{-1}}{bar} = mol\ L^{-1} bar^{-1}$

2. Write the name of any one solution which shows a positive deviation from Raoult's law. (1 M)

Ans.: The solutions of ethanol and acetone, carbon disulphide and acetone show positive deviations from Raoult's law.

3.Write the name of any one solution which shows a negative deviation from Raoult's law.(1 M)

Ans.: The solutions of phenol and aniline, chloroform and acetone exhibit negative deviations from Raoult's law.

4. Mention colligative properties. (2M)

Ans.: i) Vapour pressure lowering

ii) Boiling point elevation

iii) Freezing point depression

iv) Osmotic pressure

5. Define ebullioscopic constant. Write its SI Unit. (2 Marks)

Ans.: Ebullioscopic constant , K_b is the boiling point elevation produced by 1 molal solution.

Units of K_b : $K_b = \frac{\Delta T_b}{m} = \frac{K}{mol\ kg^{-1}} = K\ kg\ mol^{-1}$

6. Define: (Each 1 Mark)

a) Osmosis b) Osmotic pressure c) Isotonic solution

d) Hypertonic solution e) Colligative properties f) Boiling point elevation

Ans.: **a) Osmosis** :- The net spontaneous flow of solvent molecules into the solution or from more dilute solution to more concentrated solution through a semipermeable membrane is called osmosis.

b) Osmotic pressure :- The hydrostatic pressure that stops osmosis is an osmotic pressure (π) of the solution. .

c) Isotonic solution :- Two or more solutions having the same osmotic pressure are said to be isotonic solutions. For example, 0.1 M urea solution and 0.1 M sucrose solution are isotonic.

d) Hypertonic solution :- If two solutions have unequal osmotic pressures, the more concentrated solution with higher osmotic pressure is said to be hypertonic solution.

For example, if osmotic pressure of sucrose solution is higher than that of urea solution, the sucrose solution is hypertonic to urea solution,

e) Colligative properties :- The physical properties of solutions that depend on the number of solute particles in solutions and not on their nature are called colligative properties.

f) Boiling point elevation :- The difference between the boiling point of solution and that of pure solvent at any given constant pressure is called the boiling point elevation.

7. Write the condition when reverse osmosis takes place. (1M)

Ans.: The direction of osmosis can be reversed by applying a pressure larger than the osmotic pressure,

8.Define Cryoscopic constant. Write its SI Unit. (2M)

Ans.: proportionality constant K_f is called freezing point depression constant or cryoscopic constant.

The cryoscopic constant is the depression in freezing point produced by 1 molal solution of a nonvolatile solute.

Unit of K_f : $K_f = \frac{\Delta T_f}{m} = \frac{K}{mol\ kg^{-1}} = K\ kg\ mol^{-1}$.

9.Explain the relationship between Molar mass of solute and freezing point elevation.(2M)

Ans.: Since, $\Delta T_f = K_f m$ …..(i)

Suppose a solution prepared by dissolving W_2 g of solute in W_1 g of solvent.

Moles of solute = $\frac{W_2}{M_2}$

where M_2 is the molar mass of solute.

Mass of solvent = $\frac{W_1}{1000}$ kg

The molality m of the solution is given by

$$m = \frac{moles\ of\ solute}{mass\ of\ solvent\ in\ kg} = \frac{W_2/M_2}{W_1/1000}$$

$$m = \frac{1000\ W_2}{M_2 W_1} \qquad \text{…..(ii)}$$

Substitution of Eq. (ii) into Eq. (i) gives

$$\Delta T_f = K_f \frac{1000\ W_2}{M_2 W_1}$$

Hence, $M_2 = \frac{1000 K_f W_2}{\Delta T_f W_1}$ …..(iii)

10. Write the relation between molar mass of solute and osmotic pressure.(1M)

Ans.: $M_2 = \frac{W_2 RT}{\Pi V}$

3.Ionic Equilibria **Marks-4 with option 6**

1. Define acids and bases with examples according to lowery-bronsted theory. (2M)

Ans.: Acid: Acid is a substance that donates a proton (H^+) to another substance.

Base: Base is a substance that accepts a proton (H^+) from another substance.

Eg. $HCl + NH_3 \rightleftharpoons NH_4^+ + Cl^-$

Acid1 Base2 Acid2 Base1

In the above example HCl and NH_4^+ are proton donors and act as acids The NH_3 and Cl^- are proton acceptors and act as bases.

2. Write the relation between $_pH$ and $_pOH$.(2M)

Ans. The ionic product of water is $K_w = [H_3O^+][OH^-]$

Now at 298 K $K_w = 1 \times 10^{-14}$

$[H_3O^+][OH^-] = 1 \times 10^{-14}$

Taking logarithm of both sides, we write

$\log_{10}[H_3O^+] + \log_{10}[OH^-] = -14$

$-\log_{10}[H_3O^+] + \{-\log_{10}[OH^-]\} = -(-14)$

But $-\log_{10}[H_3O^+] = pH$ and $-\log_{10}[OH^-] = pOH$

$pH + pOH = 14$

3.Define: (Each 1 M)

a)Hydrolysis of salt b) Conjugate acid-base pair

c) Solubility product d) Common ion effect

Ans.: **a) Hydrolysis of salt:** It is defined as the reaction in which cations or anions or both ions of a salt react with ions of water to produce acidity or alkalinity or neutrality.

b) Conjugate acid-base pair:A pair of an acid and a base differing by a proton is said to be a conjugate acid base pair.

c) Solubility product: In the saturated solution of sparingly soluble salt the product of equilibrium concentrations of the constituent ions raised to the power equal to their respective coefficients in the balanced equilibrium expression at a given temperature is called solubility product.

d) Common ion effect: The ionization of a weak electrolyte is suppressed in presence of a strong electrolyte containing an ion common to the weak electrolyte is called common ion effect.

4.Define: Buffer solution.Explain buffer action of acidic buffer solution. (1+2 M)

Ans.: A solution which resists drastic changes in pH when a small amount of strong acid or strong base or water is added to it.

Buffer action of acidic buffer: Consider sodium acetate-acetic acid. Sodium acetate is a salt of weak acid and strong base. It dissociates completely in water producing large concentration of CH_3COO^- as follows

$$CH_3COONa_{(aq)} \rightarrow CH_3COO^-_{(aq)} + Na^+_{(aq)}$$

If a strong acid is added to this solution the added H+ ion will be consumed by the conjugate base CH_3COO^- present in large concentration.

$CH_3COO^-_{(aq)} + H^+_{(aq)} \rightarrow CH_3COOH_{(aq)}$

If a small amount of base is added the added OH^- ions will be neutralized by the large concentration of acetic acid.

$CH_3COOH_{(aq)} + OH^-_{(aq)} \rightarrow CH_3COO^-_{(aq)} + H_2O_{(l)}$

The effect of added H^+ ion and OH^- ions can not change the pH of the solution.

5.Write any four applications of buffer solution.(2M)

Ans.: i) ***In the biochemical system:*** pH of blood in our body is maintained at 7.36 -7.42 due to HCO_3^{2-} + H_2CO_3 buffer.

ii) ***Agriculture:*** The soil gets buffered due to the presence of salts such as carbonate, bicarbonates phosphates and organic acids. The choice of fertilizers depends upon the pH of soil.

iii) ***Industry:*** Buffer plays an important role in paper, dye, ink, paint and drug industry.

iv) ***Medicine:*** Penicillin preparations are stabilized by addition of sodium citrate as buffer.

v) ***Analytical Chemistry:*** In qualitative analysis a pH of 8 to 10 is required for precipitation of cations IIIA group. It is maintained with the use of $NH_4OH + NH_4Cl$ (basic) buffer.

6. Write the name of buffer solution used in preparation of penicillin drug stabilization.(1M)

Ans.: Sodium citrate buffer solution used in preparation of penicillin drug stabilization.

7. Write $_PH$ of human blood.(1M)

Ans.: $_PH$ of human blood maintained at 7.36 -7.42 (≈ 7.4)

4.Chemical Thermodynamics **Marks-6 with option 8**

1. Define: a) Extensive property b) Intensive property with examples. (Each 1 M)

Ans.: **a) Extensive property** :- A property which depends on the amount of matter present in a system is called an extensive property.

Examples : Mass, volume, internal energy, heat capacity, number of moles.

b) Intensive property :- A property which is independent of the amount of matter in a system is called intensive property.

Examples : Pressure, temperature, surface tension, viscosity, melting point, boiling point, specific heat.

2.Define: Isothermal,Isobaric,Isochoric and adiabatic processes. (Each 1 M)

Ans.: **a) Isothermal process :-**

It is the process in which the temperature of the system remains constant throughout the transformation. For a given temperature the internal energy (U) of the system remains constant.

Thus, $\Delta T = 0$ and $\Delta U = 0$.

b) **Isobaric process :-** In isobaric process the pressure remains constant during the transformation.

Thus, $\Delta P = 0$.

c) Isochoric process :- It is a process during which volume of the system remains constant during the transformation. For isochoric processes $\Delta V = 0$.

d) **Adiabatic process :-** A process in which there is no exchange of heat between system and surroundings is an adiabatic process.

In an adiabatic process the system is completely insulated from the surroundings. Thus, $\Delta Q = 0$.

3. Write sign conventions of W and Q. (1 M)

Ans.: i) +Q : Heat is absorbed by the system from the surroundings.

-Q : Heat is released by the system to the surroundings.

ii) +W : Work is done on the system by the surroundings.

-W : Work is done by the system on the surroundings.

4.Write the first law of thermodynamics in different ways.(2 M)

Ans.: The law is stated in different ways as follows.

I. Energy of the universe remains constant

II. The total internal energy of an isolated system is constant

III. Energy is neither created nor destroyed and can only be converted from one form to another.

All above statements are equivalent.

5. Write mathematical statement of first law of thermodynamics for

a) Isothermal process b) adiabatic process. (2 M)

Ans.: a) **Isothermal process :-** Temperature is constant in such a process, internal energy is constant.

Hence, $\Delta U = 0$

For isothermal process,

$\Delta U = Q + W$

$0 = Q + W$ or $W = -Q$

b) **Adiabatic process :-** In adiabatic process, there is no exchange of heat between system and its surroundings that is, $Q = 0$. Then

$\Delta U = Q + W$

$\Delta U = 0 + W$

$\Delta U = + W$ or $-\Delta U = -W$

6. State Hess's law of constant heat summation. (1M)

Ans.: The law states that, "Overall the enthalpy change for a reaction is equal to the sum of enthalpy changes of individual steps in the reaction".

7. Write the Statement of the second law of thermodynamics.(1M)

Ans.: The second law of thermodynamics states that total entropy of a system and its surroundings increases in a spontaneous process.

For the process to be spontaneous

$\Delta S_{total} = \Delta S_{sys} + \Delta S_{surr} > 0$

8. Define: (Each 1 M)

a) Enthalpy of fusion, b) Enthalpy of atomization,

c) Enthalpy of ionization, d) Enthalpy of vaporization

Ans.: **a) Enthalpy of fusion ($\Delta_{fus}H$) :** Enthalpy change that occurs when one mole of a solid is converted into liquid without change in temperature at constant pressure is enthalpy of fusion.

b) Enthalpy of atomization ($\Delta_{atom}H$) : The enthalpy change accompanying the dissociation of one mole of gaseous substance into atoms is the enthalpy of atomization.

c) Enthalpy of ionization ($\Delta_{ion}H$) : It is the enthalpy change accompanying the removal of an electron from one mole of a gaseous atom.

d) Enthalpy of vaporization ($\Delta_{vap}H$) : It is the enthalpy change accompanying the vaporization of one mole of liquid without changing its temperature at constant pressure.

5.Electrochemistry **Marks-5 with option 7**

1.Write the SI unit of conductivity.(1M)

Ans: Sm^{-1} **OR** $\Omega^{-1} m^{-1}$

2.Write the relationship between k and □ (Lambda) (1M)

Ans: □ = 1000k/c

3. Define cell constant. Write SI unit of cell constant. (1+1 M)

Ans: The ratio of separation (l) between the two electrodes divided by the area of cross section(a) of the electrode is called the **cell constant.**

SI unit of cell constant is $\mathbf{m^{-1}}$

4.Write the formula to calculate molar conductivity of the given solution. (1M)

Ans: □ = 1000k/c

5. Define: a) Cathode b) Anode (1+1M)

Ans: **a) Cathode:** It is an electrode at which the reduction takes place

b) Anode: It is an electrode at which oxidation takes place.

6. Write functions of salt bridge. (1M)

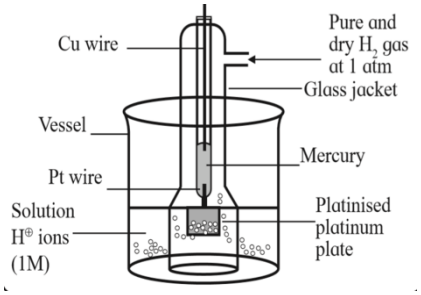
Ans: i) It provides an electrical contact between two solutions and completes the electrical circuit

ii) It prevents mixing of two solutions

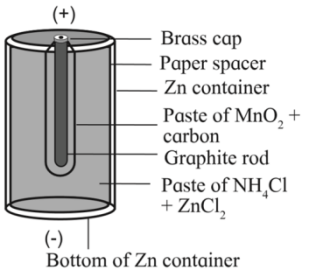
7. Define:Reference electrode. (1M)

Ans:It is an electrode whose potential is arbitrarily taken as zero or is exactly known.

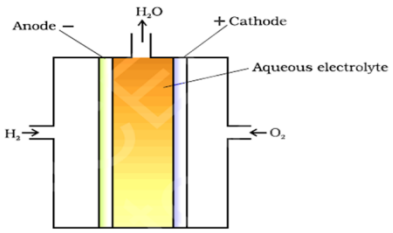
8. Draw labeled diagram of Standard hydrogen electrode (2M)



9. Draw labeled diagram of Leclanche cell(Dry Cell) (2M)



10. Draw labeled diagram of H_2-O_2 fuel cell.(2M)



11. Write applications of H_2-O_2 fuel cell.(2M)

Ans: i.The fuel cells are used on an experimental basis in automobiles.

ii. The fuel cells are used for electrical power in the space programme.

iii. In space crafts ,the fuel cell is operated at such a high temperature that the water evaporates at the same rate as it is formed. The vapor is condensed and pure water formed is used for drinking by

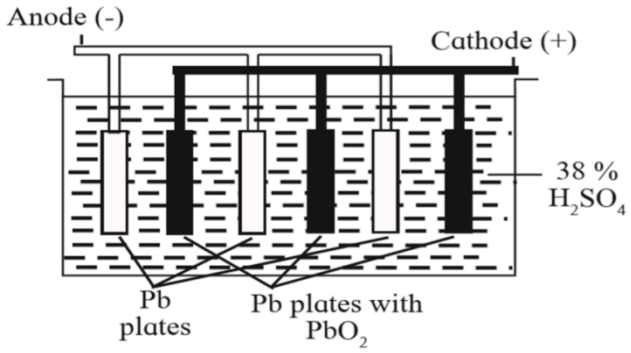
astronauts.

iv. In future, fuel cells can possibly be explored as power generators in hospitals, hotels and homes.

12.Define:Electrochemical series.

Ans: The electrodes with their half reactions are arranged according to their decreasing standard potentials(E^0V), this arrangement is called electrochemical series.

13. Draw labeled diagram of Lead accumulator.(2M)



6.Chemical Kinetics **Marks-3 with option 5**

1. Distinguish between order and molecularity of a reaction. (2M)

Ans:

Sr.No	Order	Molecularity
1.	Experimentally determined property.	It is a theoretical entity.
2.	It is the sum of powers of concentration terms of the reactants that appear in the rate equation.	It is the number of reactant molecules taking part in an elementary reaction.
3.	It may be an integer, fraction or zero.	It is an integer
4.	e.g. $2H_2O_2(g) \longrightarrow 2H_2O\ (l) + O_2\ (g)$; rate = $k[H_2O_2]$ - First Order	Eg. $O_3(g) + O(g) \longrightarrow 2O_2\ (g)$; Bimolecular Reaction

2.Write only the equation of integrated rate law for the first order reaction in solutions.(1M)

Ans: $k = \frac{2.303}{t} log 10\ \frac{[A]o}{[A]t}$

3.Write the unit of rate constant for the first order reaction.(1 M)

Ans: Unit of k = s^{-1}, min^{-1} or $(hour)^{-1}$

4. Write a unit of rate constant of zero order reaction.(1M)

Ans: mol dm^{-3} t^{-1}

5.Define: Pseudo first order reaction. (1M)

Ans: Reactions which are expected to be of higher order but follow first order kinetics.

6.Write Arrhenius equation and write terms involved in it. (1+1 M)

Ans: $k = A\, e^{-Ea/RT}$

Terms: k = rate constant, Ea = Activation energy, R= Molar gas constant ,

T = Temperature in kelvin, A = pre exponential factor.

7.Elements of Groups 16,17 and 18 **Marks-6 with option 8**

1.Write chemical composition of cryolite, fluorapatite, carnallite,copper pyrites. (Each 1M)

Ans: **Cryolite: Na_3AlF_6**

Fluorapatite : $3Ca_3(PO_4)_2,CaF_2$

Carnallite : $KCl,MgCl_2.6H_2O$

Copper pyrites : $CuFeS_2$

2. Explain the periodic trends of group 16 elements with respect to following (2M)

i) Atomic and ionic radii ii) Ionisation enthalpy :

iii) Electronegativity iv) Electron gain enthalpy.

And: i)**Atomic and ionic radii :** across a period atomic or ionic radii decrease with increasing atomic number consequent to increase in effective nuclear charge.

ii) ionization enthalpy: the ionization enthalpy decreases down the group due to increase in atomic size. However the elements of group 16 have lower ionization enthalpy value as compared to those of group 15 in the corresponding period owing to extra stable half filled electronic configuration of p orbital in elements of group 15.

iii)Electronegativity: in the group 16 elements the electronegativity decreases down the group.

iv) Electron gain enthalpy: in the group 16 electron gain enthalpy becomes less negative down the group however oxygen has less negative electron gain enthalpy than sulfur due to small atomic size.

3. Explain the anomalous behavior of Oxygen with respect to (2M)

i) Atomicity ii) Magnetic property iii) Oxidation state iv) Nature of hydrides

Ans: **i) Atomicity :** Oxygen is a diatomic molecule while others are polyatomic molecules in the group.

ii) Magnetic property : Oxygen is paramagnetic while others are diamagnetic.

iii) Oxidation State : Oxygen shows - 2 ,- 1 and + 2 oxidation States while other elements show - 2 + 2 +4 + 6 oxidation States.

iv) Nature of hydrides : Hydrides of oxygen H_2O is liquid at room temperature while hydrides of other members of group are gases.

4.Why does fluorine shows anomalous behavior.(2M)

Ans : fluorine shows anomalous behavior as compared to other halogens in the group because of following reasons

i) the smallest size of fluorine

ii) the highest electronegativity

iii) low bond dissociation enthalpy of F-F bond

iv) non availability of d orbitals in its valence shell.

5. Write anomalous properties of fluorine with respect to (2M)

Ans:***i)Electronegativity :*** Fluorine has the highest electronegativity. It has higher electronegativity than expected trends.

ii) ***Oxoacid :*** Fluorine forms only one oxoacid HOF while other halogens form a number of oxoacids

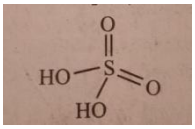
iii) ***Nature of hydride:*** Hydrides of fluorine HF is liquid due to hydrogen bonding while other halogen acids are gases.

iv) ***Ionic radii :*** ionic radii of fluorine is lower than expected.

6. Write the structures of following oxoacids of sulfur (Each 1M)

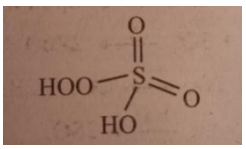
i) Sulphuric acid

Ans:



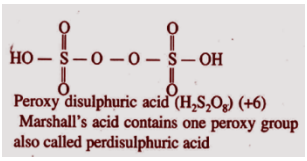
ii) Peroxy mono sulphuric acid

Ans:



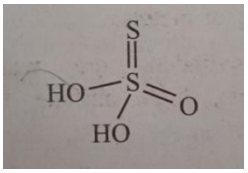
iii) Peroxy disulphuric acid

Ans:



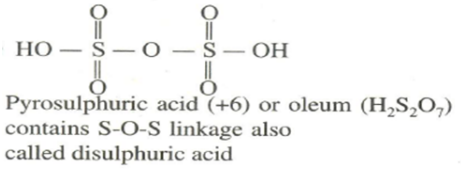
iv)Thiosulphuric acid

Ans:



vi) Pyrosulphuric acid

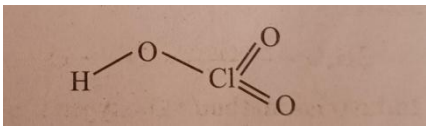
Ans:



7. Write the structures and oxidation states of following oxoacids of chlorine (Each 1M)

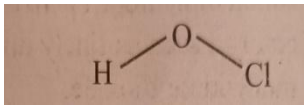
i) Chloric acid

Ans:

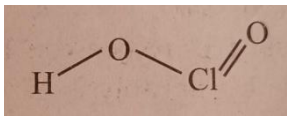


ii) Hypochlorous acid

Ans:

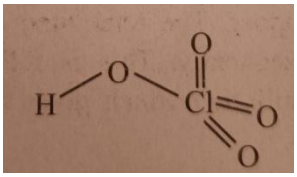


iii) Chlorous acid

Ans: 

iv) Perchloric acid

Ans:



8. Write uses of dioxygen.(1M)

Ans : i) dioxygen is important for respiration to sustain animal and aquatic life

ii) Oxygen cylinders are widely used in hospitals for high altitude flying and mountaineering.

9.Define: Dry Bleach.(1M)

Ans : Chlorine bleaches coloured organic matter in presence of moisture to colorless matter for example wood pulp for manufacturing of paper and rayons bleaching cottons and textiles.

10.Define:Interhalogen compounds.Write general characteristics of interhalogen compounds. .(1+2M)

Ans : Molecules which are formed by combination of atoms of different halogens are called interhalogen compounds.

General characteristics of interhalogen compounds are as follows.

i) They are all diamagnetic.

ii) Interhalogen compounds have an even number of atoms 2, 4 ,6 ,8 for example ClF_3 has four atoms.

iii) The central halogen exhibits different oxidation states in different interhalogen compounds.

iv) The properties of interhalogen compounds are generally intermediate between those of the halogens from which they are made.

11. Write uses of Neon ***OR*** Helium. (1M)

Ans: **Uses of neon:**

i) In neon discharge lamps and signs. These signs are visible from a long distance and also in mist or fog.

ii) For production of lasers and in fluorescent tubes.

Uses of helium :

i) Helium is used for producing inert atmosphere required for welding purpose and metallurgy of some metals.

ii) Helium nucleus is used as a bombarding particle for disintegration of atoms and for magnetic resonance imaging.

12. What is Ozone depletion? (1M)

Ans : Thinning of the ozone layer in the upper atmosphere is called ozone depletion.

8. Transition and Inner transition elements **Marks-6 with option 8**

1.Write general electronic configuration of 3d series of d-block elements (1M)

Ans : General electronic configuration of 3d series of d block elements is $[Ar]3d^{1\text{-}10}\ 4s^2$

2.Write different oxidation states of Mn.Why +2 oxidation state of Mn is most stable.(3 M)

Ans : Oxidation States of manganese are + 2, + 3, + 5, + 6, + 7.

+2 oxidation state of manganese is more stable because half filled d- orbitals $3d^5$ has more stability and lower energy.

3. Write the formula for spin only magnetic moment. (1M)

Ans: Spin only formula for magnetic moment is

$$\mu = \sqrt{n(n+2)}\ BM$$

4.Calculate the spin only magnetic moment of divalent cation(M^{2+}) of a transition metal Z=26. (2M)

Ans : The transition metal with atomic number 26 is Fe.

The electronic configuration of a Fe^{+2} is [Ar] $3d^6$

The number of unpaired electrons are n = 4

By spin only formula magnetic moment u is given by

$$\mu = \sqrt{n(n+2)}\ BM$$
$$\therefore \mu = \sqrt{4(4+2)}\ BM$$
$$\therefore \mu = 4.9\ BM$$

5. Write the name and formula of the alloy used in Fischer Tropsch process in the synthesis of Gasoline. (2 M)

Ans : The alloy used in the Fischer Tropsch process in the synthesis of gasoline is Co-Th. Cobalt thorium alloy.

6. Define: Interstitial compounds. Write properties of interstitial compounds. (1+2)

Ans : When small atoms like hydrogen, carbon or nitrogen are trapped in the interstitial space within the crystal lattice, the compounds formed are called interstitial compounds.

For example steel and cast iron

Properties of interstitial compounds are as follows

i) They are hard and good conductors of heat and electricity.

ii) Their chemical properties are similar to parent metal.

iii) Their melting points are higher than pure metals.

iv) Metallic carbides are chemically inert and extremely hard as a diamond.

v) Their densities are less than the parent metal.

7. Write the chemical composition of the following .(Each 1M)

Ans : i) Haematite :Fe_2O_3

ii) Chalcopyrite : $CuFeS_2$

iii) Calamine : $ZnCO_3$

iv) Zinc blende: ZnS.

8. Define:

Ans : **a) Pyrometallurgy :** A process in which the ore is reduced to metal at high temperature using reducing agents like carbon, hydrogen, aluminum etc, is called pyrometallurgy.

b) Hydrometallurgy : the process of extracting metals from the aqueous solution of their salts using suitable reducing agent is called hydrometallurgy.

c) Electrometallurgy : a process in which metal is extracted by electrolytic reduction of molten metallic compound is called electrometallurgy.

9.Define:

Ans : a) Ore : The mineral which contains a high percentage of the metal and from which the metal can be extracted economically is called an ore.

b) Mineral : A naturally occurring substance found in the earth's crust containing inorganic salt solids, siliceous matter etc, is called as mineral.

c) Gangue : The sand,mud and other unwanted impurities which remain mixed with the ore deposit are called as Gangue.

10. Define :

Ans : a) Lanthanoid contraction : As we move along the lanthanide series ,there is a decrease in atomic and ionic radii. This steady decrease in the atomic and ionic radii is called Lanthanoid contraction.

b) Actinoid contraction : The ionic radii decreases as we move across the series of actinoid , from Ac to Lw,which is known as actinoid contraction.

c) Transuranic elements : Elements with atomic number greater than 92 are called transuranic elements.

d) Post Actinide elements : The elements from atomic number 104 to 118 are called as post actinoid Elements.

11.Write the general electronic configuration of lanthanoids.(1M)

Ans : General electronic configuration of the lanthanoids is $[Xe]4f^{0-14}\ 5d^{0-2}\ 6s^2$.

12. Write difference between Lanthanoids and actinoids.(2M)

Ans :

Ans. Lanthanoids	Actinoids
1. Electronic configuration : [Xe] $4f^{1-14}\ 5d^{0-1},\ 6s^2$.	1. Electronic configuration : [Rn] $5f^{1-14}\ 6d^{0-1},\ 7s^2$.
2. Differentiating electron enters the $4f$ sub-shell.	2. Differentiating electron enters the $5f$ sub-shell.
3. Except Promethium, all other elements occur in nature.	3. Except Uranium and Thorium, all others are synthesized in the laboratory.
4. Binding energy of $4f$ electrons is higher.	4. $5f$-orbitals have lower binding energy.
5. Only Promethium is radioactive.	5. All elements are radioactive.

13.Write similarities between Lanthanoids and actinoids.(2M)

Ans : i) Both are series show + 3 oxidation State

ii) In both the series the f- orbitals are filled gradually.

iii) Ionic radius of the elements in both the series decreases with an increase in atomic number.

iv) The electronegativity of all the elements in both the series is low and are said to be highly reactive.

v) The nitrates ,perchlorates and sulfates of all the elements are soluble while the hydroxide fluorides and carbonates are insoluble.

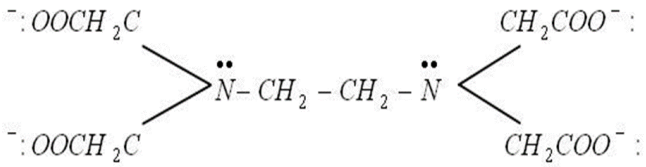
9.Coordination Compounds **Marks-5 with option 7**

1.Define:Ligand.(1M) Write one example of each, Bidentate,Hexadentate and Ambidentate ligands. (Each 1 M)

Ans: The species surrounding the central metal atom or ion are called ligands. OR Ligands are electron donor species; they may be anion, cation or neutral species.

Bidentate ligands : Ethylenediamine

Hexadentate ligands : Ethylenediaminetetraacetate ion OR $EDTA^{4-}$ ion



Ambidentate ligands : Nitro NO_2^-

2. Write the coordination number of the complexes $[Fe(C_2O_4)_3]^{3-}$ and $[Co(en)_3]^{3+}$ (Each 1 M)

Ans: $[Fe(C_2O_4)_3]^{3-}$ Coordination number is 6

And $[Co(en)_3]^{3+}$ Coordination number is 6

3. Write the name and molecular formula of one example of double salt.(2M)

Double salts **-**

e.g.Mohr's salt $FeSO_4(NH_4)_2SO_4.6H_2O$

4. Write four postulates of Werner theory of coordination complexes.(2M)

Ans: i) The metal in the complex possesses two types of valencies :

primary (ionisable) valency and secondary (non ionisable) valency.

ii)The ionisable sphere consists of entities which satisfy the primary valency of the metal.

These are generally satisfied by anions.

iii) The secondary or non ionisable valency is satisfied by either anion or ligands.

iv) The secondary valencies have a fixed spatial arrangement around the metal ion.

v)The primary valence is non rigid and non directional. Secondary valences have directional properties.

vi)The geometry of the complex is determined by the number and position of the secondary valences in space. It decides the stereo isomerism.

5. Define the terms:(Each 1 M)

i) Homoleptic complexes ii) Heteroleptic complexes

Ans:

i) Homoleptic complexes: Complexes in which metal is attached to identical ligands are homoleptic .

e.g. In $[Co(NH_3)_6]^{3+}$ all six ammonias are attached to cobalt

ii) Heteroleptic complexes: Complexes in which a metal is attached to more than one kind of ligands are heteroleptic.

e.g. in $[Co(NH_3)_4Cl_2]^+$ here four ammonia and two Cl^- bound to cobalt.

6.Write the classification of coordination complexes on the basis of charge on the complex.(3M)

Ans: The classification of complexes on the basis of charge are as follows

i) Cationic complexes(+ ve)

The complexes in which the complex ion carries a net positive charge are called cationic complexes eg .

$[Fe(H_2O)_6]Cl_3 \longrightarrow [Fe(H_2O)_6]^{3+} + 3Cl^-$

ii) Anionic complexes

The complexes in which the complex ion carries net negative charge are called anionic complexes.$K_4[Fe(CN)_6] \longrightarrow 4K^+ + [Fe(CN)_6]^{4-}$

iii) Neutral complexes

The complexes which do not carry any charge are called neutral complexes eg $[Ni(CO)_4]$, $[Pt(NH_3)_2Cl_2]$ etc.

7. Write the IUPAC name of the following complexes.(Each 1 M)

i) $[Fe(CN)_6]^{4-}$ ii) $Na_3[AlF_6]$ iii) $[PtBr_2(NH_3)_4]Br_2$ iv) $[Co(NO_2)_3(NH_3)_3]$ v) $Fe[CO)_5]$

Ans:

i) $[Fe(CN)_6]^{4-}$ - Hexacyanoferrate(II)ion

ii) $Na_3[AlF_6]$ - Sodium hexafluoroaluminate(III)

iii) $[PtBr_2(NH_3)_4]Br_2$ - Tetraaminedibromoplatinum(IV)bromide

iv) $[Co(NO_2)_3(NH_3)_3]$ - Triamminetrinitrocobalt(III)

v) $Fe[CO)_5]$ - Pentacarbonyliron(0)

8. State EAN rule.Write the formula to calculate EAN.(1+1=2 M)

Ans: Rule :- A metal ion continues to accept electron pairs from the ligands till the total number of electrons present around the metal ion in the complex becomes equal to the atomic number of the next rare gas atom.

EAN = Z – X + Y

Where,

Z=Atomic number of the metal

X= Number of electrons lost during the formation of metal ion from its atom.

Y=Number of electrons donated by the ligands.

9.Explain the following terms: (Each 1M)

i) Linkage isomers ii) Ionization isomers

iii) Coordination isomers iv) Hydrate isomers

Ans: **i)Linkage isomerism:**

Linkage isomerism arises in a coordination compound containing ambidentate ligand.

A simple example is provided by complexes containing the thiocyanate ligand, NCS^-, which may bind through the nitrogen to give M–NCS or through sulfur to give M–SCN.

ii) Ionization isomerism:

In ionization isomerism there is an exchange of ions inside and outside the coordination sphere.

Ionization isomers have the same formula but produce different ions in solution.

It is also known as ion-ion exchange isomerism.

$[Co(NH_3)_5SO_4]Br$ $[Co(NH_3)_5Br]SO_4$

iii) Coordination isomerism:

This type of isomerism arises from the interchange of ligands between cationic and anionic entities of different metal ions present in a complex.

$[Co(NH_3)_6][Cr(CN)_6]$ $[Cr(NH_3)_6][Co(CN)_6]$,

(cationic) (anionic) (cationic) (anionic)

iv) Hydrate isomerism:

This form of isomerism is known as 'hydrate isomerism' in case where water is involved as a solvent. This is similar to ionization isomerism.

Solvate isomers differ by whether or not a solvent molecule is directly bonded to the metal ion or merely present as free solvent molecules in the crystal lattice. An example is provided by the aqua complex $[Cr(H_2O)_6]Cl_3$ (violet) $[Cr(H_2O)_5Cl]Cl_2.H_2O$ (grey-green).

10.Write the name of the Pt complex which is used in the treatment of cancer.(1M)

Ans: Cisplatin

11. Write the name of the complex which is used for treatment of lead poisoning.(1M)

Ans: Ethylenediaminetetraacetate ion OR EDTA

12. Write the name of the element, by which the hemoglobin complex is formed.(1M)

Ans: Iron (Fe)

10.Halogen Derivatives **Marks-5 with option 7**

1.Write the structure of one example of allylic halide.(1M)

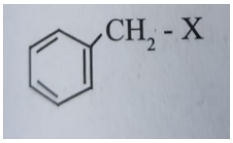
$CH_2 = CH - CH_2 - X$

2. Write the structure of one example of Vinylic halide and benzylic halide (1M)

Vinylic halide

Ans: $CH_2 = CH - X$

Benzylic halide



3.Write the preparation of ethyl chloride by using Grooves process.(2M)

$$C_2H_5OH + HCl \xrightarrow{ZnCl_2/heat} C_2H_5Cl + H_2O$$

4.Write Swartz reaction with an example. (2M)

Preparation of alkyl fluorides from alkyl chlorides or bromides

$$R\text{-}Cl + AgF \longrightarrow R\text{-}F + AgCl$$

5. Define: (Each 1 M)

a) Optical activity :

Ans: The property of a substance by which it rotates the plane of polarization of incident plane polarized light is known as optical activity.

b) Enantiomorphs :

Ans: The optical isomers which are non-super imposable mirror images of each other are called enantiomorphs

c) Racemic mixture :

Ans: Equimolar mixture of enantiomers (dextrorotatory and laevorotatory) is called racemic mixture

d) Chiral carbon :

Ans: Carbon atom in a molecule which carries four different groups/ atoms is called chiral carbon atom

6. Write the following chemical reactions: (Each 1 M)

i) Ethyl chloride with aqueous caustic potash

$$CH_3CH_2Cl + KOH(aq) \xrightarrow{Heat} CH_3CH_2OH + KCl$$

ii) Ethyl bromide with sodium methoxide

$$CH_3CH_2Br + CH_3\text{-}O\text{-}Na \rightarrow CH_3CH_2\text{-}O\text{-}CH_3 + NaBr$$

iii) Methyl iodide with silver acetate

$$CH_3I + CH_3COOAg \rightarrow CH_3COOCH_3 + AgI$$

iv) Ethyl chloride with potassium nitrite

$$CH_3CH_2Cl + KNO_2 \rightarrow CH_3\text{-}CH_2\text{-}O\text{-}N{=}O + KCl$$

v) Ethyl bromide with silver nitrite.

$$CH_3CH_2Br + AgNO_2 \rightarrow CH_3CH_2\text{-}NO_2 + AgBr$$

vi) Thionyl chloride with straight chain primary alcohol.

$$R\text{-}CH_2OH + SOCl_2 \rightarrow R\text{-}Cl + HCl\uparrow + SO_2\uparrow$$

vii) Propene with hydrogen bromide in presence of peroxide

$$CH_3\text{-}CH = CH_2 + HBr \xrightarrow{\text{Peroxide}} \underset{\text{(Major)}}{CH_3\text{-}CH_2\text{-}CH_2Br} + \underset{\text{(Minor)}}{CH_3\text{-}CH(Br)\text{-}CH_3}$$

7. Write salient features of S_N2 mechanism. (Any 4 points) (2M, Each point ½ Mark)

Ans:

i) Single step mechanism

ii) Backside attack of nucleophile

iii) Transition state with Penta coordinated carbon

iv) Nucleophile and leaving group are bonded to carbon with partial bonds and carry partial negative charge

v) When S_N2 reaction is brought at chiral carbon it is found to proceed with inversion of configuration

8.Write salient features of S_N1 mechanism. (Any 4 points)(2M, Each point ½ Mark)

Ans:

i) Two step mechanism

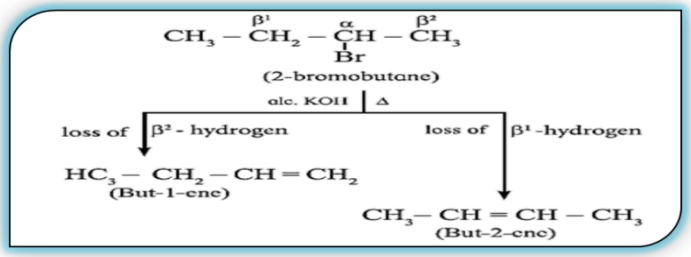
ii) heterolysis of C - X bond in slow reversible step to form planar carbocation intermediate

iii) attack of nucleophile on the carbocation in the fast second step

iv) if S_N1 reaction is carried out at chiral carbon it will proceed mainly with racemization

9.Define dehydrogenation reaction. Write the dehydrogenation reaction of 2-bromobutane with alcoholic KOH.Mention major and minor products.(1+2M)

Ans: The reaction in which hydrogen and halogen is a removed is known as dehydrohalogenation reaction



But-2-ene is major and But-1-ene is minor product.

10. What is Grignard reagent.How it is prepared, write chemical reaction.(2M)

Ans: Grignard reagent is alkyl magnesium halide.

$$R\text{-}X + Mg \xrightarrow{\text{dry ether}} R\text{-}Mg\text{-}X$$

When alkyl halide is treated with Mg metal in presence of dry ether gives Alkyl Magnesium halide (GR)

11.Write uses and environmental effects of Dichloromethane and CFC's (Freons) (2M)

Ans:

Dichloromethane -

Uses - as a solvent , propellant in aerosols

Environmental effects - overexposure of dichloromethane causes dizziness, fatigue , nausea, headache , numbness, weakness.

Freons

Uses- refrigerants , propellants in aerosol and solvent .

Environmental effects - ozone depletion in stratosphere , breathing problems , organ damage, loss of consciousness

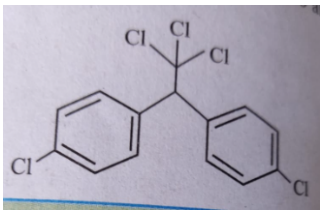
12.Define: **a) Dextrorotatory compounds**

Ans: A compound which rotates the plane of plane polarized light towards the right is called dextrorotatory compound.(d or+)

b) Laevorotatory compounds. (Each 1 M)

Ans: A compound which rotates the plane of plane polarized light towards left is called laevorotatory compound (l or-)

13. Write structure and full form of DDT. (2M)



Dichlorodiphenyltrichloroethane

11.Alcohols,Phenols and Ethers **Marks-4 with option 6**

1. Write classification of ethers. (2M)

Ans:a) symmetrical ethers (simple ethers)

When two same alkyl or aryl groups are bonded to divalent oxygen atom are called symmetrical or simple ethers

Example: CH_3 - O - CH_3 OR C_6H_5-O-C_6H_5

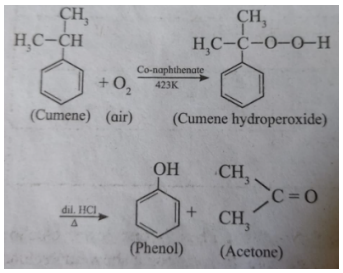
b) unsymmetrical ethers (mixed ethers)

When two different alkyl or aryl groups are bonded to divalent oxygen atom are called unsymmetrical or mixed ethers

Example CH_3 - O - C_2H_5 OR CH_3-O-C_6H_5

2. Write the chemical reaction for the commercial method of preparation of phenol.(1M)

(Preparation of phenol by using cumene/isopropylbenzene)



3.Define: Esterification.Write the chemical reaction of acetic acid with

a)Ethyl alcohol b) Phenol (3 M)

Ans: The reaction between alcohol / phenol with carboxylic acid to form an Ester is called EsterificationWrite the chemical reaction of acetic acid with

a)Ethyl alcohol

$$C_2H_5OH + CH_3COOH \rightleftharpoons CH_3COOC_2H_5 + H_2O$$

b) Phenol

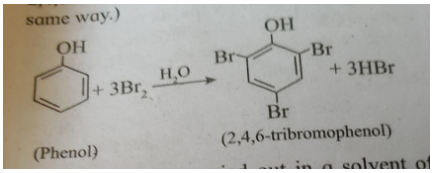
$$C_6H_5OH + CH_3COOH \rightleftharpoons CH_3COOC_6H_5 + H_2O$$

4. Write the following chemical equations/conversions.(Each 1 M)

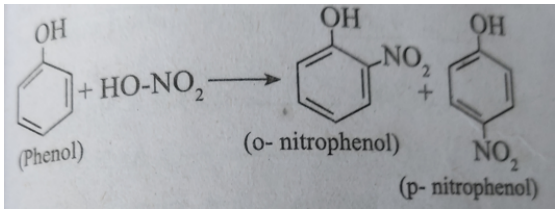
i) Ethyl alcohol with PCC

$$C_2H_5OH + (O) \xrightarrow{PCC} CH_3CHO + H_2O$$

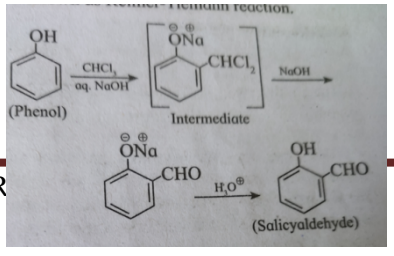
ii) phenol with bromine water



iii) phenol with dil.nitric acid



iv) phenol with chloroform in aqueous solution of sodium hydroxide



v) ethyl alcohol on oxidation with ‘Cu’ metal

$C_2H_5OH \rightarrow CH_3CHO + H_2O$

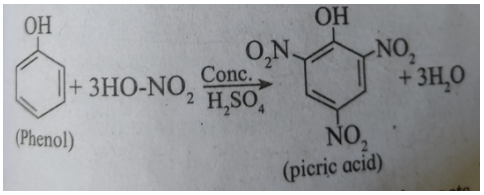
(Reaction conditions Cu/573 K is mandatory to write on arrow)

vi) secondary alcohol with ‘Cu’ metal

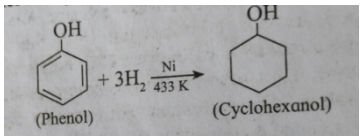
$R_2CH(OH) \rightarrow R\text{-}CO\text{-}R + H_2O$

(Reaction conditions Cu/573 K is mandatory to write on arrow)

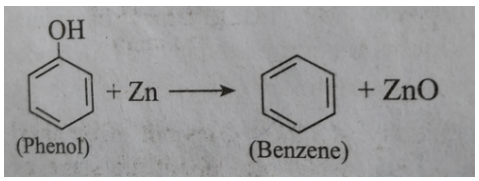
vii) Phenol to 2,4,6 trinitrophenol



viii) Phenol on catalytic hydrogenation

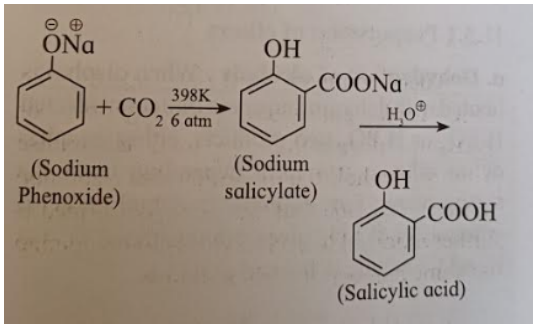


ix) Phenol on reduction with Zn dust



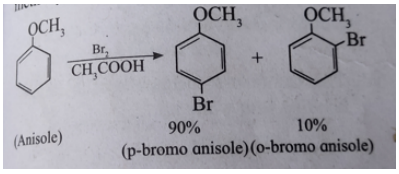
5. What is Kolbe reaction.Write chemical equation.(2M)

Ans:When sodium phenoxide is treated with Carbon dioxide at 398 K and 6 atm gives sodium salicylate which is on acidic hydrolysis gives salicylic acid is called Kolbe’s reaction.

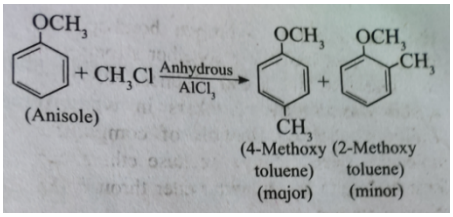


6. Write the chemical reactions of anisole with following reagents (Each 1 M)

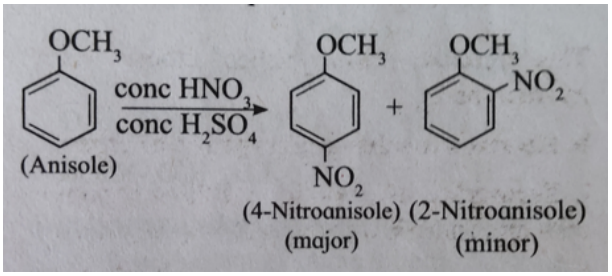
a) Bromine in acetic acid



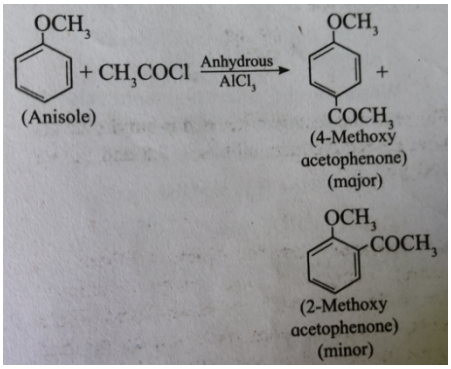
b) Methyl chloride



c) Nitrating mixture

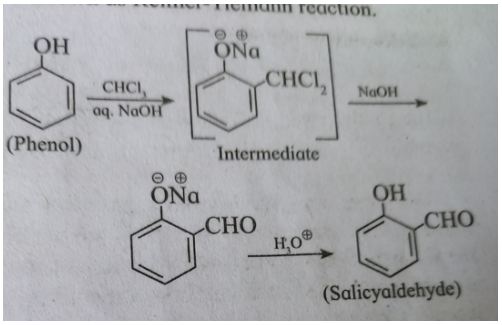


d) acetyl chloride



7. What is the Reimer -Tiemann reaction.Write chemical equation.(2M)

When phenol is treated with chloroform and aq.sodium hydroxide gives sodium salicylate which is on acidic hydrolysis salicylaldehyde (If CCl_4 is used instead of $CHCl_3$ the product is salicylic acid)



12.Aldehydes,Ketones and Carboxylic acids **Marks-6 with option 8**

1.Write Rosenmund reduction reaction with an example.(2M)

Ans: Acyl chloride is reduced to corresponding aldehyde by hydrogen using palladium catalyst poisoned with barium sulfate, the reaction is known as Rosenmund reduction reaction.

$$R-\overset{O}{\overset{\|}{C}}-Cl \xrightarrow[Pd\text{-}BaSO_4]{H_2} R-\overset{O}{\overset{\|}{C}}-H + HCl$$

(Acyl chloride) (Aldehyde)

2.Write the chemical equation,when ethanoyl chloride reacts with dimethyl cadmium.(2M)

Ans:

$$\underset{\text{(Ethanoyl chloride)}}{2CH_3-COCl} + \underset{\text{(Dimethyl cadmium)}}{(CH_3)_2Cd} \longrightarrow \underset{\text{Propanone (Acetone)}}{2CH_3\text{-}CO\text{-}CH_3} + CdCl_2$$

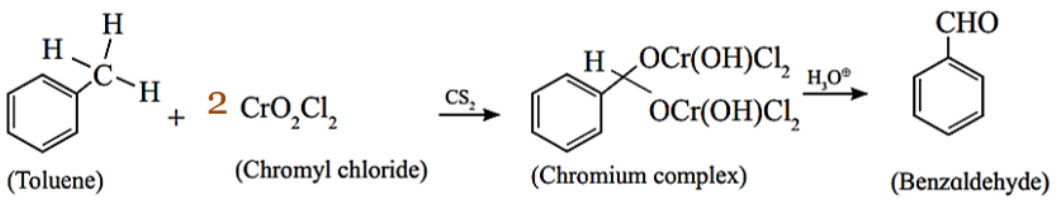
3.What is Stephen's reaction? Write the chemical reaction ,ethanenitrile undergoes stephen reaction.(2M)

Ans: Nitriles are reduced to imine hydrochloride by stannous chloride in presence of HCl which on acid hydrolysis gives corresponding aldehyde the reaction is known as Stephen's reaction.

$$\underset{\text{(Ethanenitrile)}}{H_3C-C\equiv N} + 2[H] \xrightarrow[\text{(reduction)}]{SnCl_2, HCl} \underset{\text{(ethanimine hydrochloride)}}{CH_3-HC=NH.HCl} \xrightarrow{H_3O^{\oplus}} \underset{\text{(Ethanal)}}{CH_3\text{-}CHO} + NH_4Cl$$

4.What is the Etard reaction? Write one example. (2M)

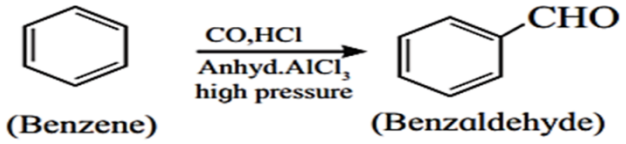
Ans: Methyl benzene is oxidized by chromyl chloride in CS2 as a solvent to form chromium complex which on acid hydrolysis gives Benzaldehyde the reaction is known as Etard reaction.



(Toluene) (Chromyl chloride) (Chromium complex) (Benzaldehyde)

5.Explain Gatterman-Koch formylation reaction with an example.(2M)

Ans: Benzene or substituted benzene is treated under high pressure with carbon monoxide and hydrogen chloride in presence of anhydrous aluminum chloride or cuprous chloride to give benzaldehyde or substituted benzaldehyde the reaction is known as Gatterman-Koch formylation reaction



6.Write the following conversions/equations.(Each 1 M)

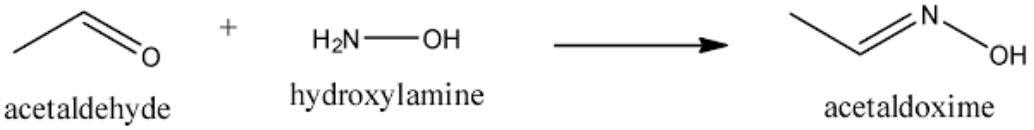
i) aldehyde reacts with hydroxyl anime

ii) ketone with hydrazine

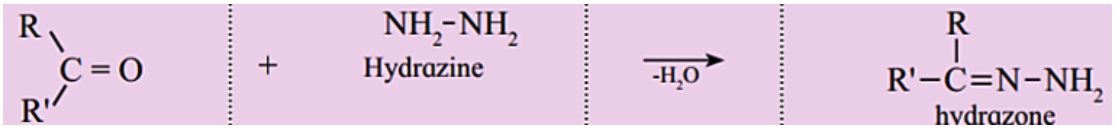
iii) aldehyde with semicarbazide

iv) ketone with phenylhydrazine

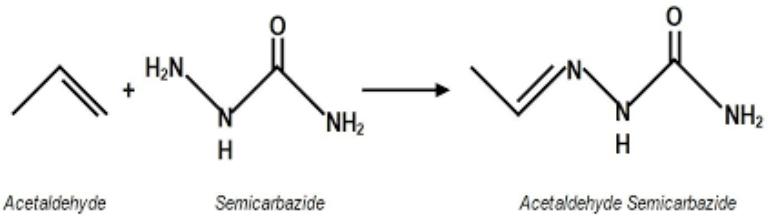
Ans: i) aldehyde reacts with hydroxyl anime



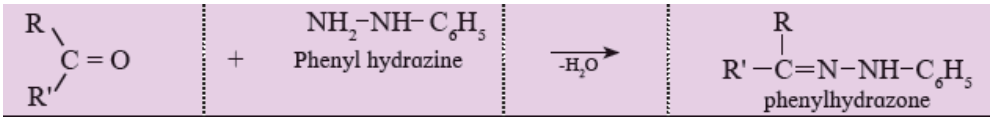
ii) ketone with hydrazine



iii)aldehyde with semicarbazide

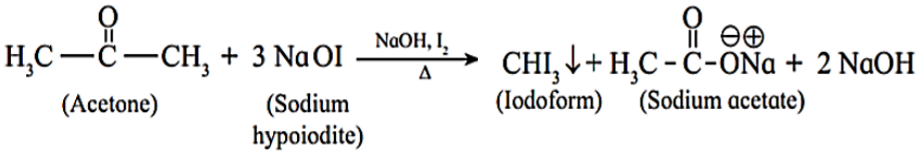


iv) ketone with phenylhydrazine



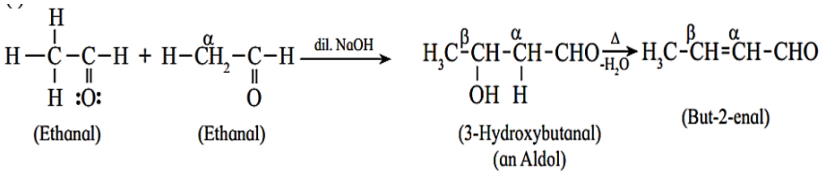
7.Explain haloform reaction with one example.(2M)

Ans: When methyl ketone or an alcohol is warmed with NaOH & iodine gives yellow ppt of iodoform. During this reaction formation of sodium salt of carboxylic acid containing one carbon atom less than the substrate.The methyl group is converted into haloform. The reaction is known as haloform reaction.



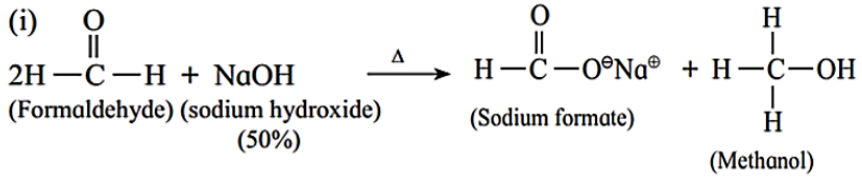
8.Write aldol condensation reaction of ethanal.(2M)

Ans: Aldehydes containing at least one α –hydrogen atom react with base like dil.NaOH,KOH or Na_2CO_3 as a catalyst to form β-hydroxyl aldehyde (aldol) hence this reaction is called aldol condensation. Aldol having α –hydrogen undergoes elimination on warming gives α , β-unsaturated aldehyde.



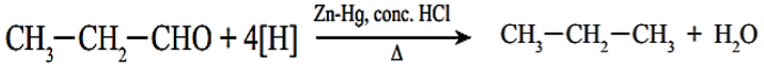
9.Write Cannizzaro reaction of methanal with Strong base NaOH.(2M)

Ans:



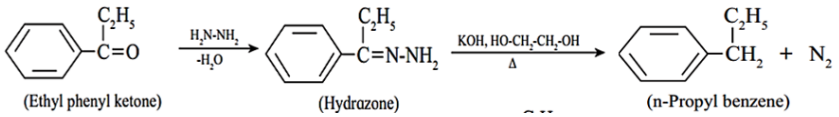
10.Explain Clemmensen reduction of propanal.(1M)

Ans: Propanal on reduction with Zn-Hg, Conc. HCl gives propane



11.Write Wolf-Kishner reduction reaction of ethyl phenyl ketone.(1M)

Ans:



12.Write the following chemical conversions.(Each 1 M)

i) acetic acid to acetamide
ii) acetic acid to acetic anhydride
iii) acetic acid to acetic anhydride by using thionyl chloride.

iv) acetic acid to ethyl alcohol

v) sodium acetate to methane

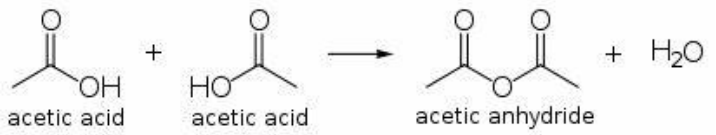
vi) acyl chloride to acid amide

Ans: i) acetic acid to acetamide

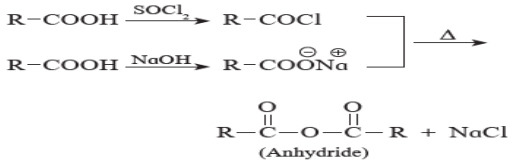
$$CH_3\text{-}COOH + NH_3 \leftrightarrow CH_3\text{-}COONH_4 \xrightarrow{\Delta} CH_3\text{-}CONH_2 + H_2O$$

Acetic acid Ammonium acetate Acetamide

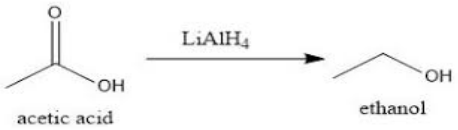
ii) acetic acid to acetic anhydride



iii) acetic acid to acetic anhydride by using thionyl chloride.



iv) acetic acid to ethyl alcohol



v) sodium acetate to methane

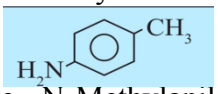
$$CH_3COONa + NaOH \xrightarrow[\Delta]{CaO} \underset{\text{Methane}}{CH_4} + Na_2CO_3.$$

vi) acyl chloride to acid amide

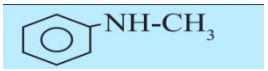
13.Amines **Marks-3 with option 4**

1.Write IUPAC name and structure of following (Each 1M)

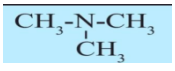
Ans: p-Toluidine - 4-Methylaniline



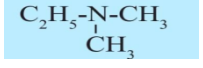
Methylphenylamine - N-Methylaniline



Trimethylamine - N,N - Dimethylmethanamine



ethyl dimethyl amine - N,N - Dimethylethanamine

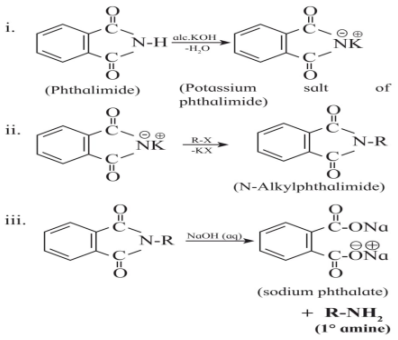


2.Write the chemical reaction for conversion of nitroalkanes to primary amines.(1M)

Ans: $R\text{-}NO_2 + 6[H] \xrightarrow{Sn/HCl} R\text{-}NH_2 + 2H_2O$

3. Write Gabriel phthalimide synthesis reaction with an example.(3M)

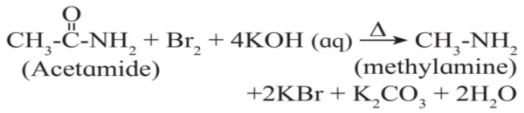
Ans:



4.Explain Hofmann bromamide degradation reaction with an example.(2M)

Ans: It is a method for conversion of an amide into primary amine containing one carbon less.

For example :



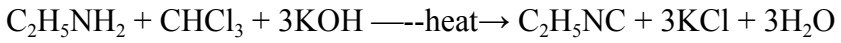
5. Why amines are basic in nature? Among,N-Methylmethanamine and N-ethylethanamine,which is more basic. (2M)

Ans: Basic nature of amines is due to presence of a lone pair of electrons on the nitrogen atom.

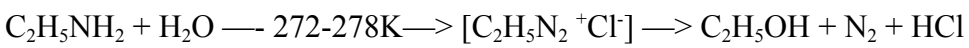
N-ethylethanamine is more basic

6. Write the chemical reaction of ethylamine with (Each 1M)

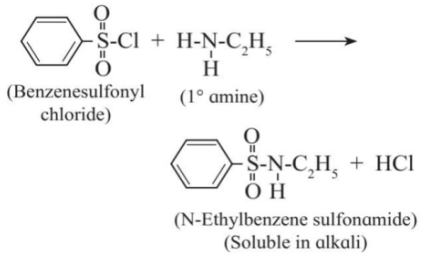
Ans: i) caustic potash(alc.KOH) and Chloroform



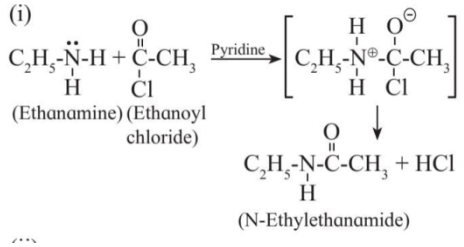
ii) Nitrous acid



iii) Hinsberg reagent(Benzene sulphonyl chloride)

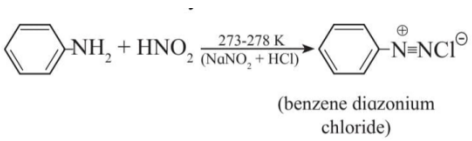


iv) Ethanoyl chloride



7.Write the chemical reaction of benzenamine with nitrous acid.(1M)

Ans:



8. Write the chemical reaction of Benzenediazonium chloride with following reagents(Each 1M)

Ans:

i) phosphinic acid(hypophosphorous acid,H_3PO_2)

$Ar\text{-}N_2^+Cl^- \xrightarrow{H3PO2/H2O} Ar\text{-}H + N_2 + H_3PO_3 + HCl$

ii) Ethanol

$Ar\text{-}N_2^+Cl^- \xrightarrow{ethanol} Ar\text{-}H + N_2 + CH_3CHO + HCl$

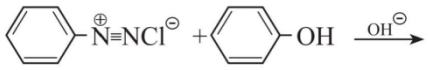
iii) Copper powder & HCl

$Ar\text{-}N_2^+Cl^- \xrightarrow{Cu\ powder/HCl} Ar\text{-}Cl + N_2$

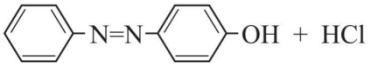
iv) CuCN/KCN

$Ar\text{-}N_2^+Cl^- \xrightarrow{CuCN/KCN} Ar\text{-}CN + N_2$

v) Carbolic acid

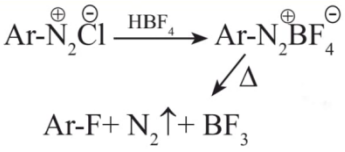


(Benzenediazonium chloride)



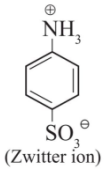
(p-Hydroxyazobenzene)

vi) Fluoroboric acid followed by heat



9. Write the structure of Zwitter ion of sulfanilic acid.(1M)

Ans:

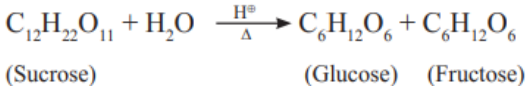


(Zwitter ion)

14.Biomolecules **Marks-3 with option 4**

1.Write preparation of glucose from sucrose .(1M)

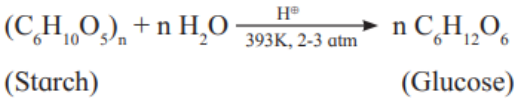
Ans: Sucrose is hydrolysed by warming with dil. Hydrochloric acid or sulfuric acid for about two hours. This hydrolysis converts sucrose into a mixture of glucose and fructose.



(Sucrose) (Glucose) (Fructose)

2.Write commercial method of preparation of glucose(from Starch).(1/2M)

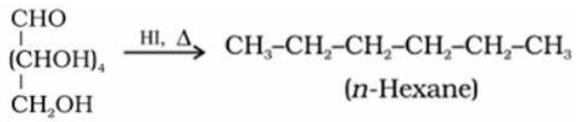
Ans: Commercially glucose is obtained by hydrolysis of starch by boiling it with dil. Sulfuric acid at 393 K under 2 to 3 atm pressure.



3. Write the chemical reaction of glucose with following reagents. (Each 1M)

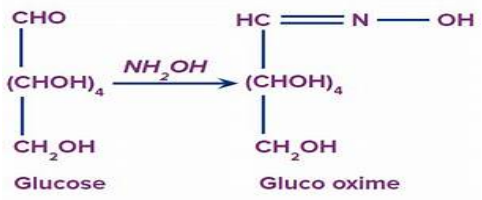
a)HI b) NH_2OH c) HNO_3 d) Br_2 water e) Acetic anhydride

Ans: a)HI



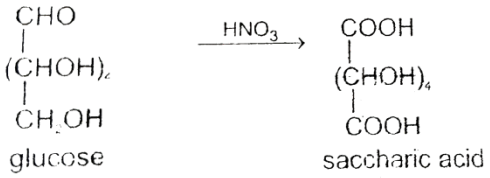
b) NH_2OH

Ans:



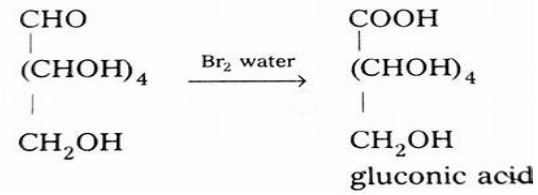
c) HNO_3

Ans:



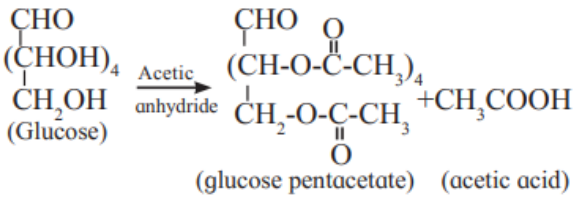
d) Br_2 water

Ans:



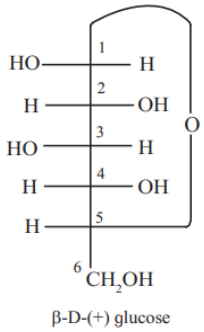
e) Acetic anhydride

Ans:



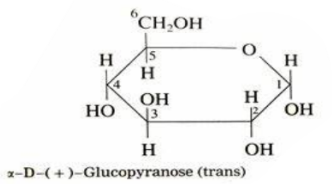
4. Write the structure of β-D-(+) Glucose by Fishcer projection formula.(1M)

Ans:



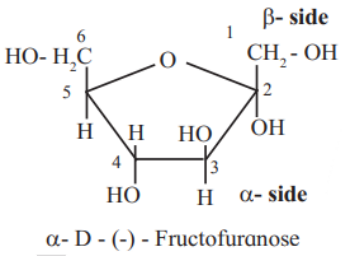
5.Write the structure of α-D-(+) Glucopyranose.(1M)

Ans:



6. Write the structure of α-D-(-) fructofuranose.(1M)

Ans:



7.Write the glycosidic linkages present in Maltose,lactose, cellulose and sucrose.(Each 1M)

Ans: **In Maltose** :- Glycosidic linkages present in Maltose is formed between C-1 of one glucose ring and C-4 of the other. The glucose ring which uses its hydroxyl group at C-1 is α -glucopyranose . Hence the linkage is called α-1,4-glycosidic linkage.

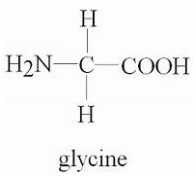
In Lactose :- Glycosidic linkages present in Lactose is formed between C-1 of β-D-galactose and C-4 of glucose.Therefore linkage in lactose is called β-1,4-glycosidic linkage.

In Cellulose :- Cellulose is a straight chain polysaccharide of β-glucose units linked by β-1,4-glycosidic bonds.

In Sucrose :- Structure of sucrose contains glycosidic linkage between C-1 of α-glucose and C-2 of β-fructose

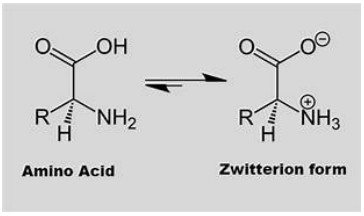
8.Write the structure of glycine (amino acid with no chiral carbon) (1M)

Ans:



9.Write the structure of Zwitter ion of alanine/ Zwitter ion of α-amino acid (Each 1 M)

Ans:



10. Define: (Each 1M)

a) Enzymes b) Peptide bond c) Denaturation of proteins d) Monosaccharides

Ans:

a) Enzymes :- Enzymes are biological catalysts which are very specific in nature.

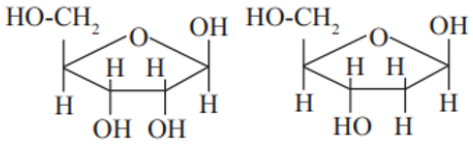
b) Peptide bond :- The amide bond (-NH-CO-) that connects two or α-amino acids to each other is called peptide bond.

c) Denaturation of proteins : Denaturation is the process by which the molecular shape of protein changes without breaking the amide/peptide bonds that form the primary structure.

d) Monosaccharides:- Carbohydrates which do not hydrolyse into smaller units are called monosaccharides.

11.Write the structure of D-ribose and 2-Deoxy-D-ribose. (2M)

Ans:



D - Ribose
(present in RNA)

2 - Deoxy-D-ribose
(present in DNA)

12.Define : Nucleotide (1M)

Ans: Nucleic acids are unbranched polymers of repeating monomers called nucleotides.

15.Introduction to Polymer Chemistry **Marks-3 with option 4**

1. Define: (Each 1M)

a) Elastomer

Ans. Elastomer ,the elastic polymers, have weak van der Waals forces which permit the polymer to be stretched.A few crosslinks between the chains help the stretched polymer to retract to its original position on removal of applied force.

b) Fibers:

Ans.Polymeric solids which form threads are called fibers .The fibers possess high tensile strength which is a property to have resistance to breaking under tension.

c) Vulcanization :

Ans . The process by which a network of cross links is introduced into an elastomer is called vulcanization.

d) Homopolymers:

Ans. The polymers which have only one type of repeating unit are called homopolymers.

e) Copolymers:

Ans. The polymers which have two or more types of repeating units are called copolymers.

2. Explain the terms (Each 1M)

a) Thermoplastic polymers

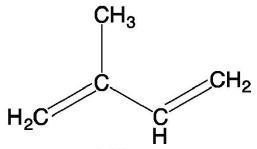
Ans. Plasticity is a property of being easily shaped or moulded .Thermoplastic polymers are capable of repeated softening on heating and hardening on cooling. These polymers possess moderately strong intermolecular forces that are intermediate between elastomers and fibers. For example - Polythene, Polystyrene, Polyvinyls etc.

b) Thermosetting polymers

Ans. Thermosetting polymers are rigid polymers. During their formation they have the property of being shaped on heating ,but they get hardened while hot .Once hardened these become infusible, cannot be softened by heating and therefore cannot be remolded. This characteristic is the result of extensive cross linking by covalent bonds formed in the moulds during the hardening /setting process while hot. for example -bakelite, urea, formaldehyde resin etc.

3.Write the name and structure of the monomer of natural rubber.(1M)

Ans. Name of monomer - Isoprene, ie. 2- methyl-1,3-butadiene



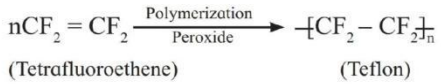
4. Write the name of the catalyst used in preparation of High density polyethylene.(1M)

Ans. Catalyst used in the preparation of high density polythene is the Zieglar -Natta catalyst.

5. Write the chemical reactions for the preparation of following polymers.(Each 1M)

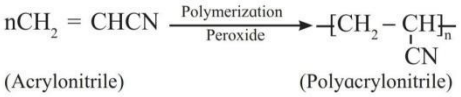
i) Teflon

Ans.



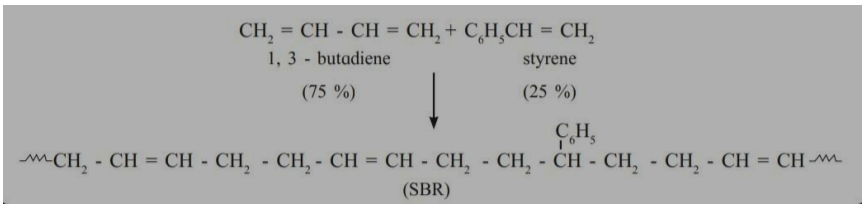
ii) Polyacrylonitrile

Ans.



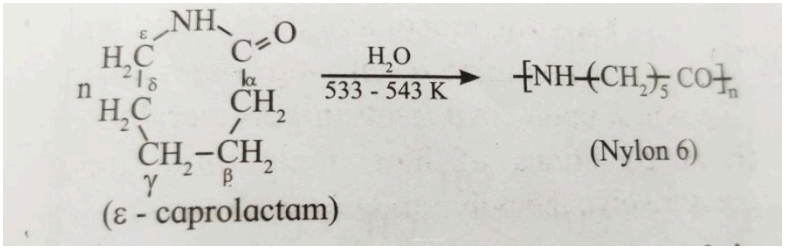
iii) SBR

Ans.



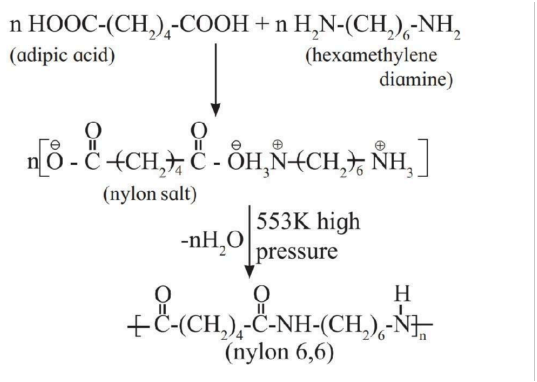
iv) Nylon-6

Ans.



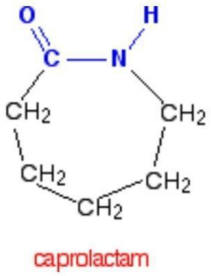
6.Write the preparation of Nylon 6,6 polymer.(2M)

Ans.



7. Write the name and structure of the monomer used in preparation of Nylon-6 polymer.(1M)

Ans.



8.Write the applications and name of the monomers used in the preparation of following Polymers (Each 1M)

i) Buna N

Ans. Name of monomer - Butadiene and acrylonitrile

Application - Adhesive, rubber belts ,shoe soles, gaskets.

ii) PVC

Ans. - Name of monomer- Vinyl chloride

Application- Water pipes ,raincoats ,flooring .

iii) Glyptal

Ans. Name of monomer- Ethylene glycol, Phthalic acid

Applications- Paints and liqueurs.

iv) Thermocol

Ans. Name of monomer - Styrene

Application - Non biodegradable therefore it is banned.

9. Write classification of polymers on the basis of intermolecular forces.(2M)

Ans. On the basis of intermolecular forces polymers are classified as

1.Elastomers - Elastomers the plastic polymer have weak Van der Waal type of intermolecular forces

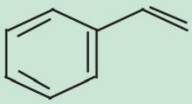
which permits the polymer to be stretched.

2. Fibers - Polymeric solids which form threads are called fibers.
3. Thermoplastic polymers - These polymers are capable of repeated softening on heating and hardening on cooling.
4. Thermosetting polymers - Thermosetting polymers are rigid polymers.

10. Write the structure and names of monomers used in SBR .(1M)

Ans. Monomer - Styrene and butadiene.

Styrene



1,3-butadiene

16.Green Chemistry and Nanochemistry **Marks-3 with option 4**

1. Define :(Each 1M)

a) Green chemistry

Ans. Green chemistry is the use of chemistry for pollution prevention by environmentally conscious design of chemical products and processes that reduce or eliminate the use or generation of hazardous substances.

b) Atom economy

Ans. Atom economy is a measure of the amount of atoms from the starting materials that are present in the useful products at the end of a chemical process.

c) Sustainable development

Ans. Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own need.

2.Mention any four principles of green chemistry. (1M)

Ans. Principles of Green chemistry -

1. Prevention of waste or by products.
2. Atom economy
3. Less hazardous chemical synthesis
4. Designing safer chemicals

3. Write the formula to calculate percentage atom economy.(1M)

Ans. %Atom economy= Formula weight of the desired product/sum of formula weight of all the reactants used in the reaction ×100

4. Write the name of gamma isomer of BHC.(1M)

Ans. Gammexane or Lindane.

5. Write advantages of nanoparticles and nanotechnology. (2 Marks)

Ans.1. Revolution in electronic and computing.

2. Energy sector - Nanotechnology will make solar power more economical .Energy storage devices will become more efficient.

3. Medical field Manufacturing of smart drugs, helps cure faster and without side effects .Curing of life threatening diseases like cancer and diabetes.

6. Write the full form of ZWT with respect to green chemistry and MRAM (Each 1M)

Ans. ZWT - Zero Waste Technology, MRAM - Magnetoresistive Random Access Memory

7.Define: (Each 1M)

a) Nanoscience

Ans. Nano science is the study of phenomena and manipulation of materials at atomic molecular and macromolecular scales where properties differ significantly from those at a larger scale.

b) Nanotechnology

Ans. Nanotechnology is the design, characterization ,production and application of structures, devices and systems by controlling shape and size at nanometre scale.

c) Nanomaterial

Ans. The nanomaterial is a material having structural components with at least one dimension in the nanometer scale that is 1 to 100 nanometer. d) Nanochemistry

d) Nanochemistry

Ans. It is the combination of chemistry and nano science. It deals with designing and synthesis of materials of nano scale with different size and shape, structure and composition and their organization into functional architectures.

8. Write the name of the metal nanoparticle,act as highly effective bacterial disinfectant,remove E.Coli from water.(1M)

Ans. Silver nanoparticles.

9.Define: (Each 1M)

a) Zero dimensional nanostructure

Ans. Zero dimensional structure is one in which all three dimensions are in the nanoscale.

b) Two dimensional nanostructure

Ans. A two dimensional nanostructure is one in which one dimension is in the nanoscale.

PART-C

Model Question Papers with Model Answers

Model Question Paper- I

Std. : 12th | Sub : Chemistry (55) | Marks-70
Date : | Pages : 4 | Time : 3 hrs

Instructions :
There are four sections in this question paper.
(1)**Section A** : Q.**1**. contains **Ten** multiple choice type questions carrying **one** mark each.
Q.**2**.contains **Eight** very short answer type questions carrying **one** mark each.
(2) **Section B** : Q.No.**3** to Q.No.**14** are **twelve** short answer type questions carrying **two** marks each. (Attempt **any Eight**)
(3) **Section C** : Q.No.**15** to Q.No.**26** are **twelve** short answer type questions carrying **three** marks each. (Attempt **any Eight**)
(4) **Section D** : Q.No.**27** to Q.No.**31** are **five** long answer type questions carrying **four** marks each. (Attempt **any Three**)
(5) Use of log is allowed.Use of calculator is not allowed.
(6) Figures to the right indicate full marks.
(7) For each multiple choice type of question,. Only the first attempt will be considered for evaluation.
(8)Start answers to each section on the new page.
(9) Given : R = 8.314 $JK^{-1}mol^{-1}$, Molar mass of iron 56 g mol^{-1} , $N_A = 6.022 \times 10^{23}$
Atomic numbers Fe (Z =26), Cu (Z = 29)

SECTION-A

Q.1 **Select and write the correct answer for the following multiple choice type of questions:** **[10]**

i) Aliphatic primary amine on reaction with nitrous acid forms ---
a) primary alcohol b) alkyl halide c) nitro alkane d) alkane nitrile

ii) One nanometer is equal to ------
a) 10^{-4} meter b) 10^{-5} meter c) 10^{-9} meter d) 10^{-8} meter

iii) Conversion of benzene diazonium chloride to phenol involves -----
a) dehydration b) hydrolysis c) hydration d) decarboxylation

iv) Formula for complex compound Pentacarbonyliron(0) is -----
a) $Fe_2(CO)_5$ b) $Fe_5(CO)_5$ c) $Fe_5(CO)$ d) $Fe(CO)_5$

v) Oxidation states for vanadium are ------
a) +2,+3, b) +2,+3,+4,+5 c) +2,+3,+5 d) +2,+3,+4,+6

vi) Enthalpy change accompanying the removal of an electron from one mole of gaseous atom is called ------
a) enthalpy of solution b) enthalpy of vaporization
c) enthalpy of ionization d) enthalpy of combustion

vii) Cryoscopic constant is expressed in -------
a) K kg mol^{-1} b) K kg mol^{2} c) K kg mol d) K kg mol^{-2}

viii) Diamond is an example of -----
a) ionic solid b) molecular solid
c) covalent network solid d) solid with hydrogen bonding

ix) At 25^0C the conductivity cell containing 0.01M KCl gives the resistance of 604 ohms. The cell constant is ---
(Given : Conductivity of 0.01M KCl at 25 ^{0}C is 0.00141 Ω^{-1} cm^{-1})
a) 8.52 cm^{-1} b) 85.2 cm^{-1} c) 0.0852 cm^{-1} d) 0.852 cm^{-1}

x) A weak monobasic acid is 0.06 % dissociated.
It's degree of dissociation is ---
a) 6×10^{-4} b) 6×10^{-3} c) 6×10^{-2} d) 36×10^{-4}

Q.2 Answer the following questions [8]

i) Name the catalyst used in commercial preparation of margarine.

ii) What is meant by coordination number ?

iii) How many sulfur atoms are present in crown shaped sulfur molecules ?

iv) $NO_2(g) + CO(g) \longrightarrow NO(g) + CO_2(g)$
The rate expression for the above reaction is , rate = $k[NO_2]^2$. What is the order of reaction with respect to CO ?

v) Mention the name of the monomer used in preparation of PVC.

vi) Complete the following reaction .
$CH_3\text{-}CO\text{-}CH_3 + NH_2OH \longrightarrow$?

vii) Give the structure of benzyl iodide.

viii) The solubility of N_2 gas in water at 25 ^{0}C and pressure of 1 bar is 6.85×10^{-4} $molL^{-1}$. Calculate Henry's constant.

SECTION-B

Attempt any EIGHT of the following questions **[16]**

Q.3 Identify 'A' and 'B' from the following reaction.

$2CH_3\text{-}CHO \xrightarrow{\text{dil.NaOH}} A \xrightarrow{\Delta} B$

Q.4 How will you prepare ethanamine from
a) nitroethane b) acetamide ?

Q.5 What happens when
a) tert-butyl alcohol is passed over hot copper
b) ethyl alcohol is oxidized by PCC ?

Q.6 What are interhalogen compounds ? Give two uses of helium .

Q.7 Explain homoleptic and heteroleptic complexes.

Q.8 Derive an expression for determination of molar mass of solute from boiling point elevation.

Q.9 Classify the following as globular and fibrous proteins.
Myosin, insulin, keratin, egg albumin.

Q.10 Write a short note on pseudo-first order reaction.

Q.11 Explain Wurtz- Fittig reaction .

Q.12 Write Consequences of Frenkel defect with reasons.

Q.13 One mole of an ideal gas is compressed from 500 cm^3 against a constant external pressure of 1.2×10^5 Pa. The work involved in the process is 36 J. Calculate the final volume.

Q.14 How many moles of electrons are passed when 0.8 ampere current is passed for one hour through molten $CaCl_2$? (96500 C)

SECTION-C

Attempt any EIGHT of the following questions **[24]**

Q.15 Derive an expression for rate constant of zero order reaction.
Define molecularity of reaction .

Q.16 Explain Stephen's reaction . Write IUPAC name of CH_3-CH_2-COOH.

Q.17 Convert acetic acid into
a) ethyl alcohol
b) acetic anhydride.
Give general electronic configuration of lanthanoids.

Q.18 What are the factors affecting the color of transition metal ion ?
Give a spin-only formula for the magnetic moment .

Q.19 Explain types of ligands .

Q.20 Write chemical reactions for the following
a) diethyl ether is in long contact with air
b) anisole reacts with methyl chloride in presence of anhydrous $AlCl_3$.
c) phenol reacts with aqueous solution of bromine.

Q.21 Give classification of carbohydrates. Write the structure of isoprene.

Q.22 Write applications of nanomaterials. Define green chemistry.

Q.23 How will you prepare Nylon 6,6 fiber ? Give two uses of terylene.

Q.24 Give structure of chlorous acid and chloric acid.
Write chemical composition of zinc blende.

Q.25 Determine whether the reactions with the following ΔH and ΔS values are spontaneous or nonspontaneous. State whether the reactions are exothermic or endothermic.
(a) $\Delta H = -110kJ$, $\Delta S = +40JK^{-1}$ at 400K
(b) $\Delta H = +40kJ$, $\Delta S = -120JK^{-1}$ at 250K.

Q.26 Calculate the pH of buffer solution containing 0.05 mol NaF per liter and 0.015 mol HF per liter. [$Ka = 7.2 \times 10^{-4}$ for HF]

SECTION-D

Attempt any THREE of the following questions **[12]**

Q.27 Write balanced chemical equations for the following conversions
(i) Ethyl chloride to ethyl acetate
(ii) Methyl iodide to methyl magnesium iodide
(iii) Ethyl bromide to n-butane
(iv) Methyl chloride to methyl fluoride.

Q.28 Explain paramagnetism. Write two uses of sulphuric acid.
Give a chemical equation for preparation of oleum from sulfur trioxide.

Q.29 Define electrode potential. Write net cell reaction during discharge of lead storage battery.
Draw a neat labeled diagram of dry cell

Q.30 Derive the relation between pH and pOH .
Write equations for first law of thermodynamics for
a) isobaric process b) isochoric process

Q.31 Define the following terms
a) Hypertonic solution
b) Hypotonic solution .
A compound forms hcp structure. Calculate the number of octahedral voids and tetrahedral voids ?

SECTION -A

Q.1 Select and write the correct answer. **[10]**

i) a) primary alcohol [1]

ii) c) 10^{-9} meter [1]

iii) b) hydrolysis [1]

iv) d) $Fe(CO)_5$ [1]

v) b) +2,+3,+4,+5 [1]

vi) c) enthalpy of ionization [1]

vii) a) K kg mol^{-1} [1]

viii) c) covalent network solid [1]

ix) d) 0.852 cm^{-1} [1]

x) a) 6×10^{-4} [1]

Q.2 Answer the following questions **[8]**

i) Nickel [1]

ii) Coordination number of metal ion in a complex is the number of ligand donor atoms directly attached to it or the number of electron pairs involved in the coordinate bond. [1]

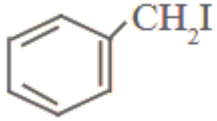
iii) 8 [1]

iv) Zero order [1]

v) Vinyl chloride [1]

vi) Complete the following reaction . [1]

$CH_3\text{-}CO\text{-}CH_3 + NH_2OH \longrightarrow (CH_3)_2C = N\text{-}OH + H_2O$

vii)  [1]

viii) 6.85×10^{-4} [1]

SECTION-B

Attempt any eight of the following questions **[16]**

Q.3 A = CH_3-CH(OH)-CH_2-CHO , [1]

B = CH_3-CH = CH-CHO [1]

Q.4 CH_3-NO_2 + 6[H] $\xrightarrow{Sn/HCl}$ CH_3-NH_2 + $2H_2O$ [1]

CH_3-CO-NH_2 + 4[H] $\xrightarrow{LiAlH4/\ ether}$ CH_3-CH_2-NH_2 [1]

Q.5 [1]

a) $(H_3C)_3C(OH)$ $\xrightarrow{heated\ copper}$ $(H_3C)_2C = CH_2$

[1]

b) H_3C -CH_2-OH $\xrightarrow{PCC}$ H_3C-CHO

Q.6 Definition [1]

Any two uses [1]

Q.7 Explanation of homoleptic complexes. [1]

Explanation of heteroleptic complexes. [1]

Q.8 $\Delta T_b = K_b m$ [1/2]

Moles of solvent = $\frac{W1}{M1}$ [1/2]

Moles of solute = $\frac{W2}{M2}$

Molality (m) = $\frac{1000\ W2}{M2W1}$ [1/2]

Molar mass of solute = $M_2 = \frac{1000\ kb\ W2}{\Delta Tb\ M2\ W1}$ [1/2]

Q.9 Myosin – fibrous protein [1/2]

Insulin – globular protein [1/2]

keratin - fibrous protein [1/2]

egg albumin - globular protein [1/2]

Q.10 Explanation [1]

Reaction [1]

Q.11 Explanation [1]

Reaction [1]

Q.12 Any four points [2]

Q.13 $W = - P_{ext}\ \Delta V$ [1/2]

$0.360 = -1.2 (V_2 - 0.5)$ [1/2]

$0.360 / 1.2 = -(V_2 - 0.5) = V_2 + 0.5$ [1/2]

$V_2 = 0.2$ liter $= 200\ cm^3$ [1/2]

Q.14 $Q = I \times t$ [1/2]

$Q = 0.8 \times 1 \times 60 \times 60$

$Q = 2880$ C [1/2]

The number of moles of electrons

$n = Q/96500$ [1/2]

$n = 2880/96500$

$n = 0.02984$ [1/2]

SECTION-C

Attempt any eight of the following questions **[24]**

Q.15 A → P

the differential rate law is given by

rate = - d[A]/[dt] [1/2]

= k [A]0 = k

d[A] = -k dt [1/2]

Integration between the limits

$$\int_{[A]_0}^{[A]^t} d[A] = -k \int_0^t dt$$ [1/2]

[A] = [A]0 at t = 0 and [A] = [A]t at t = t gives

k t = [A]0 - [A]t

Definition [1/2]

[1]

Explanation [1]

Q.16 [1]

$$R - C \equiv N + 2[H] \xrightarrow{SnCl2,\ HCl} R - HC = NH.HCl \xrightarrow{H3O^+} R - CHO + NH_4Cl$$ [1]

IUPAC name of CH_3-CH_2-COOH is propanoic acid

Q.17 [1]

$$CH_3\text{-}COOH + LiAlH_4 \xrightarrow{dry\ ether} CH_3\text{-}CH_2OH$$ [1]

[1]

$$2CH_3\text{-}COOH \xrightarrow{P2O5} CH_3COOCOCH_3$$

$[Xe]4f^{0-14}\ 5d^{0-2}\ 6s^2$

Q.18 Any four points [2]

$\mu = \sqrt{n}(n + 2)BM$ [1]

Q.19 Monodentate ligand and example [1]
Ambidentate ligand and example [1]
Polydentate ligand and example [1]

Q.20 a) balanced chemical equation [1]
b) balanced chemical equation [1]
c) balanced chemical equation [1]

Q.21 classification of carbohydrates [2]
$CH_2 = C(CH_3)-CH = CH_2$ [1]

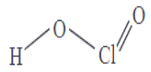
Q.22 Any two applications of nanomaterials. [2]
Definition [1]

Q.23 $n\ HOOC-(CH_2)_4-COOH + n\ H_2N-(CH_2)_6-NH_2 \rightarrow$ [1]
$n\ [^-OOC(CH_2)_4COO^- - H_3N^+(CH_2)_6N^+H_3]$
$n\ [^-OOC(CH_2)_4COO^- - H_3N^+(CH_2)_6N^+H_3] \rightarrow$
$[-CO-(CH_2)_4-CO-NH-(CH_2)_6-NH-]_n$ [1]

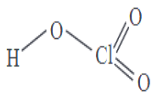
Any two uses of terylene. [1]

Q.24 [1]

Chlorous acid, $HOClO$ or $HClO_2$



Chloric acid, $HClO_3$



[1]

ZnS [1]

Q.25 $\Delta G = \Delta H - T\Delta S$ [1/2]
$= -110 - 400 \times 0.04$
$= -110 - 16$
$= -126kJ$
ΔG is negative, the reaction is spontaneous and exothermic. [1/2]
$\Delta G = \Delta H - T.\Delta S$ [1/2]
$= 40 - 250 \times (-0.12)$ [1/2]
$= 40 + 30$
$= 70kJ.$
Since $\Delta G > 0$, the reaction is non-spontaneous [1/2]

ΔG = 70kJ; The reaction is endothermic and non-spontaneous. [1/2]

Q.26 $p^{OH} = log\frac{[Salt]}{[Base]} - logK_b$ [1/2]

[1/2]

$= log\frac{0.015}{0.05} - log7.2 * 10^{-4}$

[1/2]

$= 2.6198$

$p^H = (14 - 2.6198)$ [1/2]

$= 11.3802$ [1/2]

p^H the value 11.3802. [1/2]

SECTION-D

Attempt any three of the following questions **[12]**

Q.27

i) CH_3- Cl + CH_3- CH_2 – COOAg $\xrightarrow{\Delta}$ CH_3 – COO- CH_2- CH_3 + AgCl [1]

[1]

ii) CH_3-I + Mg $\xrightarrow{\text{dry ether}}$ CH_3MgI [1]

iii) $2C_2H_5Br + 2Na \xrightarrow{\text{dry ether}} CH_3CH_2CH_2CH_3 + NaBr$ [1]

iv) $CH_3Cl + AgF \rightarrow CH_3F + AgCl$

Q.28 Explanation [1]

Example [1]

Any two uses [1]

$SO_3(g) + H_2SO_4 \rightarrow H_2S_2O_7$ [1]

Q.29 Definition. [1]

$Pb(s)+PbO_2(g)+2H_2SO_4(aq) \rightarrow 2PbSO_4(s)+2H_2O(l)$ [1]

Diagram [1]

Labeling [1]

Q.30 $Kw = [H_3O^{\oplus}][OH^-]$ [1/2]

$[H_3O^{\oplus}][OH^-] = 1.0 \times 10\text{-}14$ [1/2]

$\log_{10}[H_3O^{\oplus}] + \log_{10}[OH^-] = -14$ [1/2]

$-\log_{10}[H_3O^{\oplus}] + \{-\log_{10}[OH^-]\} = 14$ [1/2]

pH + pOH = 14 [1]

$\Delta U = QV$ [1]

$Q_p = \Delta U + P_{ext}\, \Delta V$

Q.31 Definition [1]

Definition [1]

Number of atoms in 0.4 mol = 0.4 × NA [1/2]

$= 0.4 \times 6.022 \times 10^{23} = 2.4098 \times 10^{23}$ [1/2]

Number of octahedral voids = number of atoms = 2.4098×10^{23} [1/2]

Number of tetrahedral voids = 2 × number of atoms

$= 2 \times 2.4098 \times 10^{23}$

$= 4.818 \times 10^{23}$ [1/2]

Model Question Paper- II

Std. : 12th | Sub : Chemistry | Marks-70

Date : | Pages : 4 | Time : 3 hrs

Instructions :

There are four sections in this question paper.

(1)**Section A** : Q.**1**. contains **Ten** multiple choice type questions carrying **one** mark each.
Q.**2**.contains **Eight** very short answer type questions carrying **one** mark each.

(2) **Section B** : Q.No.**3** to Q.No.**14** are **twelve** short answer type questions carrying **two** marks each. (Attempt **any Eight**)

(3) **Section C** : Q.No.**15** to Q.No.**26** are **twelve** short answer type questions carrying **three** marks each. (Attempt **any Eight**)

(4) **Section D** : Q.No.**27** to Q.No.**31** are **five** long answer type questions carrying **four** marks each. (Attempt **any Three**)

(5) Use of log is allowed.Use of calculator is not allowed.

(6) Figures to the right indicate full marks.

(7) For each multiple choice type of question, Only the first attempt will be considered for evaluation.

(8) Start answers to each section on the new page.

(9).Given : R = 8.314 $JK^{-1}mol^{-1}$, Molar mass of iron 56 g mol^{-1} , $N_A = 6.022 \times 10^{23}$
Atomic numbers Fe (Z =26), Cu (Z = 29)

SECTION - A

Q.1. Select and write the correct answer for the following multiple choice type of questions: [10]

(i) In an isothermal process

(a) $q = 0$ and $\Delta U \neq 0$ (b) $q = 0$ and $\Delta U = 0$

c) $q \neq 0$ and $\Delta U = 0$ (d) $q \neq 0$ and $\Delta U \neq 0$

(ii) The number of atoms in a face centered cubic unit cell is

(a) 4 (b) 5

(c) 6 (d) 2

(iii) The process in which ore is reduced to metal at high temperature using reducing agent

is called

(a) electrometallurgy (b) hydrometallurgy

(c) pyrometallurgy (d) combustion

(iv) Reaction between hot concentrated HI and anisole gives

(a) phenol and methyl iodide (b) iodobenzene and methyl alcohol

(c) iodobenzene and methyl iodide (d) phenol and methyl alcohol

(v) In green technology developed by Drath and Frost, adipic acid is enzymatically synthesized from

(a) sucrose (b) lactose

(c) maltose (d) glucose

(vi) Which of the following will have maximum depression in freezing point?

(a) 0.5 M $BaSO_4$ (b) 1 M KCI

(c) 0.5 M $Al_2(SO_4)_3$ (d) 0.5 M $BaCl_2$

(vii) Mendius reaction is used to convert

(a) amide into amine (b) alkyl halide into amine

(c) nitroalkane into amine (d) alkyl cyanide into amine

(viii) The coordination number of Al in potassium trioxalatoaluminate(III) is

(a) 3 (b) 6

(c) 8 (d) 9

(ix) How many coulombs of electricity are required to produce 100 g of calcium from molten $CaCl_2$? (atomic mass of Ca = 40)

(a) 96500 C (b) 2.5 × 96500 C

(c) 5 × 96500 C (d) $\frac{96500}{5}$ C

(x) The solubility product of $PbCrO_4$ is 1×10^{-16}. Then the molar solubility of $PbCrO_4$ is

(a) 1.0×10^{-6} (b) 1.0×10^{-4}

(c) 1.0×10^{-8} (d) 1.0×10^{-16}

Q.2. Answer the following questions: **[8]**

(i) Give one example of pseudo first order reaction.

(ii) What is the action of excess chlorine with ammonia?

(iii) Write the general electronic configuration of the 3d series.

(iv) Name the reagent used to convert ethyl bromide to ethyl isocyanide.

(v) Write IUPAC of Methyl n-propyl ketone.

(vi) Write formula of Hexacyanoferrate(II)complex ion.

(vii) Write the name of the catalyst used for the preparation of high density polythene polymer.

(viii) The osmotic pressure of $CaCl_2$ and urea solutions of the same concentration at the the same temperature are respectively 0.624 atm and 0.312 atm. Calculate van't Hoff factor for $CaC1_2$.

SECTION - B

Attempt any EIGHT of the following questions: **[16]**

Q.3. A reaction takes place in two steps,

$NO(g) + Cl_2(g) \rightarrow NOCl_2(g)$

$NOCl_2(g) + NO(g) \rightarrow 2NOCl(g)$

(a) Identify reaction intermediate.

(b) What is the molecularity of each step?

Q.4. Distinguish between crystalline solids and amorphous solids.

Q.5. Write the equations for preparation of ethyl chloride using

a) Hydrogen chloride b) Thionyl chloride.

Q.6. Explain preparation of glucose from sucrose.

Q.7. Define ebullioscopic constant. Write its unit.

Q.8. Classify the following ligands into monodentate and polydentate.

a) Ammonia
b) Carbon monoxide
c) Ethylenediamine
d) Ethylenediaminetetraacetate ion

Q.9. Draw structure of bromine pentafluoride. Write two uses of helium.

Q.10. How is ethanol prepared from methanal by using Grignard reagent?

Q.11. Write a short note on Hofmann bromamide degradation.

Q.12. Complete and rewrite the balanced chemical equation for the following reactions :

a) Benzaldehyde $\xrightarrow{50\%\ NaOH}$?

b) Acetone + phenyl hydrazine $\xrightarrow{H+}$?

Q.13. Calculate the constant external pressure required to compress 5 moles of an ideal gas from 23×10^{-3} m^3 to 8×10^{-3} m^3 when the work obtained is 4.545 kJ.

Q.14. Calculate standard cell potential of the following galvanic cell.
$Zn\,|\,Zn^{2+}(1M)\,||\,Pb^{2+}(1M)\,|\,Pb$. If $E^o_{Pb} = 0.126$ V & $E^o_{Zn} = -0.763$V

SECTION - C

Attempt any EIGHT of the following questions: **[24]**

Q.15. What is lanthanoid contraction? Fluorine shows only −1 oxidation state while other halogens show −1, +1, +3, +5 and +7 oxidation states, Explain.

Q.16. How is nylon 6, 6 prepared? Write two uses of terylene.

Q.17. Derive an integrated rate law expression for first order reaction.

Q.18. Define green chemistry. Write one example of nanomaterial used in following
a) Water purification
b) Tyres of car

Q.19. What are amines? How are proteins classified on the basis of molecular shape?

Q.20. How will you prepare diethyl ether by using

a) ethanol
b) sodium ethoxide ?
Write a characteristic chemical test to distinguish between carbolic acid and alcohol.

Q.21. Write the IUPAC name of $[Ni(CN)_4]^{2-}$. Draw geometrical isomers of following complexes.
a) $[Pt(NH_3)(H_2O)Cl_2]$ b) $[Co(NH_3)_4Cl_2]^+$

Q.22. What are ferrous and non-ferrous alloys? Write any two uses of alloy.

Q.23. What happens when ethanoic acid is heated with
a) P_2O_5
b) ethanol in presence of conc. H_2SO_4
c) PCl_5

Q.24. Write classification of aliphatic ketones with suitable example, Give observed electronic configuration of copper (Z = 29).

Q.25. Calculate ΔU and amount of PV work done at 298 K for the following reaction.
$C_2H_{4(g)} + HCl_{(g)} \rightarrow C_2H_5Cl_{(g)}$, $\Delta H = -72.3$ kJ.

Q.26. A buffer solution contains 0.3 M NH_4OH and 0.4M NH_4Cl. If K_b for NH_4OH is 1.8×10^{-5}, calculate pH of the solution.

SECTION - D

Attempt any THREE of the following questions: **[12]**

Q.27. Derive the relationship between freezing point depression of a solution containing non-volatile solute and its molar mass.
A unit cell of iron crystal has an edge length 288 pm and density 7.86 g cm^{-3}. Find the number of atoms per unit cell. [*Molar mass of iron = 56 g* mol^{-1}, $N_A = 6.022 \times 10^{23}$]

Q.28. Define anisotropy. Give one example showing the reducing property of ozone.
Classify the following oxides as acidic, basic and amphoteric.
Al_2O_3, CaO, SO_3, Cl_2O_7.

Q.29. Define the following terms:
(a) Enthalpy of atomization (b) Enthalpy of vaporization
Why is it necessary to add H_2SO_4 while preparing the solution of $CuSO_4$?

Q.30. Explain with a neat labeled diagram construction and working of standard hydrogen electrode. What are the difficulties in setting a standard hydrogen electrode?

Q.31. Write chemical reactions for the following conversions.
a) Bromobenzene to toluene
b) Methyl bromide to methyl propionate
Explain optical activity of 2-chlorobutane.

Model answer and Scheme of Marking-II

Std. :12th. **Sub : Chemistry (55)** Marks-70

Date : Time : 3 hrs

Notes:

i. *The marking should be strictly followed.*

ii. *Answers given below are not necessarily complete answers but are guidelines for assessment.*

iii. *Any alternative correct method should be given full credit.*

iv. *Unit must be written as per the standard rules. Deduct half mark for wrong unit or no unit.*

v. *In case of MCQs [i.e. Q (i) to (x)] evaluation should be done for the first attempt only.*

vi. *Individual question wise marks should be written for each section (excluding marks of extra questions) inside the answer book and the total should be rounded up section wise only.*

[Section A (Q. No. 1 and Q. No 2); Section B (Q. No. 3 to Q. No 14); Section C (Q. No. 15 to Q. No 26); Section D (Q. No. 27 to Q. No 31)]

vii. *Total of marks for each section should be written on the cover page of the answer book same as inside.*

viii. *In case of chemical reactions deduct ½ marks if proper conditions are not written.*

SECTION – A

Q.1. Select and write correct answer : [10]

(i) (c) $q \neq 0$ and $\Delta U = 0$ (1)

(ii) (a) 4 (1)

(iii) (c) pyrometallurgy (1)

(iv) (a) phenol and methyl iodide (1)

(v) (d) glucose (1)

(vi) (c) 0.5M $Al_2(SO_4)_3$ (1)

(vii) (d) alkyl cyanide into amine (1)

(viii) (b) 6 (1)

(ix) (c) 5 x 96500 C (1)

(x) (c) 1.0×10^{-8} (1)

Q.2 (i) One example of pseudo first order reaction (1)

(ii) $NH_3 + 3Cl_2 \rightarrow NCl_3 + 3HCl$ (1)

(iii) $3d^{1\text{-}10}\ 4s^{1\text{-}2}$ (1)

(iv) AgCN (alco.) (1)

(v) Pentan – 2 – one (1)

(vi) $[Fe(CN)_6]^{4-}$ (1)

(vii) Zieglar – Natta (triethylaluminum + titanium tetrachloride) (1)

(viii) i=2 (1)

SECTION – B

Attempt any EIGHT of the following questions: **[16]**

Q. 3. (a) $NOCl_{2\,(g)}$ (1)

(b) Molecularity = 2 (for each reaction) (1)

Q. 4. Four points of distinction $(4x\frac{1}{2} = 2)$

Q. 5. (a) Correct reaction (1)

(b) Correct reaction (1)

Q. 6.		Explanation	(1)
		Reaction	(1)
Q.7		Correct definition	(1)
		K kg mol^{-1}	(1)
Q. 8.	(a)	Monodentate	$(\frac{1}{2})$
	(b)	Monodentate	$(\frac{1}{2})$
	(c)	Polydentate	$(\frac{1}{2})$
	(d)	Polydentate	$(\frac{1}{2})$
Q. 9.		Correct structure	(1)
		Any two uses of helium	(1)
Q.10		$H - CHO + CH_3MgBr \xrightarrow{\text{dry ether}} CH_3 - CH_2 - OMgBr$	(1)
		$CH_3 - CH_2 - OMgBr \xrightarrow{H3O+} CH_3CH_2OH + MgBr(OH)$	(1)
Q.11.		Correct explanation	(1)
		Correct reaction / General reaction	(1)
Q.12.		Correct balanced reaction	(1)
		Correct balanced reaction	(1)
Q.13.		$W = - P_{ex} (V_2 - V_1)$	(1)
		$4.545 \times 10^3 = - P_{ex} (8 \times 10^{-3} - 23 \times 10^{-3})$	$(\frac{1}{2})$
		$P_{ex} = \frac{4.545 \times 10-3}{15 \times 10-3}$	$(\frac{1}{2})$
		$P_{ex} = 3.03 \times 10^{-3}$ Pa	(1)
Q.14.		$E^0_{cell} = E^0_{Pb} - E^0_{Zn}$	$(\frac{1}{2})$
		$= 0.126 - (- 0.763)$	$(\frac{1}{2})$
		$E^0_{cell} = 0.889$ V	(1)

SECTION – C

Attempt any EIGHT of the following questions **[24]**

Q.15. Correct definition (1)

Fluorine is most electronegative $(\frac{1}{2})$

It has no d – orbitals in its valence shell $(\frac{1}{2})$

Other halogens possess empty d – orbitals in the valence shell $(\frac{1}{2})$

They can expand their octet $(\frac{1}{2})$

Q.16. $nHOOC-(CH_2)_4-COOH + nH_2N-(CH_2)_6-NH_2 \rightarrow$ (1)

$n[^{-}OOC-(CH_2)_4-COO^{-}\ H_3N^{+}-(CH_2)_6-N^{+}H_3\ ]$

$\xrightarrow{-nH2O,533\ K,High\ pressure} [CO(CH_2)_4-CO-NH-(CH_2)_6-NH]_n$ (1)

Any two uses of terylene (1)

Q.17. $A \rightarrow$ product

Rate $= -\frac{d[A]}{dt} = k[A]$ $(\frac{1}{2})$

$\frac{d[A]}{A} = -k\ dt$

$\int_{[A]_0}^{[A]_t} \frac{d[A]}{[A]} = -k\int_0^t dt$ $(\frac{1}{2})$

$[\ln ln\ [A]\ ]_{[A]_0}^{[A]_t} = -k\ t$ $(\frac{1}{2})$

$\ln ln\ [A]_t - \ln ln\ [A]_0 = -k\ t$ $(\frac{1}{2})$

$$\ln ln \frac{[A]_t}{[A]_0} = -\, k\, t$$

$$k = \frac{1}{t} \ln ln \frac{[A]_0}{[A]_t} \quad (\frac{1}{2})$$

$$k = \frac{2.303}{t} \log_{10} \frac{[A]_0}{[A]_t} \quad (\frac{1}{2})$$

Q.18. Correct definition (1)

(a) Silver nanoparticles (1)

(b) Carbon black (1)

Q.19. Correct definition (1)

Globular proteins : Explanation ($\frac{1}{2}$)

Example ($\frac{1}{2}$)

Fibrous proteins : Explanation ($\frac{1}{2}$)

Example ($\frac{1}{2}$)

Q.20 (a) From ethanol – correct reaction (1)

(b) From sodium ethoxide – correct reaction (1)

Phenol gives purple / violet / green colouration with neutral ferric chloride solution ($\frac{1}{2}$)

Alcohol do not give this test ($\frac{1}{2}$)

Q.21 Tetracyanonickelate(II)ion (1)

	Cis and trans isomers of $[Pt(NH_3)(H_2O)Cl_2]$	(1)
	Cis and trans isomers of $[Co(NH_3)_4Cl_2]^+$	(1)
Q.22	Correct definition – Ferrous alloy	(1)
	Correct definition - Non ferrous alloy	(1)
	Two uses of alloy	$(\frac{1}{2} \times 2 = 1)$
Q.23	(a) $2CH_3COOH + P_2O_5 \rightarrow (CH_3CO)_2O + H_2O$	(1)
	(b) $CH_3COOH + C_2H_5OH \xrightarrow{Conc.H_2SO_4} CH_3COOC_2H_5 + H_2O$	(1)
	(c) $CH_3COOH + PCl_3 \rightarrow CH_3COCl + POCl_3 + HCl$	(1)
Q.24	Simple / symmetrical ketones	$(\frac{1}{2})$
	Example	$(\frac{1}{2})$
	Mixed / unsymmetrical ketones	$(\frac{1}{2})$
	Example	$(\frac{1}{2})$
	$[Ar]\ 3d^9\ 4s^2$	(1)
Q.25	$\Delta n = n_2 - n_1 = 1 - 2 = -1$	$(\frac{1}{2})$
	$W = -\Delta nRT$ $= -(-1) \times 8.314 \times 298$ $= 2478\ J$ $= 2.487\ kJ$	$(\frac{1}{2})$ (1)
	$\Delta H = \Delta U + \Delta nRT$ $\Delta U = \Delta H - \Delta nRT$ $\Delta U = -72.3 - (-2.478)$	$(\frac{1}{2})$

$= -69.82$ kJ $(\frac{1}{2})$

Q.26 $pK_b = -\log_{10} K_b$ $(\frac{1}{2})$

$= -\log_{10} 1.8 \times 10^{-5}$

$= 4.7447$ $(\frac{1}{2})$

$pOH = pK_b + \log_{10} \frac{[Salt]}{[Base]}$ $(\frac{1}{2})$

$= 4.7447 + \log_{10} \frac{0.4}{0.3}$

$= 4.8695$ $(\frac{1}{2})$

$pH + pOH = 14$ $(\frac{1}{2})$

$pH = 14 - pOH$

$pH = 14 - 4.8695$

$pH = 9.1305$ $(\frac{1}{2})$

SECTION – D

Attempt any THREE of the following questions

[12]

Q.27. $\Delta T_f = K_f \times m$ $(\frac{1}{2})$

W_2 g of solute with molar mass M_2 dissolved in W_1 g of solvent. $(\frac{1}{2})$

$M = \frac{1000 W2}{M2 W1}$ $(\frac{1}{2})$

$\Delta T_f = K_f \frac{1000\, W2}{M2\, W1}$

$M_2 = \frac{1000\, Kf\, W2}{\Delta Tf\, W1}$ $(\frac{1}{2})$

$\rho = \frac{n\, M}{a3\, NA}$ $(\frac{1}{2})$

$n = \frac{\rho\, a3NA}{M}$

$n = \frac{7.86 \times (2.88 \times 10 - 8) 3 \times 6.022 \times 1023}{56}$ $(\frac{1}{2})$

n = 2 (1)

Q.28. Correct definition (1)

One example (1)

Al_2O_3 - Amphoteric oxide $(\frac{1}{2})$

CaO - Basic oxide $(\frac{1}{2})$

SO_3 - Acidic oxide $(\frac{1}{2})$

Cl_2O_3 - Acidic oxide $(\frac{1}{2})$

Q.29. Correct definition (1)

Correct definition (1)

$Cu^{2+}_{(aq)} + 4H_2O_{(l)} \rightarrow Cu(OH)_2 + 2H_3O^+_{(aq)}$ $(\frac{1}{2})$

$Cu(OH)_2$ makes solution turbid $(\frac{1}{2})$

Addition of H_2SO_4, equilibrium shift to left $(\frac{1}{2})$

$Cu(OH)_2$ dissolves, clear solution is formed $(\frac{1}{2})$

Q.30. Construction (1)

Diagram (1)

Electrode reaction (1)

Two difficulties in setting SHE $(\frac{1}{2} \times 2 = 1)$

Q.31. Correct reaction (1)

Correct reaction (1)

Presence of one chiral carbon atom $(\frac{1}{2})$

Diagram of two optical isomers (1)

Racemic mixture $(\frac{1}{2})$

PART-D

Study Material of Some Selected Chapters

SOLUTIONS

Chapter Summary:

Solubility of a solute:

It is the amount of solute per unit volume of saturated solution at a specific temperature. It is expressed in mol/L.

Factors affecting solubility:

1.Nature of solute and solvent

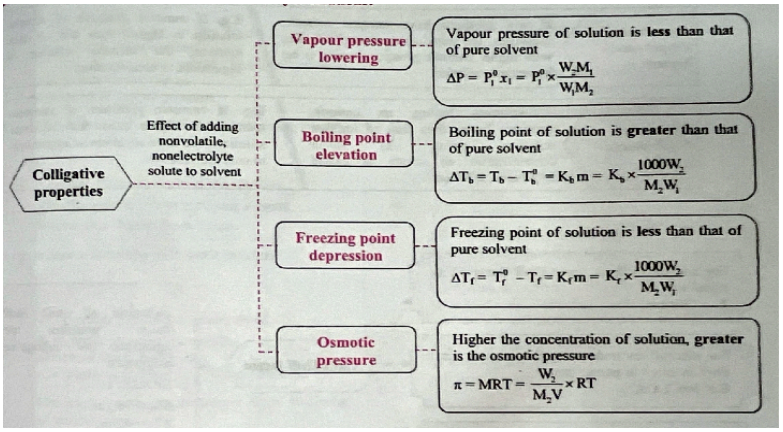
2.Temperature

3. Pressure

Henry's Law: S α P or $S = K_H P$

Raoult's Law: The partial vapor pressure of any volatile component of a solution is equal to the vapor pressure of the pure component multiplied by its mole fraction in the solution.

Colligative Properties:



Osmosis: The net spontaneous flow of solvent molecules into the solution or from more dilute solution to more concentrated solution through a semipermeable membrane is called osmosis.

Isotonic solutions: Two or more solutions having the same osmotic pressure are said to be isotonic solutions. Eg: 0.1 M urea solution and 0.1 M sucrose solution are isotonic.

Hypertonic solutions: If two solutions have unequal osmotic pressures, the more concentrated solution with higher osmotic pressure is said to be hypertonic solution. Eg: If the osmotic pressure of sucrose solution is higher than that of urea solution, the sucrose solution is hypertonic to urea solution.

Hypotonic solution: A solution having an osmotic pressure lower than that of another solution due to lower concentration of solute is called hypotonic solution. Eg: If the osmotic pressure of sucrose solution is higher than that of urea solution, the urea solution is hypotonic to sucrose solution.

Van't Hoff factor(i): It is the ratio of the colligative property of a solution of electrolyte to the colligative property of a nonelectrolyte solution of the same concentration.

VSA (1 MARK)

Q.1. What is the boiling point?

Ans: Boiling point of a liquid is the temperature at which its vapor pressure equals to the applied pressure.

Q.2. What is a semipermeable membrane?

Ans: Semipermeable membrane is a film such as a cellophane which has pores large enough to allow the solvent molecules to pass through them.

SA - I (2 MARKS)

Q.3. Derive the relationship between relative lowering of vapor pressure and molar mass of non-volatile solute.

Ans: The relative lowering of vapour pressure is equal to the mole fraction x_2 of solute in the solution.

$$\frac{\Delta P}{P_1^0} = x_2$$

But the mole fraction of a component of the solution is equal to its moles divided by the total moles of the solution

$$x_2 = \frac{n_2}{n_1+n_2}$$

where n_1 and n_2 are the moles of solvent and solute respectively, in the solution.

We are concerned only with dilute solutions hence $n_1 >> n_2$ and $n_1+n_2 \approx n_1$. The mole fraction x_2 is then given by

$$x_2 = \frac{n_2}{n_1} \quad \text{and}$$

$$\frac{\Delta P}{P_1^0} = \frac{n_2}{n_1} \quad \ldots$$

Suppose that we prepare a solution by dissolving W_2 g of a solute in W_1 g of solvent. The moles of solute and solvent in the solution are then,

$$n_2 = \frac{W_2}{M_2} \text{ and } n_1 = \frac{W_1}{M_1}$$

where M_1 and M_2 are molar masses of solvent and solute, respectively. Substitution of Eq. (2.10) into Eq. (2.9) yields

$$x_2 = \frac{\Delta P}{P_1^0} = \frac{W_2/M_2}{W_1/M_1}$$

$$\frac{P_1^0 - P_1}{P_1^0} = \frac{\Delta P}{P_1^0} = \frac{W_2 M_1}{M_2 W_1}$$

Knowing all other quantities, molar mass of solute M_2 can be calculated.

Q.4. State Henry's law. Write SI unit of Henry's law constant.

Ans: It states that the solubility of a gas in a liquid is directly proportional to the pressure of the gas over the solution.

$S \propto P$ or $S = K_H P$

K_H, the proportionality constant is called Henry's law constant.

Units : $K_H = \frac{S}{P} = \frac{mol\,L^{-1}}{bar} = mol\,L^{-1}bar^{-1}$

Q.5. Define ebullioscopic constant. Write its SI Unit.

Ans: Ebullioscopic constant , K_b is the boiling point elevation produced by 1 molal solution.

Units of K_b : $K_b = \frac{\Delta T_b}{m} = \frac{K}{mol\ kg^{-1}} = K\ kg\ mol^{-1}$

Q.6. Define cryoscopic constant. Write the condition of reverse osmosis.

Ans:Cryoscopic constant is the depression in freezing point produced by 1 molal solution of a non-volatile solute. The direction of osmosis can be reversed by applying a pressure larger than the osmotic pressure.

SA- II (3 MARKS)

Q.7. Define isotonic solution. How will you determine molar mass of solute from boiling point elevation?

Ans:

$\Delta T_b = K_b m$

Suppose we prepare a solution by dissolving W_2 g of solute in W_1 g of solvent.

Moles of solute in W_1 g of solvent = $\frac{W_2}{M_2}$ where M_2 is the molar mass of solute.

Mass of solvent = W_1 g = $\frac{W_1 g}{1000\ g/kg} = \frac{W_1}{1000}$ kg

Recall the expression of molality, m.

$$m = \frac{\text{moles of solute}}{\text{mass of solvent in kg}}$$

$$= \frac{W_2/M_2\ \text{mol}}{W_1/1000\ \text{kg}} = \frac{1000\ W_2}{M_2 W_1}\ \text{mol kg}^{-1}.$$

$$\Delta T_b = K_b \frac{1000\ W_2}{M_2 W_1}$$

Hence,

$$M_2 = \frac{1000\ K_b W_2}{\Delta T_b W_1}$$

Q.8. Define freezing point. Derive the relation between freezing point depression and molar mass of solute.

Ans: The freezing point of a liquid is the temperature at which liquid and solid are in equilibrium and the two phases have the same vapor pressure.

Since, $\Delta T_f = K_f m$ .....(i)

Suppose a solution prepared by dissolving W_2 g of solute in W_1 g of solvent.

Moles of solute = $\frac{W_2}{M_2}$

where M_2 is the molar mass of solute.

Mass of solvent = $\frac{W_1}{1000}$ kg

The molality m of the solution is given by

$$m = \frac{moles\ of\ solute}{mass\ of\ solvent\ in\ kg} = \frac{W_2/M_2}{W_1/1000}$$

$$m = \frac{1000\,W_2}{M_2 W_1} \qquad \text{.....(ii)}$$

Substitution of Eq. (ii) into Eq. (i) gives

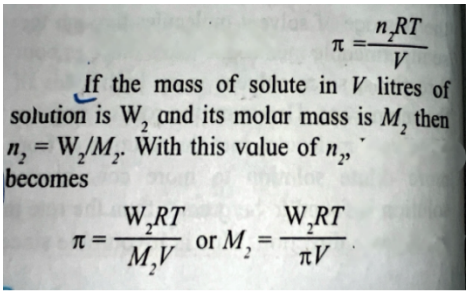
$$\Delta T_f = K_f \frac{1000\,W_2}{M_2 W_1}$$

Hence, $$M_2 = \frac{1000 K_f W_2}{\Delta T_f W_1} \qquad \text{.....(iii)}$$

Q.9. Define van't Hoff factor. Derive an expression to calculate molar mass of a non-volatile solute by osmotic pressure measurement.

Ans: van't Hoff factor (i) is the ratio of the colligative property of a solution of electrolyte to the colligative property of a nonelectrolyte solution of the same concentration.

For very dilute solutions, the osmotic pressure follows the equation,

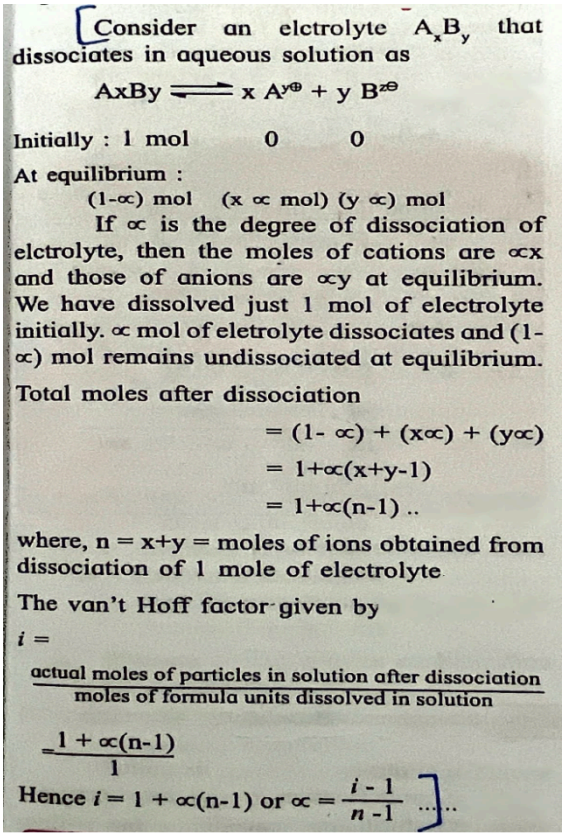

$$\pi = \frac{n_2 RT}{V}$$

If the mass of solute in V litres of solution is W_2 and its molar mass is M_2 then $n_2 = W_2/M_2$. With this value of n_2, becomes

$$\pi = \frac{W_2 RT}{M_2 V} \text{ or } M_2 = \frac{W_2 RT}{\pi V}$$

Q.10. Define osmotic pressure. How is van't Hoff factor related to degree of dissociation?

Ans:The hydrostatic pressure that stops osmosis is an osmotic pressure (π) of the solution



Consider an elctrolyte A_xB_y that dissociates in aqueous solution as

$$AxBy \rightleftharpoons x\,A^{y\oplus} + y\,B^{z\ominus}$$

Initially : 1 mol 0 0

At equilibrium :

$(1-\alpha)$ mol $(x\,\alpha$ mol) $(y\,\alpha)$ mol

If α is the degree of dissociation of elctrolyte, then the moles of cations are αx and those of anions are αy at equilibrium. We have dissolved just 1 mol of electrolyte initially. α mol of eletrolyte dissociates and $(1-\alpha)$ mol remains undissociated at equilibrium.

Total moles after dissociation

$$= (1-\alpha) + (x\alpha) + (y\alpha)$$
$$= 1+\alpha(x+y-1)$$
$$= 1+\alpha(n-1) \ldots$$

where, $n = x+y$ = moles of ions obtained from dissociation of 1 mole of electrolyte

The van't Hoff factor given by

$$i = \frac{\text{actual moles of particles in solution after dissociation}}{\text{moles of formula units dissolved in solution}}$$

$$= \frac{1+\alpha(n-1)}{1}$$

Hence $i = 1 + \alpha(n-1)$ or $\alpha = \frac{i-1}{n-1}$ .....

CHEMICAL THERMODYNAMICS

Chapter Summary:

Terms Used in Thermodynamics

a) System: a) Open System: Both energy & matter exchange with surrounding
b) Closed System: Only energy but not matter exchange with surroundings
c) Isolated system:Neither energy nor matter exchange with surroundings

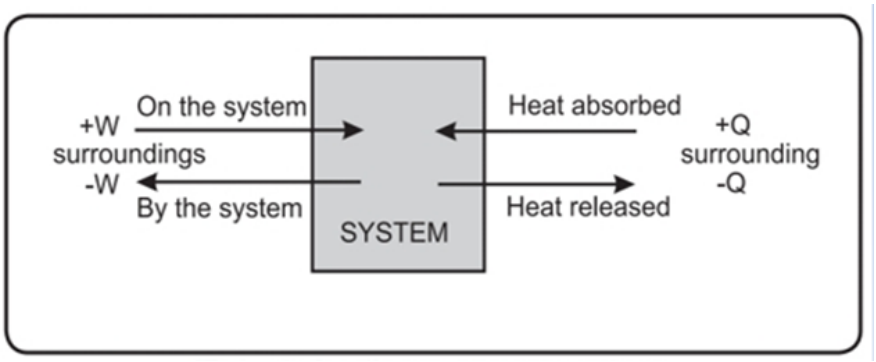
Properties of System:

a) Extensive property: Depends on quantity of matter present in system eg. Mass
b) Intensive Property: Independent on quantity of matter present in system eg Density

Types of process: -

Types of Process	Constant	Equation	Egs.
Isothermal	Temperature	$\Delta T = 0$ & $\Delta U = 0$	Boiling of water at 100 ^{0}C
Isobaric	Pressure	$\Delta P = 0$	Laboratory reaction carried in open container at const. atmospheric pressure.
Isochoric	Volume	$\Delta V = 0$	Chemical reaction carried in closed container.
Adiabatic	-	$Q=0$	Neutralisation reaction in perfectly insulated closed vessel

Sign Convention of W and Q



Work done In different Process:

1. In isothermal process when pressure is constant

$W = -P_{ext} \times \Delta V$ **OR** $W = = -P_{ext} \times (V_2 - V_1)$

2. Work done in reversible process $W_{max} = -2.303\ nRT \log_{10} V_2/V_1$
3. Work done in vacuum W= 0

Internal Energy (U): Every substance associated with a definite amount of energy which is stored in a substance is called internal energy.

$\Delta U = U_2 - U_1$; U_1 and U_2 are internal energies of initial & final state

First Law of Thermodynamics

First law of thermodynamics is also called the law of conservation of energy.

Statement: a) Energy is neither be created nor destroyed it converts one form into another.

$\Delta U = Q + W$

Enthalpy (H): It is the sum of internal energy and energy equivalent to PV work.

$H = U + PV$; H is state function and $\Delta H = H_2 - H_1$

Enthalpy change in chemical reaction $\Delta H = \Delta U + \Delta n_g RT$

Work done in chemical Process. $W = -\Delta n_g RT$

Thermochemistry

It deals with enthalpy change in chemical reaction.

Consider a chemical reaction $aA + bB \rightarrow cC + dD$

$\mathbf{\Delta_r H = (cH_C + dH_D) - (aH_A + bH_B)}$

Where H_A, H_B, H_C & H_D are molar enthalpies of A, B, C and D respectively.

$\mathbf{\Delta_r H = \Sigma Hp - \Sigma H_R}$

Bond Enthalpy of Reaction: $\Delta_r H^0 = \Sigma \Delta H^0_{(\text{reactant bonds})} - \Sigma \Delta H^0_{(\text{product bonds})}$

Entropy:- Measuring of randomness or disorder of substance is called entropy

Change in Gibbs Energy: $\Delta G = \Delta H - T\Delta S$

VSA (1 M each)

Q.1. Define Intensive property.

Ans. Intensive property: The properties that are independent of the quantity of matter present in the system.

Q.2. Define Extensive Property

Ans:Extensive property: The properties that are dependent on the quantity of matter present in the system.

Q.3. Write Mathematical equations for the first law of thermodynamics.

Ans:$\Delta U = Q + W$

SA- I (2 Marks each)

Q.3. Derive the relation between ΔH and ΔU for chemical reaction OR for gas phase reaction.

Ans: At constant pressure ΔH and ΔU related as $\Delta H = \Delta U + P\Delta V$

for gaseous reaction $\Delta H = \Delta U + P(V_2 - V_1)$

$\Delta H = \Delta U + PV_2 - PV_1$ …..(1)

we assume reactant and product behave ideally, By ideal gas equation PV = nRT

When n_1 moles of gaseous reactants produce n_2 moles of gaseous products then,

$PV_1 = n_1RT$ and $PV_2 = n_2RT$…..(2)

Substitute eq^n (2) in (1)

$\Delta H = \Delta U + n_2RT - n_1RT$

$\mathbf{\Delta H = \Delta U + \Delta n_g RT}$

Δn_g= No. of moles of gas products - No. of moles of gas reactants

Q.4.What is the SI unit of Entropy? State whether ΔS is +ve , -ve or Zero for the following process.

i) $2H_{2(g)} + O_{2(g)} \rightarrow 2H_2O(l)$ ii) $CaCO_{3(s)} \rightarrow CaO(s) + CO_{2(g)}$

Ans.: SI unit of entropy is J/K

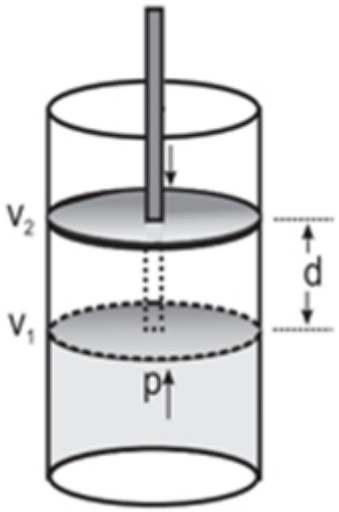
i) $2H_{2(g)} + O_{2(g)} \rightarrow 2H_2O(l)$

Ans.: ΔS= -ve

ii) $CaCO_{3(s)} \rightarrow CaO(s) + CO_{2(g)}$

Ans.: ΔS= +ve

Q.5.Derive expression of work done at constant external pressure or PV type work.



•If a certain amount of gas having pressure P enclosed in a cylinder fitted with a movable piston of area A.

•V1 is the initial volume of gas at temp.(T). On the expansion the force exerted by gas is the P x area of the piston.

f = -Pext x A ……(i) ,

Piston moves a distance 'd'

then W= f x d (ii)

From eqn (i) and (ii)

W = -Pext x A x d……(iii)

But A x d is change in volume ΔV .

i.e. ΔV= A x d……(iv)

From eqn (iii) and (iv)

W = -Pex x ΔV OR W = -Pex $(V_2 - V_1)$

Q.6. **Write mathematical equation of first law of thermodynamics for following process (1M each)**

a) Isothermal Process b) Isochoric process

Ans. 1) Isothermal process:- $\Delta T = 0$ hence $\Delta U = 0$,

- $\Delta U = Q + W$ (1^{st} law of thermo.) $0 = Q + W$

$+W = -Q$ OR $- W = + Q$

b)Isochoric process:- $W = -Pex\ \Delta V$……(1) (eq^n of work done)

$\Delta U = Q + W$ (1^{st} law of thermodynamics)

$\Delta U = Q - Pex\ \Delta V$……(from eq^n 1)

SA-II (3 Marks each)

Q.7).300 mmol of an ideal gas occupies 13.7 dm^3 at 300K. Calculate the work done when the gas is expanded until its volume has increased by 2.3 dm^3

a) isothermally against a constant external pressure of 0.3 bar. b) isothermally and reversibly c) into vacuum.

Ans: Data - n =300 mmol= 0.3 mol. $\Delta V = 2.3\ dm^3$, $V_1 = 13.7\ dm^3$ $V_2 = 13.7 + 2.3 = 16\ dm^3$ T = 300K Pex = 0.3 bar

a) W in isothermally against constant. external pressure of 0.3 bar

$W = -Pex\ \Delta V$; $W = -0.3 \times 2.3$; $= -0.69\ dm^3$ bar

$W = -0.69 \times 100 = -69J$

b) Isothermally and reversibly

$W_{max} = -2.303\ nRT \log V_2/V_1$

$= -2.303 \times 0.3 \times 8.314 \times 300 \times \log 16/13.7$

$= -2.303 \times 0.3 \times 8.314 \times 300 \times 0.0674$

$= -116.1J$

c) Work done in vacuum When gas expands in vacuum work done W= 0

Q.8. Estimate the standard enthalpy of combustion of methane gas if $\Delta_f H^0\ (CO_2) = -393.5$ kJmol-1

$\Delta_f H^0\ (H_2O) = -285.8$ kJmol-1; $\Delta_f H^0\ (CH_4) = -74.8\ kJmol^{-1}$

Ans:- Required thermochemical equation for combustion of methane.

$CH_{4(g)} + 2O_{2(g)} \rightarrow CO_{2(g)} + 2H_2O_{(l)}$

$\Delta_f H^0 = \Sigma \Delta_f H^0\ (product) - \Sigma \Delta_f H^0\ (reactant)$

$= [\ \Delta_f H^0\ (CO_2) + 2 \times \Delta_f H^0\ (H_2O)] - [\ \Delta_f H^0 (CH_4) + 2x\ \Delta_f H^0\ (O_2)]$

$= [\ -393.5 + 2 \times -285.8] - [-74.8 + 2 \times 0]$

$= (-393.5 - 571.6) + 74.8$

$= -965.1 + 74.8$

$= -890.3\ kJ\ mol^{-1}$

Q.9.**Define Enthalpy of Fusion.State and Explain Hess's law of constant heat summation.**

Ans. Enthalpy of Fusion ($\Delta_{fus}H$):- Enthalpy change occurs when one mole of a solid is converted into liquid without change in temperature at constant pressure is enthalpy of fusion.

Hess's law: The law states that overall the enthalpy change for a reaction is equal to the sum of enthalpy change of individual steps in the reaction.

Explanation:-

Suppose chemical reaction $A \rightarrow C$ ΔH_1

Same reaction takes place in following two steps

$A \rightarrow B$ ΔH_2 and $B \rightarrow C$ ΔH_3

$\Delta H_1 = \Delta H_2 + \Delta H_3$

Eg. $C_{(graphite)} + O_{2(g)} \rightarrow CO_{2(g)}$ $\Delta H = -393.5kJ$

Reaction takes place in the following steps.

$C_{(graphite)} + ½\ O_{2(g)} \rightarrow CO_{(g)}$ $\Delta H = -110.5kJ$

$CO_{(g)} + ½\ O_{2(g)} \rightarrow CO_{2(g)}$ $\Delta H = -283.0\ kJ$

$C_{(graphite)} + O_{2(g)} \rightarrow CO_{2(g)}$ $\Delta H = -393.5kJ$

Q.10. State second law of thermodynamics in terms of entropy.For a certain reaction $\Delta H^0 = 219kJ$ and $\Delta S^0 = -21J/K$ Determine whether the reaction is spontaneous or nonspontaneous.

Ans: Statement **:**Total entropy of system and its surroundings increases in spontaneous process.

$$\Delta S_{total} = \Delta S_{sys} + \Delta S_{surr} > 0$$

Solution: Given:- $\Delta H^0 = 219kJ$, $\Delta S^0 = -21J/K = -21 \times 10^{-3}\ kJ/K$,

$T = 298\ K$ (standard state)

$\Delta G^0 = \Delta H^0 - T\Delta S^0$

$= 219 - (298 \times -21 \times 10^{-3})$

$= 219-(-6.258)$

$= 219 + 6.258 = 225.2$

As ΔG^0 is +ve reaction is nonspontaneous

BIOMOLECULES

Chapter Summary:

Introduction:

Biomolecules are carbohydrates, proteins, nucleic acids, enzymes etc.

Carbohydrates: poly hydroxy aldehydes or ketones or compounds which give rise to search units on hydrolysis.

Classification of carbohydrates:

Monosaccharides.

Oligosaccharides.

Polysaccharides.

Preparation of glucose:

1) from sucrose.

2) from starch.

Structures and properties of glucose.

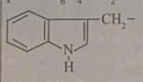
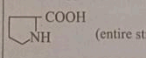
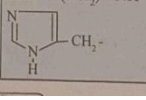
1) action of HI
2) action of hydroxylamine.
3) action of hydrogen cyanide.
4) action of bromine water or oxidation
5) action of acetic anhydride.

Optical isomerism in glucose: .

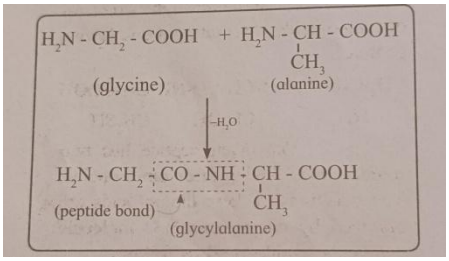
Ring structures of glucose and fructose.
Haworth formula of sucrose.
Howorth formula of maltose.
Haworth formula of lactose.
Haworth formula of Amylose ,Amylopectin,and cellulose.

PROTEINS:

Alpha Amino acids.

Type	Name	R	Three letter symbol	One letter symbol
Neutral ∝-amino acids	1. Glycine	H-	Gly	G
	2. Alanine	CH_3-	Ala	A
	3. Valine*	Me_2CH-	Val	V
	4. Leucine*	Me_2CH-CH_2 -	Leu	L
	5. Isoleucine*	$CH_3-CH_2-CH(Me)$-	Ile	I
	6. Asparagine	$H_2N-CO-CH_2$ -	Asn	N
	7. Glutamine	$H_2N-CO-CH_2-CH_2$-	Gin	Q
	8. Serine	$HO-CH_2$-	Ser	S
	9. Threonine*	CH_3-CHOH-	Thr	T
	10. Cysteine	$HS-CH_2$ -	Cys	C
	11. Methionine*	$Me-S-CH_2-CH_2$	Met	M
	12. Phenyalanine*	$Ph-CH_2$-	Phe	F
	13. Tyrosine	$p-HO-C_6H_4-CH_2$-	Tyr	Y
	14. Tryptophan*		Trp	W
	15. Proline	 (entire structure)	Pro	P
Acidic	16. Aspartic acid	$HOOC-CH_2$ -	Asp	D
	17. Glutamic acid	$HOOC-CH_2-CH_2$-	Glu	G
Basic	18. Lysine*	$H_2N-(CH_2)_4$-	Lys	K
	19. Arginine*	$HN=C(NH_2)-NH-(CH_2)$-	Arg	R
	20. Histidine*		His	H

Peptide Linkage



Types of proteins:

1) Globular protein 2)fibrous proteins depending on molecular shape of proteins.

Structures of protein:

1)Primary structures of protein
2)Secondary structure of protein
3)Tertiary structure of protein
4)Quaternary structure of protein.

Denaturation of proteins:

The maturation is the process by which the molecular shape of protein changes without breaking the amide or peptide bond that forms the primary structure.

ENZYMES:

Chemical reactions take place in our bodies with the help of biological catalysts called enzymes .

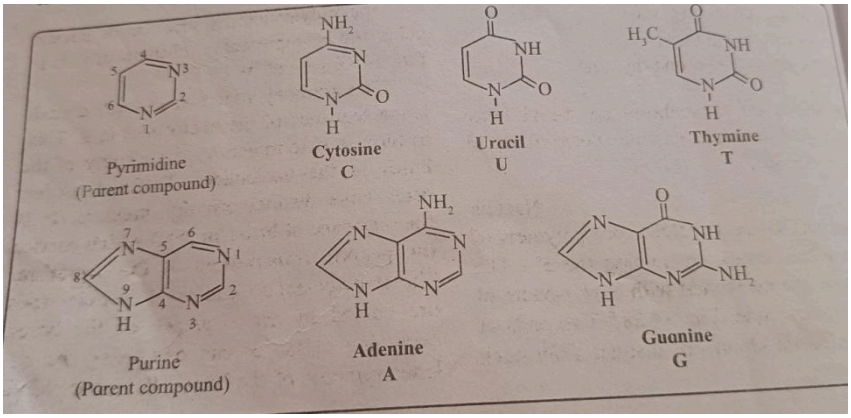
For example: Insulin: an enzyme secreted by pancreas controls blood sugar level.

Amylase: an enzyme present in saliva hydrolyzes starch.

NUCLEIC ACIDS:

1) Nucleotides.
2) Nucleoside.

Bases in nucleic acids.

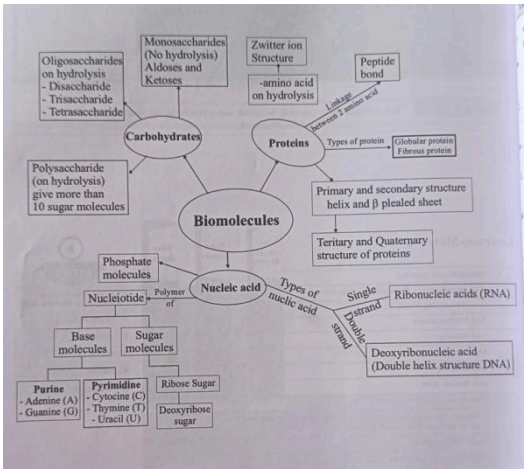


Structure of

1)RNA

2)DNA .

MIND MAP :



Very short answer type questions (1 Mark each)

Q.1)Which disaccharides are called inverter sugar?

Ans: Sucrose is called an invert sugar.

Q.2) Name the enzyme present in saliva.

Ans: Amylase present in saliva.

Short type answer Type -I question (2M)

Q.1) What are nucleic acids? What are its types?

Ans: Important biomolecule found in nuclei of living cell and it carries genetic information is called a nucleic acid.

There are two types of nucleic acids: ribo nucleic acids (RNA) and deoxyribonucleic acid (DNA).

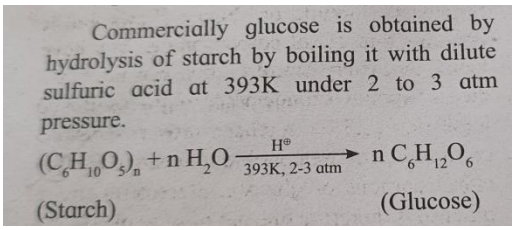
Q.2) How are proteins classified on the basis of molecular shapes?

Ans: Depending upon molecular shapes proteins are classified into two groups.

1) Globular protein: they have spherical shape and are usually soluble in water. for example insulin
2) Fibrous protein: they have elongated road-like shape and are usually insoluble in water. for example keratin

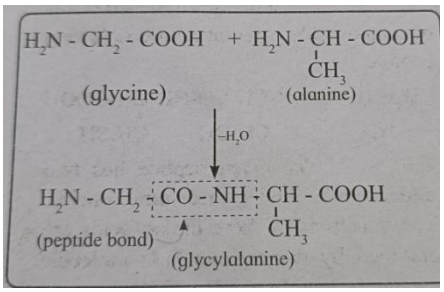
Q 3) How is glucose prepared commercially?

Ans:



Q.4) What is peptide Linkage?How is peptide linkage formed?

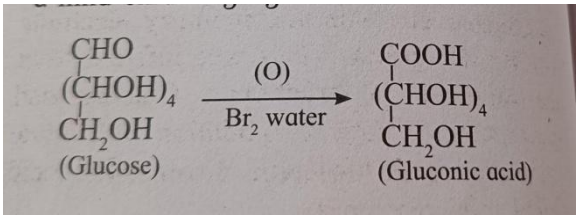
Ans: The bond that connects Alpha amino acids to each other is called peptide bond.



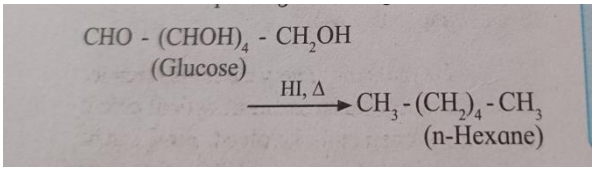
Short type answer Type-II question (3M)

Q.1) What is the action of following reagents on glucose?a)Br-water b)HI c) Acetic anhydride.

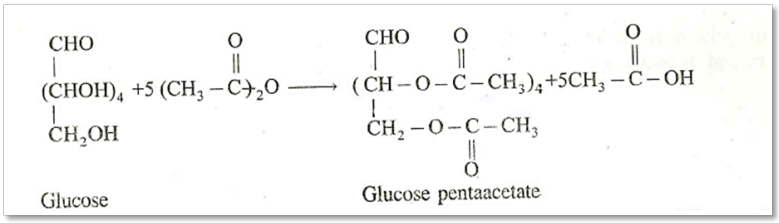
Ans: a) Bromine water acts as a mild oxidizing agent,it oxidizes glucose to gluconic acid .



b) glucose on prolonged heating with HI gives n- hexane.



c) Glucose reacts with acetic anhydride to form glucose Pentacetate.



Q.2) Classify the following carbohydrates

a)Starch b) Raffinose c) fructose d) Ribose e) cellulose f) lactose

Ans: Monosaccharides - Fructose, Ribose

Disaccharides - lactose

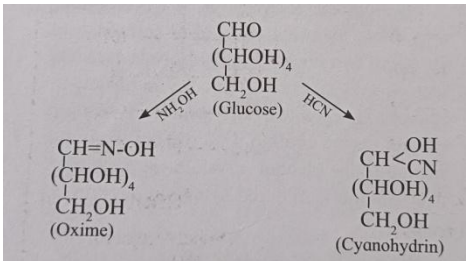
Trisaccharides - Raffinose

Polysaccharides - Starch and cellulose.

Q.3) What is zwitter ion ? What is the action of a) hydroxylamine and b) hydrogen cyanide on glucose?

Ans: Proton transfer from the acidic group to the basic group of amino acids forms a salt which is a dipolar ion called zwitter ion.

a) Glucose reacts with hydroxylamine and forms oxime.
b) Glucose reacts with hydrogen cyanide and gives cyanohydrin.



Q.4) What is denaturation of protein? What is the effect of denaturation on the structure of protein? Give an example of it.

Ans: Irreversible process in which protein gets easily precipitated is called the *denaturation of proteins.*

Effects of denaturation of protein on its structure are as follows

i) Denaturation uncoils the protein and destroys the shape of protein and thus loses their characteristic biological activity.

ii) During the denaturation secondary , tertiary structures are destroyed but primary structure remain intact.

For example:boiling of eggs to coagulate eggs white and conversion of milk to curd.

TRANSITION AND INNER TRANSITION ELEMENTS

Chapter Summary

Transition and inner transition elements are kept at the center of the periodic table that is between s block and p block elements . Therefore regular gradation in the properties takes place through these elements. There are four series of transition elements.

3d series	$[Ar]\,3d^{1-10}\,4s^{1-2}$	Scandium (Z = 21) to Zinc (Z = 30)
4d series	$[Kr]\,4d^{1-10}\,5s^{2}$	Yattrium (Z = 39) to Cadmium (Z = 48)
5d series	$[Xe]\,5d^{1-10}\,6s^{2}$	Lanthanum (Z = 57) to Mercury (Z = 80)
6d series	$[Rn]\,6d^{1-10}\,7s^{2}$	Actinium (Z = 89) to Copernicium (Z = 112)

General Electronic configuration of transition elements is $(n-1)d^{1-10}\,ns^{1-2}$.

With an increasing atomic number electrons are added to the penultimate shell.

They all are metals.

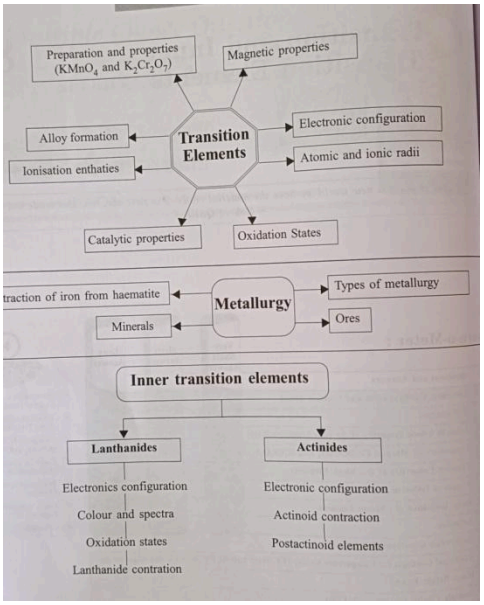
Trains in atomic properties of the first transition series.

Compounds of Mn and Cr. Potassium permanganate and potassium dichromate.

Common properties of d- block elements.

Inner transition element that is f block element lanthanides and actinides.

Mind Map:



VSA :(1 Mark)

Q.1) Write the formula of oxide of lanthanide with +2 oxidation State.

Ans: In +2 oxidation State lanthanide forms stable oxide of the type of M_2O_3 where M is metal.(La_2O_3).

Q.2) Write chemical composition of the Zieglar-Natta catalyst.

Ans: Ziegler- Natta catalyst is Triethyl aluminum and titanium tetrachloride.$(C_2H_5)_3Al + TiCl_4$.

SA-I (2Marks)

Q.1) Distinguish between lanthanide and actinides.

Ans:

Ans. Lanthanoids	Actinoids
1. Electronic configuration : [Xe] $4f^{1-14}\ 5d^{0-1},\ 6s^2$.	1. Electronic configuration : [Rn] $5f^{1-14}\ 6d^{0-1},\ 7s^2$.
2. Differentiating electron enters the $4f$ sub-shell.	2. Differentiating electron enters the $5f$ sub-shell.
3. Except Promethium, all other elements occur in nature.	3. Except Uranium and Thorium, all others are synthesized in the laboratory.
4. Binding energy of $4f$ electrons is higher.	4. $5f$-orbitals have lower binding energy.
5. Only Promethium is radioactive.	5. All elements are radioactive.

Q.2)Why $La(OH)_3$ is the strongest base while $Lu(OH)_3$ is the weakest base? write any two applications of catalytic properties of transition metal and compounds.

Ans: 1) Atomic size of La is larger than Lu , from La to Lu atomic size decreases. Due to this electropositive character decreases and basic character decreases hence $La(OH)_3$ is the strongest base while $Lu(OH)_3$ is the weakest base.

Q.3) Write any four properties of lanthanides.

Ans: i) lanthanoids are short metal with silvery white color and brightness reduces on exposure of air

ii) They are good conductors of heat and electricity.

iii) Except promethium all are non radioactive in nature

iv) The atomic and ionic radii decreases from LA to Lu.

v) They are paramagnetic.

Q.4) Calculate the spin only magnetic moment of Fe^{+2} ion with (Z= 26).

Ans:

The electronic configuration of Fe^{2+} ion is

$Fe^{2+} = [Ar]\ 3d^6$ $\boxed{\uparrow\downarrow}\ \boxed{1}\ \boxed{1}\ \boxed{1}\ \boxed{1}$

The number of unpaired electrons in Fe^{2+} ion are, n = 4.

By spin only formula, magnetic moment μ is given as,

$\mu = \sqrt{n\,(n+2)}$ BM

$\therefore\ \mu = \sqrt{4\,(4+2)}$ BM

$\therefore\ \mu = 4.9$ BM

HALOGEN DERIVATIVES

Chapter Summary:

- Alkyl/ Aryl halides may be classified as mono, di, tri or polyhalogen compounds depending on whether they contain one, two, three or more halogen atoms in their structures. They may also be classified as haloalkanes , haloalkenes, haloalkanes and haloarenes depending on the hydrocarbon skeleton to which the halogen atom is bonded. Since halogen atoms are more electronegative than carbon, the carbon-halogen bond of alkyl halide is polarized; the carbon atom bears a partial positive charge, and the halogen atom bears a partial negative charge.
- Alkyl halides are prepared by the free radical halogenation of alkanes, addition of halogen acids to alkenes, replacement of –OH group of alcohols with halogens using phosphorus halides, thionyl chloride or halogen acids.
- Aryl halides are prepared by electrophilic substitution to arenes.
- Fluorides and iodides are best prepared by halogen exchange method.
- Boiling points of alkyl halides are considerably higher than those of corresponding alkanes due to higher polarity and higher molecular mass. Though alkyl halides are moderately polar, they are insoluble in water but completely soluble in organic solvents.
- Alkyl halides show variety of chemical reactions such as nucleophilic substitution reactions, elimination reactions and reaction with metal atoms like Mg and Na to form Organometallic compounds

- Chemical kinetics suggests that there are two types of Nucleophilic substitution reactions S_N1 and S_N2. Knowledge of optical isomerism (chirality) is useful to understand nucleophilic substitution reactions of alkyl halides. When S_N2 reaction is brought about at chiral carbon (in an optically active substrate), the product is found to have inversion of configuration. S_N1 reaction proceeds mainly with racemisation.
- Aryl halides show low reactivity towards nucleophilic substitution reactions. However, the presence of certain groups at certain positions of the ring, markedly activate the halogen of aryl halides towards substitution. Aryl halides undergo electrophilic substitution reaction slowly as compared to benzene.
- A number of polyhalogen compounds are useful in industry and agriculture. Some polyhalogen compounds described in this section are dichloromethane, chloroform, carbon tetrachloride, iodoform, freon and DDT.However, they are also showing environmental hazards.

MIND MAP

Classification of halogen derivatives

On the basis of hydrocarbon skeleton

On the basis of number of halogen atoms

Classification of monohalogen derivatives

Alkyl halides Allylic halides Benzylic halide Vinylic halides Haloalkyne haloarenes

Methods of preparation of alkyl halides

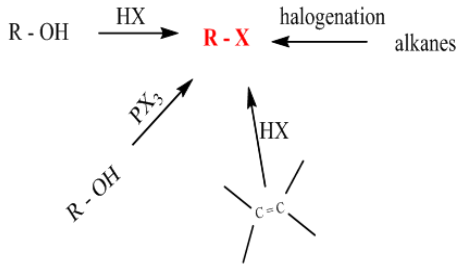
$R - OH \xrightarrow[or\ PCl_5]{SOCl_2} R - Cl$

Finkelstein reaction

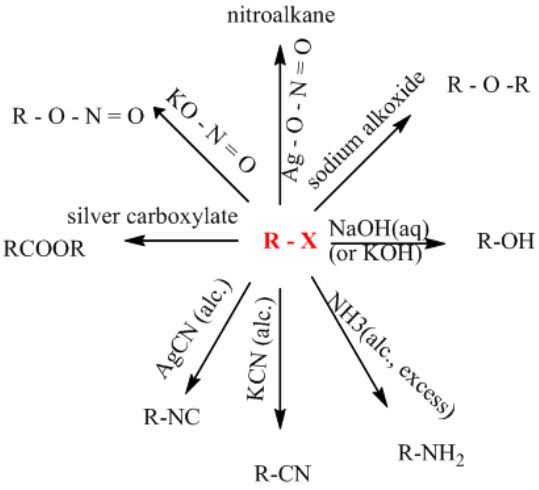
R-Cl or R-Br $\xrightarrow{NaI}$ R-I

Swartz reaction

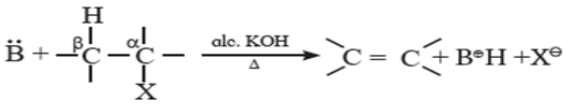
R-Cl or R-Br $\xrightarrow{AgF}$ R-F



Chemical properties – nucleophilic substitution reactions



Elimination reaction

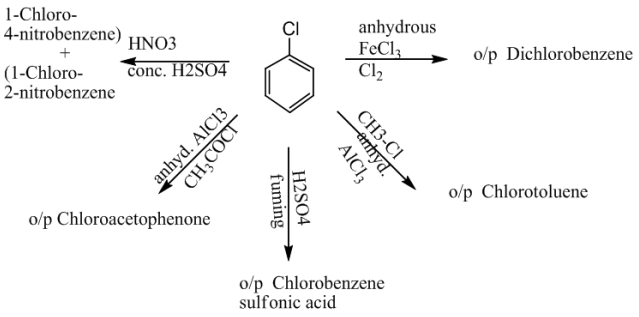


Reaction with active metals

$$R\text{-}X + Mg \xrightarrow{\text{dry ether}} R\text{-}Mg\text{-}X$$

$$2\,R\text{-}X + 2\,Na \xrightarrow[\text{ether}]{\text{dry}} R\text{-}R + 2\,NaX$$

Reactions of haloarenes



Polyhalogen compounds described in this section are dichloromethane, chloroform, carbon tetrachloride, iodoform, freon and DDT .

VSA (1 Mark each)

Q1) Write IUPAC name of Benzyl iodide .

Ans. : Iodophenylmethane

Q2) Write an example of the Swartz reaction .

Ans. : $R - Cl + AgF \rightarrow R - F + AgCl\downarrow$

SA – I (2 Marks)

Q.1) Write the reaction for preparation of ethyl chloride using thionyl chloride. Why is this considered to be the preferred method for preparation of alkyl chloride?

Ans. :

$C_2H_5 - OH + SOCl_2 \rightarrow C_2H_5 - Cl + SO_2\uparrow + HCl\uparrow$

There is no need to put extra efforts for its separation. Therefore this method is preferred for preparation of alkyl chloride

Q.2) Define the following terms .

a) Plane polarized light b) Optical activity

Ans. : a) Plane polarized light - light having oscillations only in one plane perpendicular to direction of propagation of light is known as plane polarized light.

b) Optical activity - Property of a substance by which it rotates the plane of polarization of incident plane polarized light is known as optical activity.

Q.3) Write environmental effects of

a) Triiodomethane b) DDT

Ans. : a) triiodomethane - It causes irritation to skin and eyes. It may cause respiratory irritation or breathing difficulty, dizziness, nausea, depression of the central nervous system and visual disturbance.

b) DDT - Exposure to high doses of DDT may cause vomiting, tremors or shakiness. DDT is a persistent organic pollutant, readily absorbed in soils and tends to accumulate in the ecosystem. When dissolved in oil or other liquid, it is readily absorbed by the skin. It is resistant to metabolism. It accumulates in fatty tissues. There is a ban on use of DDT due to all these adverse effects .

4) Write salient features of S_N2 reaction mechanism.

Ans. :

i.Single step mechanism with simultaneous bond breaking and bond forming.

ii. Backside attack of nucleophile

iii. In the transition state (T.S.) the nucleophile and leaving groups are bonded to the carbon with partial bonds and carry partial negative charge.

iv. The T.S. contains pentacoordinate carbon having three σ (sigma) bonds in one plane making bond angles of 120 ° with each other and two partial covalent bonds along a line perpendicular to this plane.

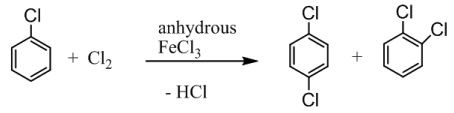
v. When SN2 reaction is brought about at chiral carbon (in an optically active substrate), the product is found to have inversion of configuration.

SA – II (3 Marks)

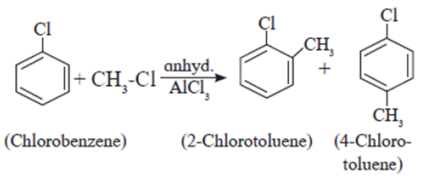
Q.1) Write the chemical reactions for the following conversions.

a) chlorobenzene to 1,4-dichlorobenzene
b) chlorobenzene to 4-chlorotoluene
c) chlorobenzene to 4 - Chlorobenzenesulfonic acid

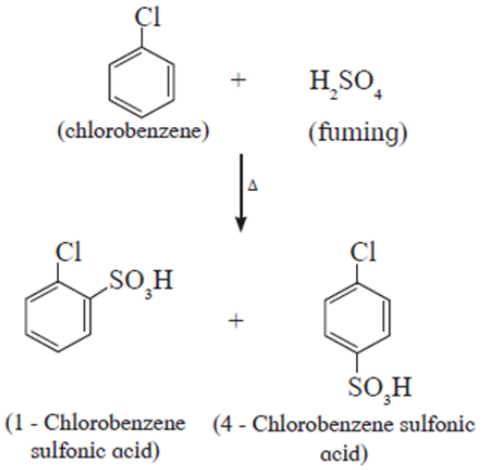
Ans. : a) chlorobenzene to 1,4-dichlorobenzene



b) chlorobenzene to 4-chlorotoluene



c) Chlorobenzene to 4 - Chlorobenzenesulfonic acid



Q.2) Write the major product in the following reactions .

a) C_2H_5Br + AgCN (alc) → ?

b) CH_3-CH(Br)CH_3 + KOH (aq) → ?

c) C_2H_5Br + CH_3COOAg → ?

Ans.: a) C_2H_5NC b) CH_3-CH(OH)CH_3 c) $CH_3COOC_2H_5$

Q.3) Identify 'A' , 'B' and 'C' in the following reaction sequence .

$CH_3CH_2CH_3$ $\xrightarrow{PBr3}$ A $\xrightarrow[(alc)]{KOH}$ B $\xrightarrow{HBr}$ C

Ans.:

$CH_3CH_2CH_3 \xrightarrow{PBr_3} CH_3CH_2CH_2Br$ [A]

$CH_3CH_2CH_2Br \xrightarrow{KOH\ (alc)} CH_3 - CH = CH_2$ [B]

$CH_3 - CH = CH_2 \xrightarrow{HBr} CH_3\text{-}CH(Br)\text{-}CH_3$ [C]

Q.4) Write the name the reagents that will used in the following conversions

a) alkyl halide to alkyl nitrite
b) alkyl halide to alkane nitrile
c) alkyl halide to primary amine

Ans.: a) $AgNO_2$ silver nitrite

b) KCN (alc.)

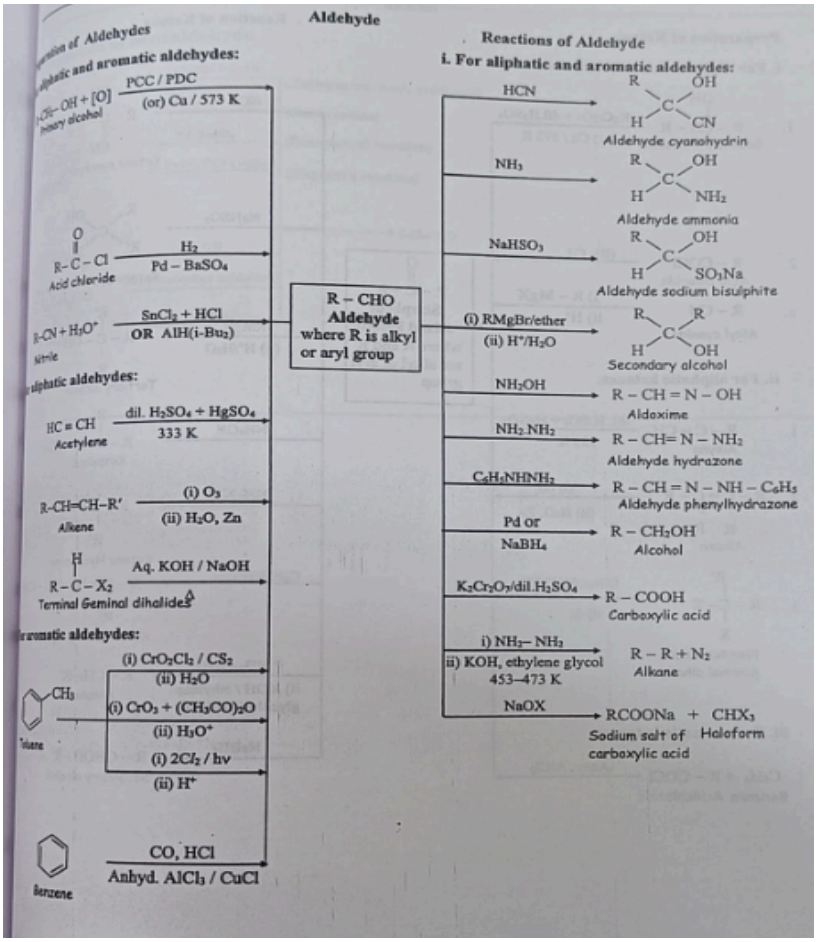
c) NH_3 (alc.,excess)

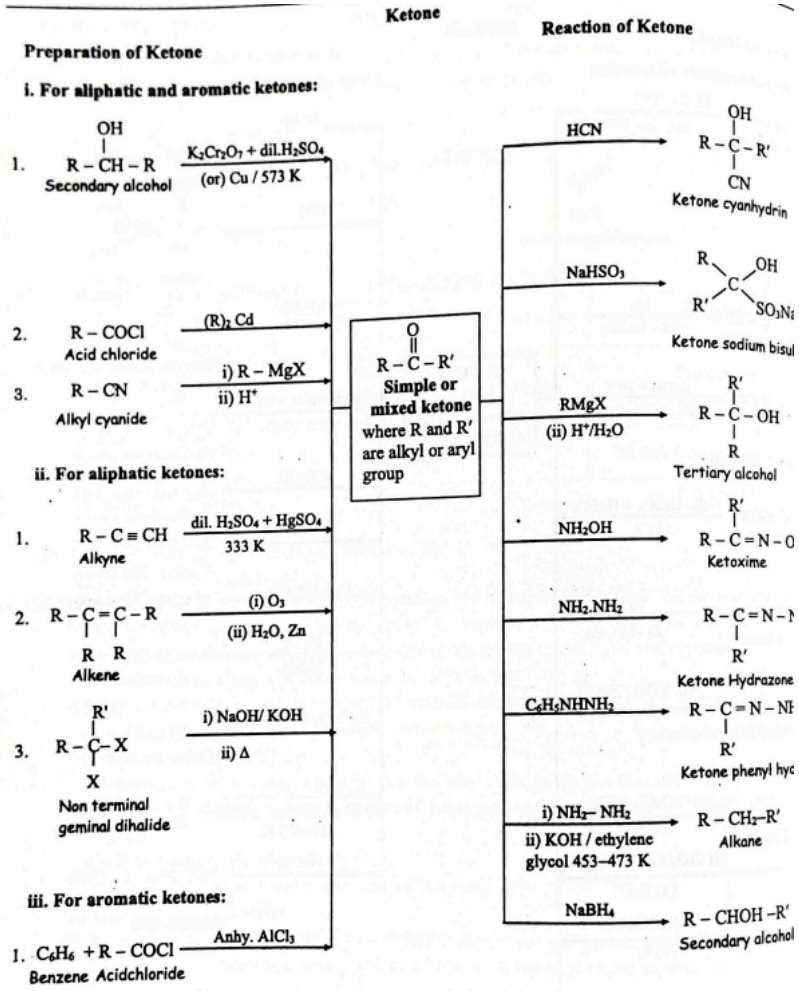
ALDEHYDES, KETONES AND CARBOXYLIC ACIDS

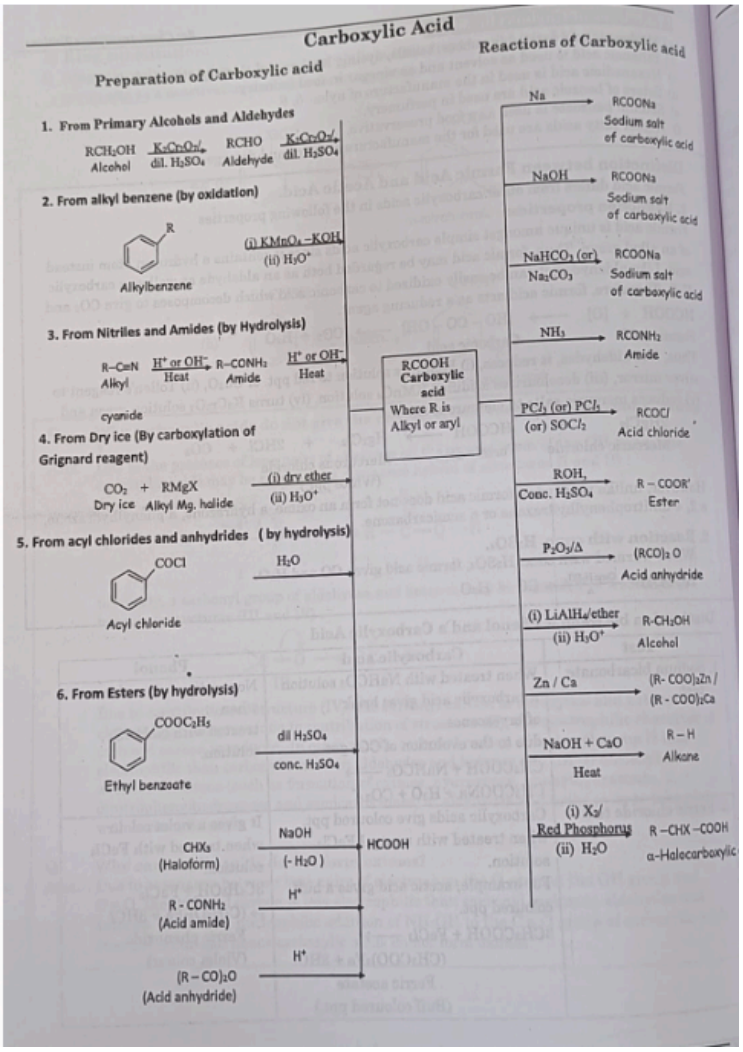
Chapter Summary:

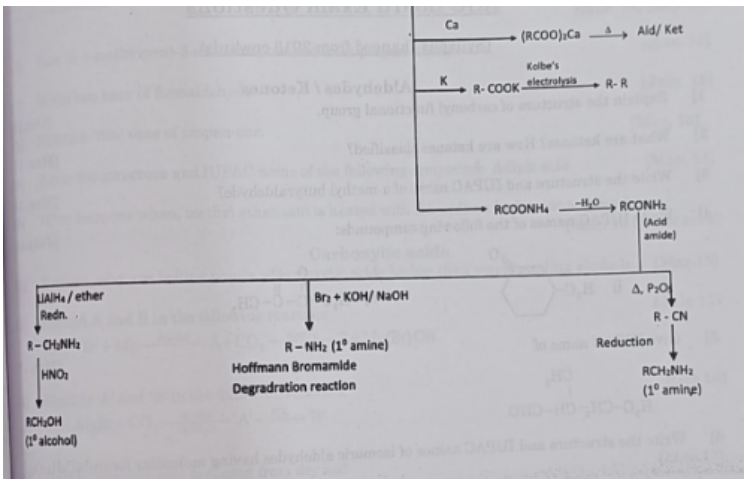
Carbonyl compounds : The organic compounds containing carbonyl groups are called carbonyl compounds.

eg. Aldehydes,ketones,carboxylic acid ,Ester,Amide,Acid anhydride




Ketone
Reaction of Ketone
Preparation of Ketone
i. For aliphatic and aromatic ketones:
1. R – CH(OH) – R
Secondary alcohol
K2Cr2O7 + dil.H2SO4
(or) Cu / 573 K
2. R – COCl
Acid chloride
(R)2 Cd
3. R – CN
Alkyl cyanide
i) R – MgX
ii) H+
R – C(=O) – R′
Simple or mixed ketone where R and R′ are alkyl or aryl group
ii. For aliphatic ketones:
1. R – C ≡ CH
Alkyne
dil. H2SO4 + HgSO4
333 K
2. R – C(R)=C(R) – R
Alkene
(i) O3
(ii) H2O, Zn
3. R – C(R′)(X) – X
Non terminal geminal dihalide
i) NaOH/ KOH
ii) Δ
iii. For aromatic ketones:
1. C6H6 + R – COCl
Benzene Acidchloride
Anhy. AlCl3
HCN
R – C(OH)(CN) – R′
Ketone cyanhydrin
NaHSO3
Ketone sodium bisul
RMgX
(ii) H+/H2O
R – C(R′)(R)(OH)
Tertiary alcohol
NH2OH
R – C(R′) = N – O
Ketoxime
NH2.NH2
R – C(R′) = N – N
Ketone Hydrazone
C6H5NHNH2
R – C(R′) = N – NH
Ketone phenyl hyd
i) NH2– NH2
ii) KOH / ethylene glycol 453–473 K
R – CH2–R′
Alkane
NaBH4
R – CHOH –R′
Secondary alcohol





VSA (1 mark each)

Q.1 What is formalin?

Ans: Formalin is a 40% aqueous solution of formaldehyde.

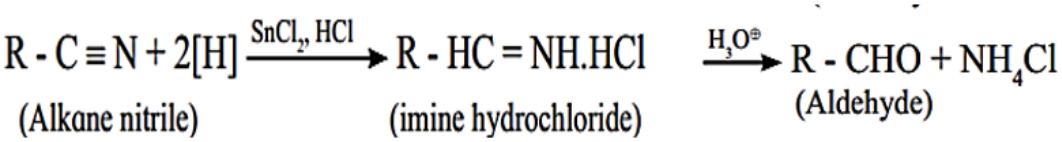
Q.2 Why do aldehydes and ketones have lower boiling points?

Ans: Aldehydes and ketones have lower boiling points because of intermolecular hydrogen bonding.

SA- I (2 mark each)

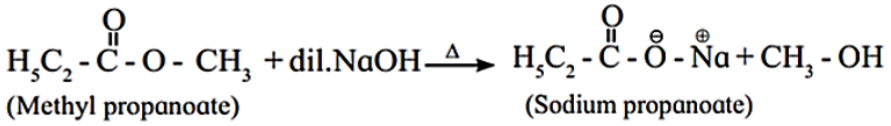
Q.1 Write a note on Stephen's reaction.

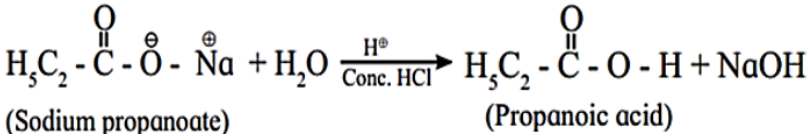
Ans: An ethereal solution of a nitrile is reduced to imine hydrochloride by Stannous chloride in the presence of HCl gas; this on acid hydrolysis gives corresponding aldehyde the reaction is known as Stephen's reaction.



Q.2 Write a balanced chemical reaction for the preparation of propanoic acid from methyl propanoate.

Ans: When methyl propanoate is heated with dil.alkali like NaOH or KOH to form water soluble sodium or potassium salt of carboxylic acid which on acidification gives carboxylic acid.





Q.3 Explain why aldehydes are more reactive toward nucleophilic addition reaction than ketone.

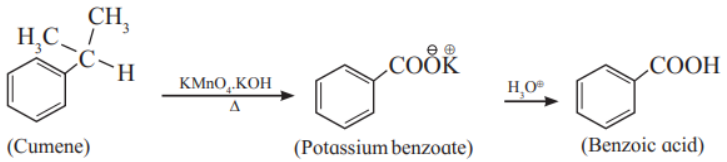
Ans: Reactivity of aldehydes and ketones is due to the polarity of the carbonyl group which results in electrophilicity of carbon.This can be well explained in terms of both the electronic effects and steric effect.

1. Influence of electronic effects : A ketone has two electron donating alkyl groups bonded to carbonyl carbon which are responsible for decreasing its positive polarity and electrophilicity. In contrast, aldehydes have only one electron donating group bonded to carbonyl carbon. This makes aldehydes more electrophilic and hence reactive than ketones.

2. Steric effects : Two bulky alkyl groups in ketone come in the way of incoming nucleophiles. This is called steric hindrance to nucleophilic attack. On the other hand, nucleophiles can easily attack the carbonyl carbon in aldehyde because it has one alkyl group and is less crowded or sterically less hindered . Hence aldehydes are more easily attacked by nucleophiles.

Q.4 Write a balanced chemical reaction for the preparation of benzoic acid from cumene.

Ans:



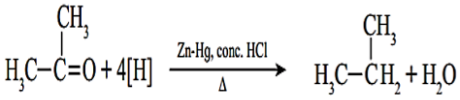
(Cumene) (Potassium benzoate) (Benzoic acid)

SA-II (3 mark each)

1) Write the balanced chemical reaction for the following.
   a) Acetone to propane
   b) Acetyl chloride to acetaldehyde
   c) Benzoyl chloride to acetophenone

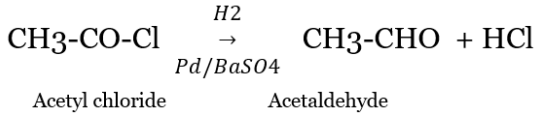
Ans:

a) Acetone to propane



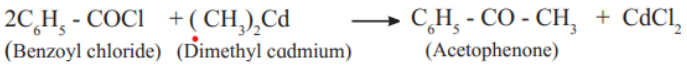
Acetone Propane

b) Acetyl chloride to acetaldehyde



Acetyl chloride Acetaldehyde

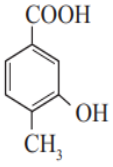
c) Benzoyl chloride to acetophenone



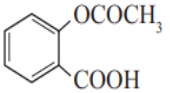
(Benzoyl chloride) (Dimethyl cadmium) (Acetophenone)

2) Draw structure of a) 3-Hydroxy-4-methylbenzoic acid b)Aspirin c) Adipic acid

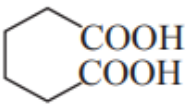
Ans:



a) (3-Hydroxy-4-methylbenzoic acid)



b) (Acetyl salicylic acid) (Aspirin)

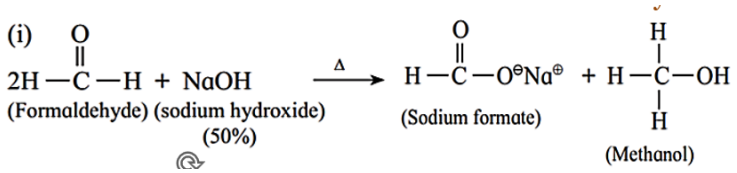


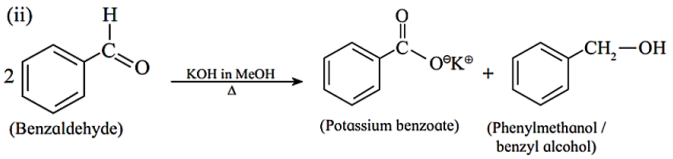
c) (Adipic acid)

3) Write a note on cannizzaro reaction.

Cannizzaro reaction : This reaction is given by only aldehydes not having α –hydrogen atom react with concentrated alkali.it undergoes self oxidation & reduction reaction.

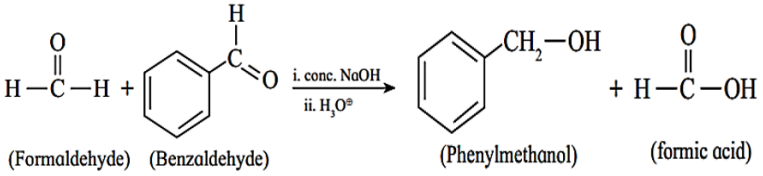
One molecule of aldehyde is reduced to alcohol & at the same time the second molecule is oxidized to alkali salt of carboxylic acid.





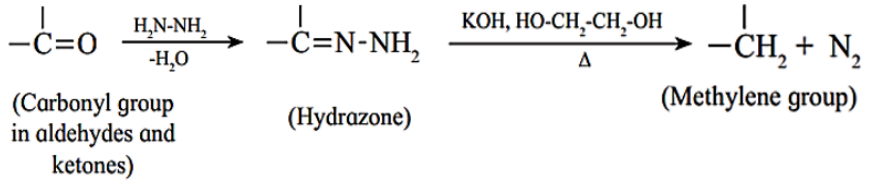
Cross Cannizzaro reaction :

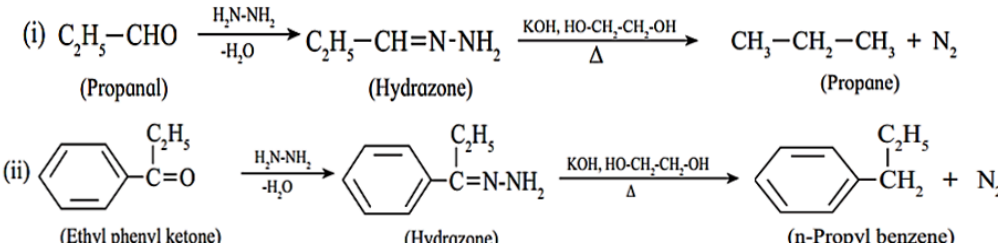
When a mixture of formaldehyde & Benzaldehyde reacts with strong base formaldehyde is oxidized to formic acid & Benzaldehyde is reduced to Benzyl alcohol.



4) Explain wolf-Kishner reduction reaction.

When aldehydes & ketones react with Hydrazine gives corresponding hydrazone which is heated with NaOH or KOH in high boiling solvent ethylene glycol it gives alkanes.





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