Sample Paper 12 Solutions

Class XII 2023-24

Chemistry

Time: 3 Hours **Max. Marks: 70**

General Instructions:

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

SECTION-A

Directions (Q. Nos. 1-16) : The following questions are multiple-choice questions with one correct answer. Each question carries 1 mark. There is no internal choice in this section.

1. Order of reaction can be

(a) zero (b) fraction

(c) whole number (d) integer, fraction, zero

Ans : (d) integer, fraction, zero

Order of reaction is equal to the number of molecules whose concentration is changing with times. It can be zero or in fractions or an integer.

2. For an electrolyte, elevation of B.P. is directly proportional to:

(a) molarity (b) molality

(c) mole fraction (d) all of these

Ans : (b) molality

$$\Delta T_b = K_b \times i \times \text{molality}$$

Where ΔT_b = elevation in boiling

i = vant Hoff factor

Hence, $\Delta T_b \propto$ Molality

3. The complexes $[Co(NH_3)_6][Cr(CN)_6]$ and $[Cr(NH_3)_6][Co(CN)_6]$ are the examples of which type of isomerism ?

(a) Linkage isomerism

(b) Ionisation isomerism

(c) Coordination isomerism

(d) Geometrical isomerism

Ans : (c) Coordination isomerism

Coordination isomerism occurs when cationic and anionic complexes of different metal ions are present in a salt. Interchange of ligand between the complexes give isomers e.g. $[Co(NH_3)_6][Cr(CN)_6]$ is an isomer of $[Co(CN)_6][Cr(NH_3)_6]$

4. Colligative properties of the solution depend on:

(a) Nature of solute

(b) Nature of solvent

(c) Number of particles present in the solution

(d) Number of moles of solvent only

Ans : (c) Number of particles present in the solution

Colligative properties of dilute solution containing non volatile solute depends upon the number of particles of the solute present in the solution.

5. The fuel used in the cell used in Apollo mission was

(a) H_2 (b) $H_2 - O_2$

(c) CH_4 (d) O_2

Ans : (b) $H_2 - O_2$

Fuel cell made of H_2-O_2 is used in Apollo-mission. It is pollution free and has highest efficiency (about 70%). It is also less in weight.

Hence, (b) is the correct option.

6. The rate of a chemical reaction

(a) increases as the reaction proceeds

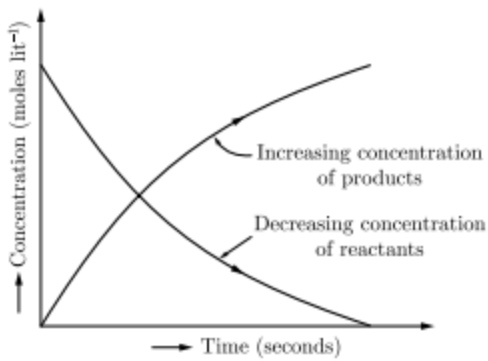
(b) decreases as the reaction proceeds

(c) may increase or decrease during the reaction

(d) remains constant as the reaction proceeds

Ans : (b) decreases as the reaction proceeds

The rate of a chemical reaction is directly proportional to the concentration of the reactants i.e. rate of reaction decreases with decrease of concentration and increases with increase in concentration. As the reaction progresses the reactant is converted into the product and thus the concentration of reactants decreases while that of the products increases.



7. An example of a compound with functional group $-O-$ is :

(a) Acetic acid (b) Methyl alcohol

(c) Diethyl ether (d) Acetone

Ans : (c) Diethyl ether

Ethers contain the functional group $-O-$

8. Acetamide is treated with the following reagents separately. Which one of these would yield methylamine?

(a) $NaOH - Br_2$ (b) Sodalime

(c) Hot con. H_2SO_4 (d) PCl_5

Ans : (a) $NaOH - Br_2$

$$CH_3CONH_2 \xrightarrow[Br_2]{NaOH} CH_3NH_2$$

(Hofman bromamide reaction)

9. In a hydrogen-oxygen fuel cell, combustion of hydrogen occurs to

(a) produce high purity water

(b) create potential difference between two electrodes

(c) generate heat

(d) remove absorbed oxygen from electrode surfaces

Ans : (b) create potential difference between two electrodes

In $H_2 - O_2$ fuel cell, the combustion of H_2 occurs to create potential difference between the two electrodes.

10. Which of the following is a disaccharide?

(a) Lactose (b) Starch

(c) Cellulose (d) Fructose

Ans : (a) Lactose

Lactose is a disaccharide.

11. Which reagent cannot be used to prepare an alkyl halide from an alcohol ?

(a) $HCl + ZnCl_2$ (b) NaCl

(c) PCl_5 (d) $SOCl_2$

Ans : (b) NaCl

NaCl is an ionic compound cannot displace –OH by Cl. Rest all other reagents($HCl + ZnCl_2$, PCl_5, $SOCl_2$) displaces -OH from alcohol and provide Cl^- as a nucleophile.

12. Which of the following represents the correct order of the acidity in the given compounds?

(a) $FCH_2COOH > CH_3COOH > BrCH_2COOH > ClCH_2COOH$

(b) $BrCH_2COOH > ClCH_2COOH > FCH_2COOH > CH_3COOH$

(c) $FCH_2COOH > ClCH_2COOH > BrCH_2COOH > CH_2COOH$

(d) $CH_3COOH > BrCH_2COOH > ClCH_2COOH > FCH_2COOH$

Ans : (c) $FCH_2COOH > ClCH_2COOH > BrCH_2COOH > CH_2COOH$

Electron withdrawing substituent increases the acidity by increasing the ionic character of $-O-H$ by inductive effect. Electronegativity decreases in the order. F>Cl>Br and hence -I effect also decreases in the same order, therefore the correct option is

$FCH_2COOH > ClCH_2COOH > BrCH_2CO > CH_3COOH$

Directions (Q. Nos. 13-16) : Each of the following questions consists of two statements, one is Assertion and the other is Reason. Give answer :

13. **Assertion :** Benzene diazonium salt on boiling with water forms phenol.

Reason : C-N bond is polar.

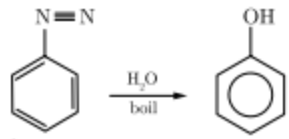
(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

Ans : (b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.



benzene diazonium salt

Although C-N bond is polar but it is not exact reason for the substitution.

14. **Assertion :** In acidic medium, $K_2Cr_2O_7$ exists as $Cr_2O_7^{2-}$ (orange) while in basic medium it is converted to CrO_4^{2-} (yellow).

Assertion : $K_2Cr_2O_7$ is hygroscopic in nature and changes colour on reaction with water.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

Ans : (c) Assertion is correct but Reason is incorrect.

$K_2Cr_2O_7$ changes colour only with change in pH of aqueous solution.

15. **Assertion :** $[Co(NO_2)_3\ (NH_3)_3]$ does not show optical isomerism.

Reason : It has a plane of symmetry.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

Ans : (a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

Optical isomerism is found in octahedral complexes with 1, 2 or 3 symmetrical bidentate ligands only. Since given compound is not having any bidentate ligand, it will not show optical isomerism. It is because it has plane of symmetry, a plane which is perpendicular to equatorial plane.

16. **Assertion :** Benzene diazonium chloride does not give test for nitrogen.

Reason : Loss of N_2 gas takes place during heating.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

Ans : (a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

Benzene diazonium chloride does not give test of nitrogen as nitrogen gas is evolved on heating.

SECTION-B

Directions (Q. Nos. 17-21) : This section contains 5 questions with internal choice in one question. The following questions are very short answer type and carry 2 marks each.

17. What is salt bridge? What are its uses?

Ans :

Salt bridge : When two solution in an electrochemical cell are kept apart through an arrangement, the arrangement is called slat-bridge.

Salt bridge carries out two important functions :

1. It completes the circuit.
2. It maintains the electrical neutrality of the solution in the half cells.

18. Why the properties of third transition series are very similar to second transition series?

Ans :

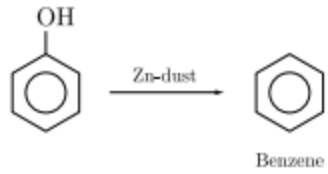
Due to lanthanoid contraction, the size of an atom of the

third transition series ($5d$-series) is almost the same as that of the element of the second transition series ($4d$-series). Hence their properties are also similar.

19. How will you convert Phenol to benzene?

Ans :

Phenol to benzone : On treating phenol with Zinc-dust, we get benzone.



Benzene

20. Define Order of a reaction. Illustrate your answer with an example.

Ans :

Order of a reaction : The sum of the powers of the concentration terms of the reactants present in the rate equation is called order of a reaction.

Order of a reaction can be 0,1,2,3, and even a fraction.

Example :

1. $N_2O_5 \longrightarrow N_2O_4 + \frac{1}{2}O_2$

   $\text{Rate} \propto [N_2O_5]$

   Hence, It is a first order reaction.

2. $2N_2O \longrightarrow 2N_2 + O_2$

   $\text{Rate} \propto [N_2O]^2$

   Hence, It is Second order reaction.

or

What are complex reactions? Name one complex reaction.

Ans :

A sequence of elementary reactions, reactants give the products, the reactions are called complex reactions.

Eg.– Oxidation of Ethane to CO_2 and H_2O passes through a series of intermediate steps in which alcohol, aldehyde and acid are formed.

21. What are reducing and non reducing sugars?

Ans :

All those carbohydrates in which functional groups (aldehydic or ketonic) are free, reduce Fehling solution and Tollen's reagent are called reducing sugar e.g. glucose, fructose while others which do not reduce these reagents are called non reducing sugar e.g. Sucrose.

SECTION-C

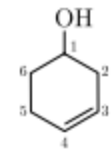
Directions (Q. Nos. 22-28) : This section contains 7 questions with internal choice in one question. The following questions are short answer type and carry 3 marks each.

22. Derive the structure of cyclohex-3-en-1-ol.

Ans :

1. A six-membered ring is implied by 'cyclohex'.
2. 'en' at carbon-3 denotes the presence of a carbon-carbon double bound at carbon atom "3" of six-membered ring.
3. '1-ol' means that a $-OH$ group is present at C$-$1 of six-membered ring.

Thus, the structure of cylohex-3-en-1-ol is as shown below:



23. State colligative properties of dilute solution. Write down the different types of colligative properties.

Ans :

There are four main colligative properties:

1. Relative lowering in Vapour pressure.
2. Elevation is boiling point.
3. Depression in freezing point.
4. Osmotic pressure.

All the above said colligative properties (C.P) are directly propositional to the concentration i.e.

C.P. $\propto$ concentration.

Therefore value of all the colligative properties decreases with the dilution. e.g. a pure liquid has zero-concentration and will show maximum vapour pressure means relative lowering in V.P is zero, or elevation in Boiling point in zero.

24. Explain magnetic behaviour of transition metals.

Ans :

Transition metal contain unpaired electrons in the $(n-1)\,d$ -orbitals, therefore most of the transition metal ions and their compounds are paramagnetic. The magnetic character is expressed in terms of magnetic moment. As the number of unpaired electrons increases from 1 to 5 the magnetic moment and hence paramagnetic character also increases Magnetic moment is calculated by the formula (spin only formula)

$$\mu = \sqrt{n(n+2)}\, B.M$$

Where n = number of unpaired electron

$B.M.$ = Bohr Magneton.

25. Draw the structure of all isomeric alcohols of molecular formula $C_4H_{10}O$ and give their IUPAC names.

Ans :

1. $CH_3-CH_2-CH_2-CH_2-OH$ Butan-1-ol.
2. $CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_2-OH$

   2-Methyl propan-1-ol

3. $CH_3-\underset{\displaystyle OH}{\underset{|}{CH}}-CH_2-CH_3$

   Butan-2-ol

4. $CH_3-\underset{\displaystyle OH}{\underset{|}{\overset{\displaystyle CH_3}{\overset{|}{C}}}}-CH_3$

   2-Methyl propan-2-ol

26. What are the common types of secondary (2°) structure of proteins?

Ans :

The secondary (2°) structure of protein refers to the shape in which a long polypeptide chain can exist. They are found to exist in two different types of structure:

(i) **α-helix Structure :** α-helix is one of the most common ways in which a polypeptide chain forms all possible hydrogen bonds by twisting into a right handed screw (helix) with the $-NH$ group of each am ino acid hydrogen bonded to the $>C=O$ of an adjacent turn of the helix.

(ii) **β-pleated Sheet Structure :** In β-structure all peptide chains are streched out to nearly maximum extension and then laid side by side which are held together by intermolecular hydrogen bonds. The structure resembles the pleated folds of drapery and therefore is known as β -pleated sheet structure.

27. Write the following reactions of Benzene diazonium chloride.

(i) Sandmeyer reaction

(ii) Gatterman reaction

Ans :

(i) **Sandmeyer reaction :** The Cl^-, Br^- and CN^- nucleophiles can be introduced in the benzene ring in the presence of Cu(I) ion. This reaction is called Sandmeyer reaction.

$$C_6H_5\overset{+}{N}_2Cl^- \xrightarrow{Cu_2Cl_2/HCl} C_6H_5Cl + N_2$$

$$C_6H_5\overset{+}{N}_2Cl^- \xrightarrow{Cu_2Br_2/HBr} C_6H_5Br + N_2$$

$$C_6H_5\overset{+}{N}_2Cl^- \xrightarrow{CuCN + KCN} C_6H_5CN + N_2$$

(ii) **Gatterman reaction :** Chloride Cl^-, Bromide Br^- are introduced in the benzene ring by treating the diazonium salt solution with halogen acid in the presence of copper powder. This reaction is called Gatterman reaction.

$$C_6H_5\overset{+}{N}_2Cl^- \xrightarrow{Cu/HCl} C_6H_5Cl + N_2 + CuCl$$

$$C_6H_5\overset{+}{N}_2Cl^- \xrightarrow{Cu/HBr} C_6H_5Br + N_2 + CuBr$$

or

What do you mean by invert sugar?

Ans :

Sucrose (cane sugar or table sugar) on hydrolysis give an equimolar mixture of D-(+)-glucose and D-(−) fructose. Sucrose is a dextrorotatory with sepcific rotation +66.5° but after hydrolysis gives dextrorotatory glucose +52.5° and laevo rotatory fructose −92.4° since the laevorotation of fructose is more than dextrorotation of glucose the mixture is laevorotatory.

$$\underset{\text{Sucrose}}{C_{12}H_{22}O_{11}} + H_2O \longrightarrow \underset{\text{Glucose}}{C_6H_{12}O_6} + \underset{\text{Fructose}}{C_6H_{12}O_6}$$

Thus hydrolysis of sucrose brings about a change in the sign of rotation, from dextro (+) to laevo (−) and product (Glucose and Fructose) is named as invert sugar. The overall process is called inversion of sugar.

28. (i) Define the following terms:

(a) Enantiomers

(b) Racemic mixture

(ii) Why is chlorobenzene resistant to nucleophilic substitution reaction?

Ans :

(i)

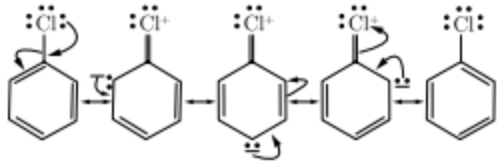
(a) The stereoisomers retated to each other as non-superimposable mirror images are called enantiomers.

(b) Equimolar mixture of d and I form is known as racemic mixture.

(ii) Two reasons for the resistivity or less reactivity of chlorobenzene towards a nucleophilic substitution reaction are as follows:

(a) **Resonance Effect :** The electron pair of chlorine atom

is involved in conjugation with the n-electrons of the benzene ring and the following resonating structures are obtained.



As a result, electrons of C—Cl bond get de-localised and a partial double bond character develops in the bond and hence, it becomes difficult for the nucleophile to cleave the C—Cl bond.

(b) **Increased Electron Density :** A repulsion is suffered by the nucleophile due to increased electron density on the benzene ring which prohibits the nucleophile to make a close access for the attack on the molecule.

SECTION-D

Directions (Q. Nos. 29-30) : The following questions are case-based questions. Each question has an internal choice and carries 4 marks each. Read the passage carefully and answer the questions that follow.

29. Carbohydrates are polyhydroxy aldehydes and ketones and those compounds which on hydrolysis give such compounds are also carbohydrates. The carbohydrates which are not hydrolysed are called monosaccharides. Monosaccharides with aldehydic group are called aldose and those which free ketonic groups are called ketose. Carbohydrates are optically active. Number of optical isomers $= 2^n$.

Where n = number of asymmetric carbons. Carbohydrates are mainly synthesised by plants during photosynthesis. The monosaccharides give the characteristic reactions of alcohols and carbonyl group (aldehydes and ketones). It has been found that these monosaccharides exist in the form of cyclic structures. In cyclization, the $-OH$ groups (generally C_5 or C_4 in aldohexoses and C_5 or C_6in ketohexoses) combine with the aldehyde or keto group. As a result, cyclic structures of five or six membered rings containing one oxygen atom are formed, e.g., glucose forms a ring structure. Glucose contains one aldehyde group, one 1° alcoholic group and four 2° alcoholic groups in its open chain structure.

Answer the following questions :

(a) What is the name the first member of ketose sugar?

(b) How many optical isomers are present in $CH_2OH(CHOH)_4CHO$?

(c) Write the reaction of glucose with hydroxylamine.

or

(d) How many moles of acetic anhydride are needed for acetylation of glucose? What does it confirm?

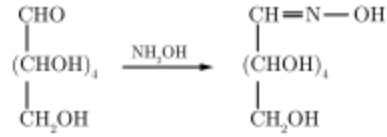
Ans :

(a) The first member of ketose sugar is ketotriose.

(b) No. of chiral atoms = 4

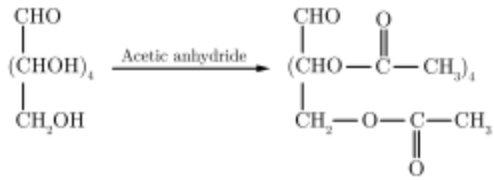
No. of optical isomers $= 2^4 = 16$

(c)



or

(d) Acetylation of glucose with acetic anhydride gives glucose pentacetate which confirms the presence of five $-OH$ groups attached to different carbon atoms



30. A solution containing 30 g of non-volatile solute exactly in 90 g of water has a vapour pressure of 2.8 K Pa at 298 k Further 18 g of water is added to this solution. The new vapour pressure becomes 2.9 k Pa at 298 K When a non-volatile solute is added to a solvent, the surface has molecules of solute and solvent both. Thus, the number of molecules of solvent present in upper surface is less. The number of solvent molecules escaping from the surface is reduced.

Answer the following questions :

(a) Write down the expression for relative lowering of vapour pressure with the mole fraction of the solute.

(b) Calculate the vapour pressure of water at 298 K.

(c) Find out the molecular mass of solute?

or

(d) Name two factors on which the vapour pressure of the liquid depends.

Ans :

(a) The relative lowering of vapour pressure is given by the following expression,

$$\frac{(p^{\circ}_{solvent} - p_{solution})}{p^{\circ}_{solvent}} = \frac{n_2}{(n_1 + n_2)}$$

(b) For dilute solutions,

$$n_2 << n_1,$$

Therefore,

$$\frac{(p^\circ_{solvent} - p_{solution})}{p^\circ_{solvent}} = \frac{n_2}{n_1}$$

$$= \frac{(W_2 \times M_1)}{(M_2 \times W_1)}$$

$$\frac{(p^\circ_{solvent} - 2.8)}{p^\circ_{solvent}} = \frac{6}{M_2} \quad ...(1)$$

Similarly for Second case we get,

$$\frac{(p^\circ_{solvent} - 2.9)}{p^\circ_{solvent}} = \frac{(30 \times 18)}{(M_2 \times 108)}$$

$$\frac{(p^\circ_{solvent} - 2.9)}{p^\circ_{solvent}} = \frac{5}{M_2} \quad ...(2)$$

On solving eq.(1) and (2), we get

$$\frac{(p^\circ_{solvent} - 2.8)}{(p^\circ_{solvent} - 2.9)} = \frac{6}{5}$$

$$p^\circ_{solvent} = 3.4 \text{ k Pa}$$

i.e., vapour pressure of water at 298 K is 3.4 kPa

(c) Substituting the value of $p^\circ_{solvent}$ in (1) we get,

$$\frac{(3.4 - 2.8)}{3.4} = \frac{6}{M_2}$$

or

$$\frac{0.6}{3.4} = \frac{6}{M_2}$$

$$M_2 = 34 \text{ g}$$

or

(d) (i) Nature of liquid (intermolecular force)

(ii) Temperature.

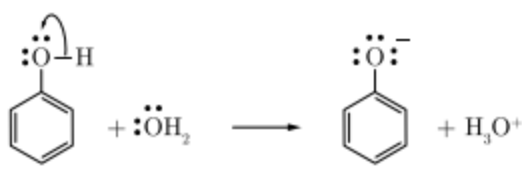
SECTION-E

Directions (Q. Nos. 31-33) : The following questions are long answer type and carry 5 marks each. Two questions have an internal choice.

31. Give two reactions that show the acidic nature of Phenol. Compare its acidity with that of ethanol.

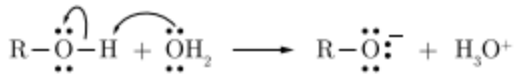
Ans :

Comparision of acidic nature of phenol and ethanol : The phenoxide ion left after the removal of a proton is stabilized by resonance.

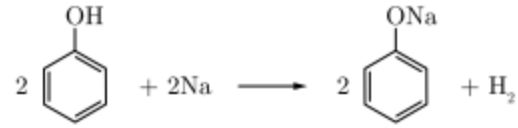


Phenol Phenoxide ion

Wherease ethoxide ion left after removal of a proton from alcohol is not stabilized by resonance.

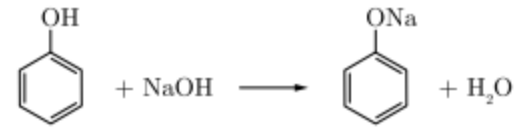


1. **Reaction with sodium :** Phenols reacts with active metals like sodium to liberate H_2 gas.



Phenol Sod. Phenoxide

2. **Reaction with NaOH :** Phenol dissolves in NaOH to form sodium phenoxide and water.



Phenol Sod. Phenoxide

32. (a) Differentiate between Osmosis and diffusion. How is osmotic pressure determined by Berkeley-Hartlay method?

(b) 18 g of glucose ($C_6H_{12}O_6$) was added to 1 kg water at 1.013 bar atmospheric pressure in a vessel. At which temperature will water boil? K_b for water is 0.52 K Kg mol^{-1}.

Ans :

	Osmosis	Diffusion
1.	The process of osmosis takes place through a semi-permiable membrane.	No semi-permeable membrane is needed for the diffusion process.
2.	The osmosis involves the movement of the solvent molecules only.	In diffusion both the solute and the solvent molecules can move.
3.	Osmosis is limited to solutions only.	Diffusion is common in gases as well as in liquids.
4.	Osmosis can be stopped or reversed by applying additional pressure on the higher concentration side.	It cannot be stopped or reversed.

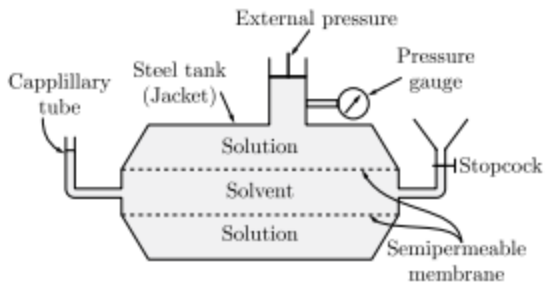
(a) **Osmotic-pressure determination by barkeley hartley method :** A porcelain tube having copper ferocyanide membrane in its walls is enclosed in a metallic jacket.

The porcelin tube is fitted with a reservoir of pure solvent at one end and a capillary tube-at the other end. there is an arrangement in a metallic jacket for applying external pressure which can be measured with

the help of pressure gauge.

The concentration of the solution does not change as the flow of solvent is not permitted into the solution.

Note : As osmotic-pressure is balance by the external pressure, there is no strain on the membrane, thus is does not burst.



(b) Given, Mass of solute (glucose),

$$W_B] = 18\,\text{g}$$

Hence, molar mass of glucose

$$M_B = 180$$

Mass of solvent, (W_A) water i.e.

$$= 1\,\text{kg} = (1000\,\text{g})$$

$$k_b = 0.52\,\text{k.kg.mol}^{-1}$$

Hence, $\Delta T_b = k_b.\frac{W_B}{M_B} \times \frac{1}{W_A(\text{kg})}$

Where, ΔT_b = elevation in boiling point.

Hence, $\Delta T_b = 0.52 \times \frac{18}{180} \times \frac{1}{1} = \frac{0.52}{10}$

Hence, $\Delta T_b = 0.052$

Since, Boiling point of pure water

$$= 100^\circ\text{C}$$

The solution will boil

at the temperature $= 100 + 0.052 = 100.052^\circ\text{C}$

or

(a) What do you mean by the term 'elevation of boiling point'?

(b) State Raoult's law. How is it useful in determining the molecular weight of non-electrolyte solute?

Ans :

(a) **Elevation in boiling point :** The boiling point of a liquid is that temperature at which its vapour pressure becomes equal to the atmospheric pressure. When a non-voltile solute is added to a solvente the boiling point of the solution is always higher than that of pure solvent. For example, A solution of 1 mole of sucrose in 1000g of water boils at 373.52 K at 1 atm pressure. This difference in the boiling points of the solution *wt* and pure solvent (T_b°) is called the elevation of boiling point (ΔT_b). Elevation in boiling point depends on the number of solute molecules rather than their nature.

So, elevation in boiling point is given by

$$\Delta T_b = T_b - T_b^\circ$$

For dilute solution, the elevation in boiling point is directly proportional to the molal concentration of the solute in a solution.

Thus, $\Delta T_b \propto m$(molal concentration of solution)

$$\Delta T_b = \text{K}_b\text{m}$$

where m (molality) is the number of moles of solute dissolved.

(b) **State Raoult's law**, states that, At a given temperature, for a solution of volatile liquids, the partial vapour pressure of each component of the solution is directly proportional to its mole fraction.

Let two volatile liquids 1 and 2 have mole fractions as x_1 and x_2 , respectively. If p_1 and p_2 are vapour pressure of these components in the solutions, then according to Raoult's law

For component 1, $p_1 \propto x_1$ and $p_1 = p_1^\circ\ x_1$

Similarly, for component 2, $p_2 = p_2^\circ\ x_2$

Where p_1° is the vapour pressure of pure component 1 and p_2° is the vapour pressure of pure component 2 at same temperature.

Usefulness of Determination of Molecular : Weight of Non-electrolyte Solute : Solute particles in a solution may go for association or dissociation , thus their molecular mass may changes. Thus to determine the molecular-mass of an abnormal solute, collegative-properties are very useful, as they only depends on the number not on the nature of solute.

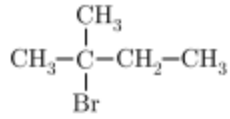
33. Arrange the compounds of each set in order of reactivity towards S_N2 displacement:

(i) (a) 2-Bromo-2-methylbutane
(b) 1-Bromopentane
(c) 2-Bromopentane

(ii) (a) 1-Bromobutane-3-methylbutane
(b) 2-Bromo-2-methylbutane
(c) 2-Bromo-3-methylbutane

(iii) (a) Bromobutane
(b) 1-Bromo-2, 2-dimethylpropane
(c) 1-Bromo-2-methylbutane
(d) 1-Bromo-3-methylbutane.

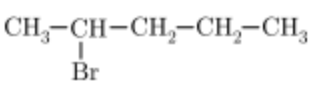
Ans :

(i) (a) 

2-Bromo-2-methylbutane (3°)

(b) 

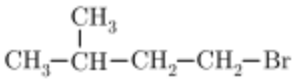
1-Bromopentane (1°)

(c) 

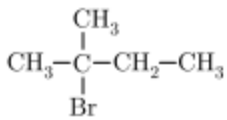
2-Bromopentane (2°)

The reactivity in S_N2 depends upon steric hindrance hence the order of reactivity in S_N2 reaction is $1° > 2° > 3°$ therefore order of reactivity is:

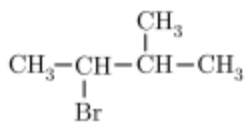
1-Bromopentane>2-Bromopentane>2-Bromo-2-methylbutane.

(ii) (a) 

1-Bromo-3-methylbutane(1°)

(b) 

2-Bromo-2-methylbutane (3°)

(c) 

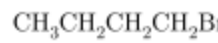
2-Bromo-3-methylbutane (2°)

The order of reactivity towards S_N2 displacement is:

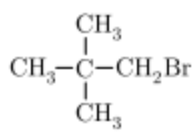
1-Bromo-2-methyl butane (1°)

>2-Bromo-3-methylbutane (2°)

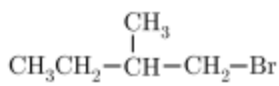
>2-Bromo-2-methylbutane (3°)

(iii)(a) 

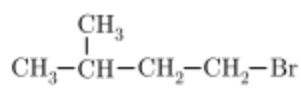
1-Bromobutane

(b) 

1-Bromo-2, 2-dimethylpropane

(c) 

1-Bromo-2-methylbutane

(d) 

1-Bromo-3-methylbutane

The order of steric hindrance is b > c > d > a a hence the order of reactivity is:

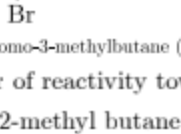
1-Bromobutane>1-Bromo-3-methylbutane>1-Bromo-2-methylbutane>1-Bromo-2, 2-dimethylpropane.

or

Write the structure of the major organic product in each of the following reaction :

1. $CH_3CH_2CH_2Cl + NaI \xrightarrow{\text{acetone, heat}}$
2. $(CH_3)_3CBr + KOH \xrightarrow{\text{ethanol heat}}$
3. $CH_3CH(Br)CH_2CH_3 + NaOH \xrightarrow{\text{Water}}$
4. $CH_3CH_2Br + KCN \xrightarrow{\text{aq ethanol}}$
5. $C_6H_5ONa + C_2H_5Cl \longrightarrow$
6. $CH_3CH_2CH_2OH + SOCl_2 \longrightarrow$
7. $CH_3CH_2CH = CH_2 + HBr \xrightarrow{\text{Peroxide}}$
8. $CH_3CH = C(CH_3)_2 + HBr \longrightarrow$

Ans :

1. $CH_3CH_2CH_2I$
2.
3.
4. $CH_3CH_2 - CN$
5. $C_6H_5 - O - C_6H_5$
6. $CH_3CH_2CH_2Cl$
7. $CH_3CH_2CH_2CH_2Br$
8. 

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