2023	12	27	TS-C5	SEAT NUMBER				

IIT INSPIRE
ACADEMY OF SCIENCE
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XI & XII Science (CBSE/state)
IIT- JEE (Mains + Advance)
NEET, MH-CET , NDA
Mo. No. 9595445177/9021445177

Branches : Chhatrapati Sq., Mangalmurti Sq.

6

(4 Pages)

is not allowed.
5. All symbols having their usual meanings unless otherwise stated.
6. For each MCQ, correct answer must be written along with its alphabet.
7. Evaluation of each MCQ would be done for the first attempt only.

SECTION-A

Q.1 Select and write the correct answers to the following questions: **[10]**

1)A weak monobasic acid is 0.05% dissociated. The $\propto$ value (degree of dissociation) is_____.

Ans:

c) 5×10^{-4} _____ **(1)**

2)Carbohydrates that do not hydrolyse further are_____.

Ans:

c) monosaccharides **(1)**

3)During the electrolysis of aqueous NaCl, gas liberated at cathode is_____.

Ans:

b)H_2 **(1)**

4)_____ is gaseous element group of 16.

Ans:

b) Oxygen **(1)**

5)Inner transition elements are placed in_____ period.

Ans:

d) $6^{th} \wedge 7^{th}$ **(1)**

6)Phenol id reduced to_____ on heating with zinc dust.

Ans:

b) benzene **(1)**

7)Carboxylic acid present in curd is_____.

Ans:

c) lactic acid **(1)**

8)Isobutylamine is an example of _____ amine.

Ans:

b) $2°\,amine$ **(1)**

9)Terylene is _____ fibre.

Ans:

b) polyester **(1)**

10) $\Delta H\,for\,reaction\,is -110\,kJ, \Delta S\,is +40\,JK^{-1}\,at\,400\,K$. **The free energy change for the reaction is_____.**

Ans:

c) $-126\,kJ$ **(1)**

Q.2 Answer the following questions in one sentence: [8]

(1) Define the terms with examples: (1)

a) polymorphism

Ans:

A single substance that exists in two or more forms or crystalline structures is said to be polymorphous.

Example:

Calcite and aragonite are two forms of calcium carbonate; $\alpha -$¿quartz, $\beta -$¿quartz an crystobalite is three of the several forms of silica.

(2) What is the effect of pressure on solubilities of solods, liquids and gases? (1)

Ans:

a) Pressure has no effect on the solubilities of solids and liquids as they are incompressible.

b) The solubility of gases increases with increasing pressure.

(3) Find the values of ΔU under following conditions:

(1)

1. A system releases 10 kJ of heat and performs 15 kJ of work on the surroundings.

Ans:

1. Suppose a system release $10\,kJ$ of heat and performs $15\,kJ$ of work on the surroundings. These quantities are removed from internal energy of the system. Hence, $\Delta U = -25\,kJ$

(4) What are the difficulties in setting standard hydrogen electrode? (1)

Ans:

a) It is difficult to obtain pure and dry hydrogen gas.

b) The pressure of hydrogen gas cannot be maintained exactly at 1 atm throughout the measurement.

c) It is also difficult to maintain the concentration of $H^{+¿¿}$ ion solution at exactly 1 M. The bubbling of H_2 gas into the solution results in the evaporation of water which changes the concentration of the solution.

(5) Define the following term giving one examples of each. (1)

1. Elementary reactions

Ans:

1. **Elementary Reactions:** Reactions that occur in a single step and cannot be broken down further into simpler reactions are called elementary reactions.

E.g., $O_{3(g)} \longrightarrow O_{2(g)} + O_{(g)}$

$C_2H_5I_{(g)} \longrightarrow C_2H_{4(g)} + HI_{(g)}$

(6) What is difference between a double salt and a complex? Give an example. (1)

Ans:

A double salt dissociates in water completely into simple ions, whereas a coordination complex dissociates in water with at least one complex ion.

Eg: Mohr's salt, $FeSO_4(NH_4)_2SO_4.6H_2O$ is a double salt while $K_4[Fe(CN)_6]$ is a complex.

(7) How are haloalkanes prepared from alcohols by reaction with thionyl chloride?(1)

Ans:

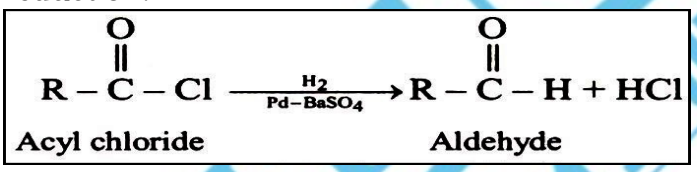
Thionyl chloride reacts with straight chain primary alcohols to give unrearranged alkyl chloride. The byproducts obtained are gases. There is no need to put extra efforts for its separation. Therefore this method is preferred for preparation of alkyl chloride.

$R-OH + SOCl_2 \xrightarrow{\Delta} R-Cl + SO_2\uparrow + HCl\uparrow$

(8) How are aldehydes prepared by Rosenmund reduction? (1)

Ans:

Acyl chloride is reduced to corresponding aldehyde by hydrogen using a palladium catalyst poisoned with barium sulfate. This reaction is known as Rosenmund reduction.



SECTION-B

Attempt any eight of the following questions: [16]

Q.3 Cesium chloride crystallizes in cubic unit cell with Cl^{-} ions at the corners and a Cs^{+} ion in the centre of the cube. How many CsCl molecules are there in the unit cell? (2)

Ans:

Given: Cl^- ions are present at corners of the cube. Cs^+ ion is at the centre of the cube.

To find: Number of CsCl molecules in the unit cell

Calculation:

i. Cl^- ions are present at the 8 corners.
The contribution of each corner particle to the unit cell is 1/8. Hence, the number of Cl^- ions that belongs to the unit cell = $8 \times (1/8) = 1$

ii. Cs^+ ion is at the centres of unit cell.
The contribution of particle at the centre to the unit cell is 1. Hence, the number of Cs^+ ions that belongs to the unit cell = 1

There is one Cl^- ion and one Cs^+ ion in the unit cell.

Hence, the number of CsCl molecules in the unit cell = **1**.

Q.4 Define pH and pOH. Derive the relationship between pH and pOH. (2)

Ans:

1. The pH of a solution is defined as the negative logarithm to the base 10, of the concentration of $H^{+¿¿}$ ions in solution in $mol\,dm^{-3}$.
   pH is expressed mathematically as
   $pH = -\log_{10} ¿$
2. Similarly, pOH of a solution can be defined as the negative logarithm to the base 10, of the molar concentration of $OH^{-¿¿}$ ions in solution.
   $pOH = -\log_{10} ¿$
   Relationship between pH and pOH:
   The ionic product of water is given as:
   $K_w = ¿$
   Now, $K_w = 1 \times 10^{-14}\, at\, 298\, K$
   Thus, ¿
   Taking logarithm of both the sides, we write
   $\log_{10} ¿$
   $-\log_{10} ¿$
   Now, $pH = -\log_{10} ¿$ and $pOH = -\log_{10} ¿$
   $\therefore pH + pOH = 14$

Q.5 State and explain mathematical formulation of the first law of thermodynamics. (2)

Ans:

1. **State:** According to this law "the total energy of system and surroundings remains constant when the system changes from an initial state to final state".
2. A system exchange energy with its surroundings either by transfer of heat or by doing work. An energy supplied to the system increases its internal energy. On the other hand, removal of heat or work from the system decreases its internal energy.
3. Suppose (Q) is heat supplied to the system and W work done on the system by the surroundings. The internal energy of the system would increase.
4. Increase in internal energy of the system is equal to sum of the quantity of heat supplied to the system and amount of work done on the system i.e.,
   $\Delta U = Q + W$
   Where, ΔU is an increase in internal energy of the system.
5. For infinitesimal changes,
   $dU = dQ + dW$

Q.6 a) What is cell constant? What are its units and explain. (2)
b) Define green chemistry.

Ans:

a) Cell constant:

1. The conductivity of an electrolytic solution is given by,
   $k = \frac{1}{R}\frac{l}{a}$
2. For a given cell, 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.
   Cell constant ¿ $\frac{l}{a}$
3. Therefore, conductivity becomes
   $k = \frac{Cell\,constant}{R}$
4. The unit of cell constant is m^{-1} (SI unit) or cm^{-1} (CGS unit).

b) 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 substance.

Q.7 What is the oxidation state of xenon in the following compounds? **(2)**

$XeOF_4, XeO_3, XeF_6, XeF_4, XeF_2$

Ans:

Compound	Oxidation state of xenon
$XeOF_4$	+6
XeO_3	+6
XeF_6	+6
XeF_4	+4
XeF_2	+2

Q.8 Is the complex $[CoF_6]$ cationic or anionic if the oxidation state of cobalt ion is +3? **(2)**

Ans:

If the oxidation state of Co in $[CoF_6]$ is +3, then the charge on complex would be -3. Hence, the given complex would be anionic.

Q.9 Define mineral and ore? **(2)**

Ans:

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

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

Q.10 What is Grignard reagent? How is it prepared? **(2)**

Ans:

Grignard reagent: When alkyl halide is treated with magnesium in dry ether as solvent, it gives alkyl magnesium halide. This is known as Grignard reagent.

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

Alkyl halide → Alkyl magnesium halide

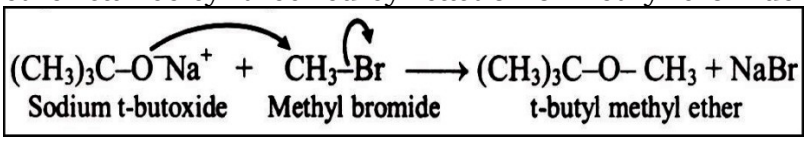
Q.11 Write a note on Williamson's synthesis of ethers. **(2)**

Ans:

1. Simple as well as mixed ethers can be prepared in laboratory by Williamson Synthesis.
2. In this method alkyl halide is treated with sodium alkoxide or sodium phenoxide to give dialkyl ethers or alkyl aryl ethers.

   $R-X+Na^{+}¿O^{-}¿ \rightarrow R-O-R+NaX$

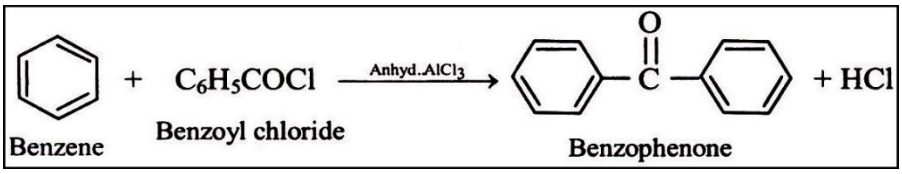
   $R-X+Na^{+}¿O^{-}¿ \rightarrow R-O-Ar+NaX$
3. This reaction follows S_N2 mechanism. Ether is formed as a result of backside attack by alkoxide/ phenoxide ion (a nucleophile) on alkyl halide.
4. The alkyl halide used in this reaction must be primary. For example: t-butyl methyl ether can be synthesized by reaction of methyl bromide with sodium t-butoxide.



Q.12 Explain the preparation of aromatic ketones by Friedel Craft's acylation reaction. **(2)**

Ans:

Aromatic ketones can be prepared by Friedel Craft's acylation reaction.



Q.13 a) What are the types of amines?
b) What are the polymers? **(2)**

Ans:

a) Types of amines: Alkyl amines $(1^0, 2^0, 3^0)$ and aryl amines.

b)

1. Chemically polymers are complex, giant macromolecules made from the repeating units, which are derived from small molecules called 'monomers'.
2. Thus, interlinking of many units constitutes polymers.
3. Polymers are high molecular mass macromolecules $(10^3 - 10^7$ u).
4. Both inorganic as well as organic polymers are known.

Q.14 What are essential amino acids? Give two examples. **(2)**

Ans:

Amino acids which cannot be synthesized in human body and have to be obtained through diet are called essential amino acids.

Eg: Leucine and isoleucine

SECTION-C

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

Q.15 What are valence band and conduction band? **(3)**

Ans:

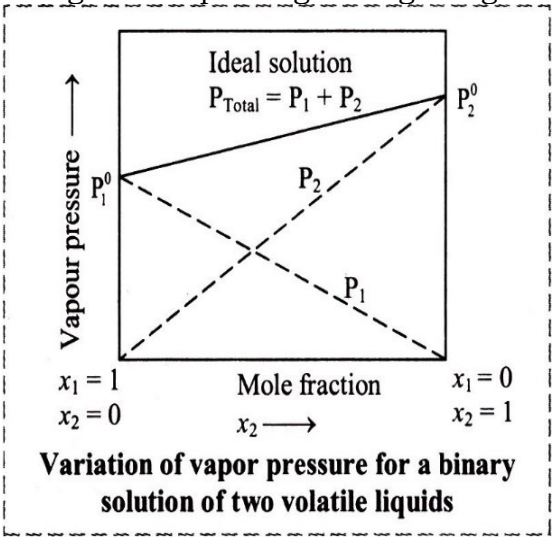
1. **Valence band:** The band having lower energy than conduction band is the valence band.
   The electrons in valence band are not free to move because they are tightly bound to the respective nuclei.
2. **Conduction band:** The highest energy band formed by interaction of the outermost energy levels of closely spaced atoms in solids is called the conduction band.
   Conduction band may be partially occupied or vacant.
   Electrons in conduction band are mobile and delocalized over the entire solid. They conduct electricity when electrical potential is applied.

Q.16 State and explain Raoult's law of vapour pressure. **(3)**

Ans:

1. It states that "the partial vapour pressure of any volatile component of a solution is equal to the vapour pressure of the pure component multiplied by its mole fraction in the solution".
2. Suppose that for a binary solution of two volatile liquids A_1 and A_2, P_1 and P_2 are their partial vapour pressures and x_1 and x_2 are their mole fractions in solution. Then according to Raoult's law,
   $P_1 = P_1^0 x_1$ and $P_2 = P_2^0 x_2$
   Where, P_1^0 and P_2^0 are vapour pressures of pure liquids A_1 and A_2.
   According to Dalton's law of partial pressures, the total pressure P above the solution is,
   $P = P_1 + P_2 = P_1^0 x_1 + P_2^0 x_2$
   Since $x_1 = 1 - x_2$
   $P = P_1^0(1 - x_2) + P_2^0 x_2$
   ¿ $P_1^0 - P_2^0 x_2 + P_2^0 x_2$
   ¿ $(P_2^0 - P_1^0) x_2 + P_1^0$

Because P_1^0 and P_2^0 are constants, a plot of P versus x_2 is a straight line as shown in the diagram. The diagram also shows that the plots of P_1 versus x_1 and P_2 versus x_2 are straight lines passing through origin.



Variation of vapor pressure for a binary solution of two volatile liquids

a. For P versus x_2 straight line,
$P = P_1^0$ at $x_2 = 0$ and $P = P_2^0$ at $x_2 = 1$

b. For P_1 versus x_1 straight line,
$P_1 = 0$ at $x_1 = 0$ and $P_1 = P_1^0$ at $x_1 = 1$

c. For P_2 versus x_2 straight line,
$P_2 = 0$ at $x_2 = 0$ and $P_2 = P_2^0$ at $x_2 = 1$

Q.17 1) Define the following terms: **(3)**

a) Isotonic solutions

b) Isothermal process

2) Why cations are Lewis acids?

Ans:

1)

a) Isotonic Solutions:

Two or more solutions having the same osmotic pressure are said to be isotonic solutions.

b) Isothermal Process:

a. It is the process in which temperature of the system remains constant throughout the transformation.

b. In such process heat flows from the system to surroundings and vice versa so as to keep the temperature constant. For a given temperature the internal energy (U) of the system remains constant. Thus, $\Delta T = 0$ and $\Delta U = 0$.

2) Cations are electron deficient species and can accept an electron pair. Hence, cations are Lewis acids.

Q.18 What is standard cell potential for the reaction **(3)**

$3\ni\iota_{(s)} + 2\,Al^{3+\iota[1M]} \rightarrow 3\ni\iota^{2+\iota[1M]+2Al_{(s)}\iota\iota\iota}$, **if** $E_\iota^0 = -0.25\,V$ **and** $E_{Al}^0 = -1.66\,V$**?**

Ans:

Given: $E^{\circ}_{Ni} = -0.25\ V,\ E^{\circ}_{Al} = -1.66\ V$

To find: Standard cell potential

Formula: $E^{\circ}_{cell} = E^{\circ}_{cathode} - E^{\circ}_{anode}$

Calculation: Electrode reactions are

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

At cathode: $Al^{3+}_{(aq)} + 3e^{-} \longrightarrow Al_{(s)}$

The standard cell potential is given by

$E^{\circ}_{cell} = E^{\circ}_{cathode} - E^{\circ}_{anode}$

$E^{\circ}_{cell} = E^{\circ}_{Al} - E^{\circ}_{Ni} = (-1.66\ V) - (-0.25\ V) = \mathbf{-1.41\ V}$

Q.19 Derive the expression for-half-life of zero order reaction or show that the half-life of zero order reaction is proportional to the initial concentration of reactant. (3)

Ans:

The rate constant of zero order reaction is given by equation

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

Using the conditions $t = t_{\frac{1}{2}}, [A]_t = \frac{[A]_0}{2}$,

Eq. (1) becomes

$k = \frac{[A]_0 - [A]_{1/2}}{t_{\frac{1}{2}}} = \frac{[A]_0}{2t_{\frac{1}{2}}} = \frac{[A]_0}{2t_{1/2}}$

Therefore, $t_{\frac{1}{2}} = \frac{[A]_0}{2K}$

Hence, the half-life of zero order reactions is proportional to the initial concentration of reactant.

Q.20 The first ionization enthalpies of S, Cl and Ar are 1000, 1256 and 1520 kJ/mol^{-1}, respectively. Explain the observed trend. (3)

Ans:

1. The elements S, Cl and Ar belong to third period of the periodic table.
2. Across a period, effective nuclear charge increases and atomic size decreases with increase in atomic number.
   Therefore, the energy required for the removal of electron from the valence shell (I.E.) increases in the order: $S < Cl < Ar$

Q.21 How are alloys classified? (3)

Ans:

Alloys are classified as ferrous and nonferrous alloys.

1. Ferrous alloys have atoms of other elements distributed randomly in atoms of iron in the mixture. As percentage of iron is more, they are termed ferrous alloys.
   Eg: Nickel steel, chromium steel, stainless steel etc. All steels have 2% carbon.
2. Nonferrous alloys are formed by mixing atoms of transition metal other than iron with a non-transition element.
   Eg: Brass, which is an alloy of copper and zinc

Q.22 What are cationic, anionic and neutral complexes? Give one example of each. (3)

Ans:

1. **Cationic Complexes:** A positively charged coordination sphere or a coordination compound having a positively charged coordination sphere is called cationic sphere

complex.

Eg: $\left[Zn\left(NH_3\right)_4\right]^{2+¿¿}$

2. **Anionic Sphere Complexes:** A negatively charged coordination sphere or a coordination compound having negatively charged coordination sphere is called anionic sphere complex.

   Eg: $\left[Fe\left(CN\right)_6\right]^{3-¿¿}$

3. **Neutral Sphere Complexes:** A coordination complex which does not possess cationic or anionic sphere are neutral complexes or neutral sphere complex.

   Eg: $\left[¿\left(CO\right)_4\right]$

Q.23 Write the action of Cu on **(3)**

1) Primary alcohol **2) Secondary alcohol** **3) Tertiary alcohol**

Ans:

When vapours of primary, secondary and tertiary alcohols are passed over hot copper following reactions are observed.

i. $R-CH_2-OH \xrightarrow[\text{Oxidation}]{Cu/573K} R-CHO$

1° alcohol — Aldehyde

ii. $R-\underset{\underset{OH}{|}}{CH}-R' \xrightarrow[\text{Oxidation}]{Cu/573K} R-\underset{\underset{O}{||}}{C}-R'$

2° alcohol — Ketone

iii. $H_3C-\underset{\underset{CH_3}{|}}{C(OH)}-CH_3 \xrightarrow[\text{dehydration}]{Cu/573K} H_3C-\underset{\underset{CH_3}{|}}{C}=CH_2$

3° alcohol — Alkene

Q.24 Explain aldol condensation with suitable examples.

(3)

Ans:

1. Aldehydes containing at least one $\alpha-¿$hydrogen atom undergo a reaction in presence of dilute alkali (dilute NaOH, KOH or Na_2CO_3) as catalyst to form $\beta-¿$hydroxy aldehydes (aldol). This reaction is known as aldol reaction.
2. Formation of aldol is an addition reaction.
3. Aldol formed from aldehyde having $\alpha-¿$hydrogens undergoes subsequent elimination of water molecule on warming, giving rise to $\alpha,\beta-¿$unsaturated aldehyde.
4. The overall reaction is called aldol condensation. It is a nucleophilic addition-elimination reaction.
5. The reaction can be given as,

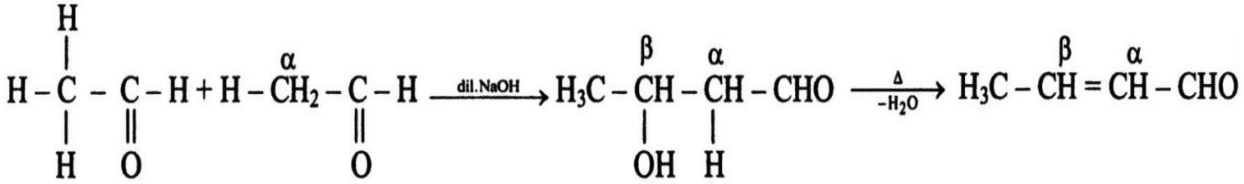
$2R-CH_2-CHO \xrightarrow{\text{aq.NaOH}} R-CH_2-\underset{\underset{OH}{|}}{CH}-CHR-CHO$

Aldehyde — Aldol

$R-CH_2-\underset{\underset{OH}{|}}{CH}-CHR-CHO \xrightarrow[\text{warm}]{-H_2O} R-CH=CR-CHO$

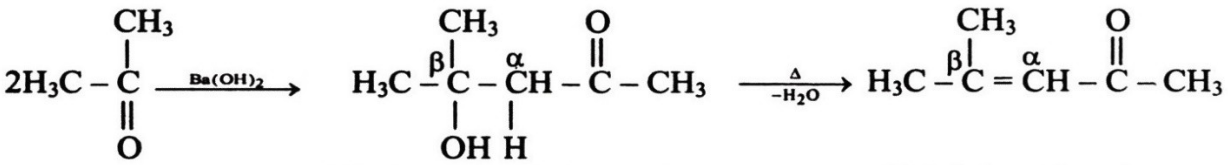
Aldol — α,β-Unsaturated aldehyde

e.g.



6. Ketones containing at least two $\alpha-$¿hydrogen also undergo aldol condensation reaction and give an $\alpha,\beta-$¿unsaturated ketone.

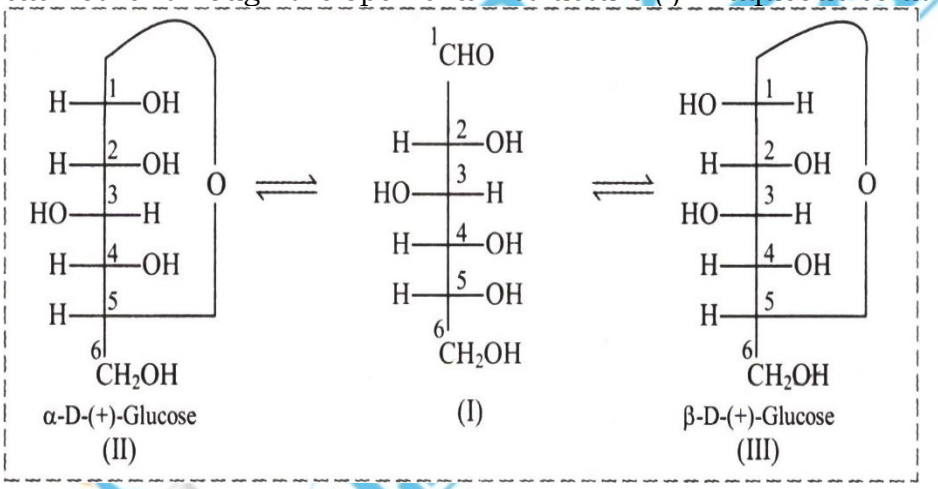
e.g.



Q.25 Explain the ring structure of glucose. **(3)**

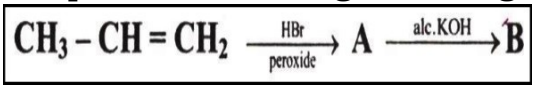
Ans:

1. Glucose is found to have two cyclic structures (II and III) which are in equilibrium with each other through the open chain structure (I) in aqueous solution.



2. The ring structure of glucose is formed by reaction between the formyl $(-CHO)$ group and the alcoholic $(-OH)$ group at C-5. Thus, the ring structure is a hemiacetal structure.
3. The two hemiacetal structures (II and III) differ only in the configuration of C-1, the additional chiral centre resulting from ring closure. The two ring structures are called $\alpha-$¿ and $\beta-$¿ anomers of glucose and C-1 is called the anomeric carbon.
4. The ring of the cyclic structure of glucose contains five carbons and one oxygen. Thus, it is a six membered ring. It is called pyranose structure, in analogy with the six membered heterocyclic compound pyran. Hence glucose is also called glucopyranose.

Q.26 a) Complete the following reaction giving major product.



Ans:

$$CH_3-CH=CH_2 \xrightarrow[\text{Peroxide}]{HBr} CH_3CH_2CH_2Br \xrightarrow{\text{Alc.KOH}} CH_3CH=CH_2$$

Propene — 1-Bromopropane (A) (major product) — Propene (B)

b) Note on denaturation of proteins? **(3)**

Ans:

Denaturation of Proteins:

1. High temperature, acid, base and even agitation can disrupt the non-covalent interactions responsible for a specific shape of protein. This is denaturation of protein.
2. Denaturation is the process by which the molecular shape of protein changes without breaking the amide/peptide bonds that form the primary structure.
3. Denaturation results in disturbing the secondary, tertiary or quaternary structure of protein. This causes change in properties of protein and the biological activity is often lost.

SECTION-D

Attempt any three of the following question: **[12]**

Q.27 a) The dissociation constant of NH_4OH is 1.8×10^{-5}. Calculate its degree of Dissociation in 0.01 M solution.

b) Give uses of $K\,MnO_4$.

(4)

Ans:

a)

Given: Dissociation constant (K_b) = 1.8×10^{-5}, Concentration (c) = 0.01 M

To find: Degree of dissociation (α)

Formula: $K_b = \alpha^2 c$

Calculation: $c = 0.01\ M = 1 \times 10^{-2}\ M$

Using formula,

$$K_b = \alpha^2 c$$

$$\alpha = \sqrt{\frac{K_b}{c}}$$

$$\text{Hence, } \alpha = \sqrt{\frac{1.8\times10^{-5}}{1\times10^{-2}}} = \sqrt{1.8\times10^{-3}} = \sqrt{18\times10^{-4}}$$

$$= 4.242 \times 10^{-2} = \mathbf{0.04242}$$

b)

1. Used as an antiseptic.
2. Used for unsaturation test in laboratory.
3. Used in volumetric analysis of reducing agents.
4. Used for detecting halides in qualitative analysis.
5. Used as powerful oxidizing agent in laboratory and industry.

Q.28 a) Comment on the statement: no work is involved in an expansion of gas in vacuum.

b) Explain enthalpy of ionization and electron gain enthalpy. Give example. **(4)**

Ans:

a)

1. A free expansion means expansion against zero opposing force. Such expansion occurs in vacuum.
2. When the gas expands in vacuum, there is no opposing force, that is, $P_{ext}=0$. The work done by a system during such expansion is $W=-P_{ext}\Delta V=0$
   Thus, no work is done when the gas expands freely in vacuum.

b)

Enthalpy of Ionization $\left(\Delta_{ion}H\right)$**:**

1. Enthalpy of ionization is the enthalpy change accompanying the removal of an electron from one mole of gaseous atom.
2. For example,

   $Na_{(g)} \rightarrow Na^{+}_{(g)} + e^{-}$ $\quad \Delta_{ion}H = 494\,kJ\,mol^{-1}$

   The equation signifies when one mole of gas-phase atomic sodium is ionized to gas phase Na^{+} ions, the enthalpy change is $494\,kJ$.

Electron Gain Enthalpy:

1. The electron gain enthalpy is the enthalpy change when one mole of gas-phase atoms of an element accept electron to form gaseous anion.
2. For example,

$Cl_{(g)} + e^{-} \rightarrow Cl^{-}_{(g)}$ $\quad \Delta_{eg}H = -349\,kJ\,mol^{-1}$

Electron gain enthalpy of Cl is $-349\,kJ\,mol^{-1}$

Q.29 a) In a first order reaction 60% of the reactant decomposes in 45 minutes. Calculate the half-life for the reaction. (4)

b) What is meant by diamagnetic and paramagnetic?
Give one example of diamagnetic and paramagnetic transition metal and lanthanoid metal

Ans:

a)

Given: $[A]_0 = 100\%,\ [A]_t = 100 - 60 = 40\%,\ t = 45\ min$

To find: Half life of reaction $(t_{1/2})$

Formula: $k = \frac{2.303}{t}\log_{10}\frac{[A]_0}{[A]_t}$

Calculation: Substitution of these in above

$$k = \frac{2.303}{t}\log_{10}\frac{100}{40}$$

$$= \frac{2.303}{45\ min}\log_{10}(2.5)$$

$$= \frac{2.303}{45\ min} \times 0.3979 = 0.0203\ min^{-1}$$

$$t_{1/2} = \frac{0.693}{k} = \frac{0.693}{0.0203\ min^{-1}} = \mathbf{34\ min}$$

$$\frac{2.303}{45} \times 0.3979$$
$$= \text{Antilog}_{10}(\log_{10}2.303 + \log_{10}0.3979 - \log_{10}45)$$
$$= \text{Antilog}_{10}(0.3623 + \bar{1}.5998 - 1.6532)$$
$$= \text{Antilog}_{10}(\bar{2}.3089)$$
$$= 0.0203\ min^{-1}$$

b)

Diamagnetic Substances: The substances with all electrons paired, are weakly repelled by magnetic fields. Such substances are called as diamagnetic substances.

Paramagnetic Substances: The substances with unpaired electrons are weakly attracted by magnetic field. Such substances are called as paramagnetic substances.

Examples:

	Transition metal	Lanthanoid metal
Diamagnetic	Zinc	Ytterbium
Paramagnetic	Titanium	Cerium

Q.30 a) Explain the role of green chemistry.

b) Write structure of optically active alcohol having molecular formula $C_4H_{10}O$ **(4)**

Ans:

a)

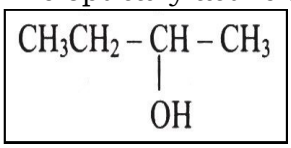
The green chemistry approach recognize that the Earth does have a natural capacity for dealing with much of the waste and pollution that society generates. It is only when that capacity us exceeded that we become unsustainable.

Following is the role of Green Chemistry:

1. To promote innovative chemical technologies that reduce or eliminate the use or generation of hazardous substances in the design, manufacture and use of chemical products.
2. The green chemistry helps to capital expenditure, to prevent pollution.
3. Green chemistry incorporates pollution prevention practices in the manufacture of chemicals and promotes pollution prevention and industrial ecology.
4. Green chemistry is a new way of looking at chemicals and their manufacturing process to minimize any negative environmental effects.
5. Green chemistry helps to protect the presence of ozone in the stratosphere essential for the survival of life on the earth.
6. Green chemistry is useful to control greenhouse effect (Global warning).

b)

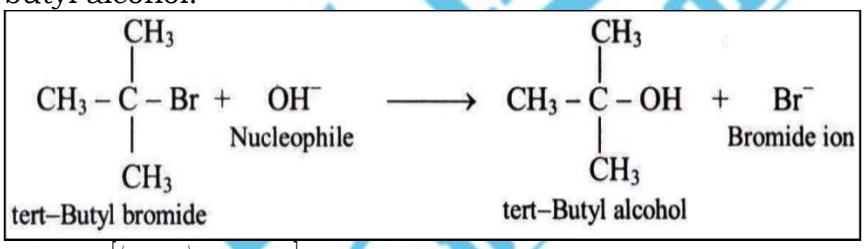
The optically active alcohol having molecular formula $C_4H_{10}O$ is



Q.31 Give a brief idea about S_N1 mechanism with the help of an example. (4)

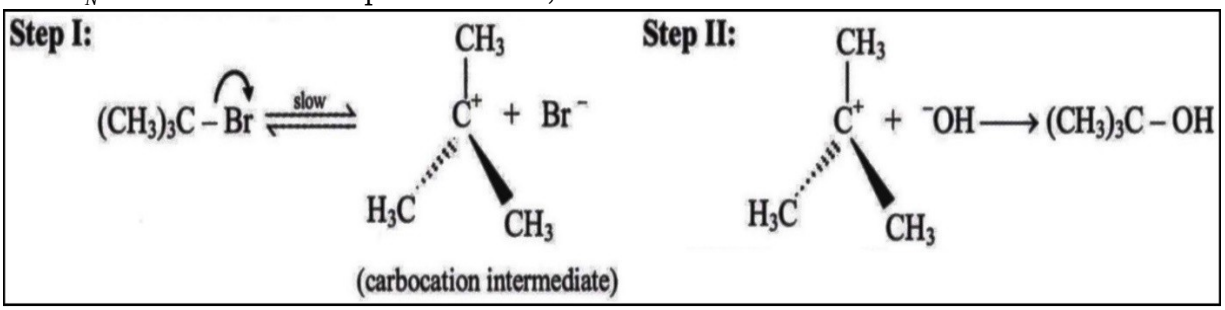
Ans:

1. S_N1 mechanism is a referred to as substitution nucleophilic unimolecular mechanism.
2. For example, the reaction between tert-butyl bromide and hydroxide ion to give tert-butyl alcohol.



$Rate = k\left[(CH_3)_3C-Br\right]$

3. The reaction follows a first-order kinetics.
   That is the rate of this reaction depends on concentration of only one species, which is the substrate molecule, tert-butyl bromide. Hence it is called substitution nucleophilic unimolecular, S_N1.
4. It can be seen in this reaction that concentration of only substrate appears in the rate equation; concentration of the nucleophile does not influence the reaction rate.
5. In other words, tert-butyl bromide reacts with hydroxide by a two-step mechanism.
   In the slow step C-X bond in the substrate undergoes heterolysis and in the subsequent fast step the nucleophile uses its electron pair to form a new bond with the carbon undergoing change.
6. The S_N1 mechanism is represented as,



"All the Best"

"When you focus on problems,
you get more problems,
When you focus on possibilities,
you have more opportunities."