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Class	10th	Chapter	21
Subject	Chemistry	Board	Punjab

CHAPTER 21: Organic Chemistry

A. Multiple Choice Questions

1. Choose the correct IUPAC name for the compound $HC(=CH_2)-CH_2-CH_3$ **[or** $CH_2=CH-CH_2-CH_3$**]:**

(a) But-3-ene **(b) But-1-ene** (c) But-2-ene (d) Butene

- **Answer: (b)**

2. Select a branched chain compound:

(a) $CH_2=CH-CH_2-CH_3$ **(b)** $CH_2=C(CH_3)-CH-CH_3$ (c) $CH_3-CH=CH-CH_3$ (d) $CH_3-CH=CH-CH_2-CH_3$

- **Answer: (b)**

3. Which is the displayed formula of ethanol?

(a) C_2H_5OH (b) CH_3-CH_2-OH (c) $H-C(H)_2-C(H)_2-OH$ **(d)** H_3C-CH_2-O-H **(with all individual bonds displayed)**

- **Answer: (d)**

4. Identify the aldehydic functional group among the following:

(a) $-C(=O)-OH$ (b) $-OH$ (c) $-C(=O)-$ **(d)** $-C(=O)-H$

- **Answer: (d)**

5. Select the general formula of alkyne family:

(a) C_nH_{2n+1} (b) C_nH_{2n} **(c)** C_nH_{2n-2} (d) C_nH_{2n-1}

- **Answer: (c)**

6. How many structural isomers will there be for a saturated hydrocarbon having five carbon atoms?

(a) 2 **(b) 3** (c) 4 (d) 5

- **Answer: (b)** *(n-pentane, isopentane, and neopentane)*

7. Which ester among the following will be called ethyl propanoate?

(a) $CH_3-C(=O)-OCH_3$ (b) $CH_3-CH_2-C(=O)-OCH_3$ (c) $CH_3-C(=O)-OC_2H_5$ **(d)** $CH_3-CH_2-C(=O)-OC_2H_5$

- **Answer: (d)**

8. Which functional group is present in alkenes?

(a) No functional group (b) Carbon-carbon triple bond **(c) Carbon-carbon double bond** (d) Carbon-carbon single bond

- **Answer: (c)**

B. Short Answer Questions

- **21.1 What is the difference between saturated and unsaturated hydrocarbons?**
  - **Saturated hydrocarbons (Alkanes):** Hydrocarbons containing only single covalent bonds ($C-C$) between carbon atoms (e.g., methane, ethane).
  - **Unsaturated hydrocarbons (Alkenes/Alkynes):** Hydrocarbons containing at least one double ($C=C$) or triple ($C\equiv C$) covalent bond between carbon atoms (e.g., ethene, ethyne).
- **21.2 Write down the structural formula of Butan-2-ol.**
  - Condensed formula: $CH_3-CH(OH)-CH_2-CH_3$
  - Structural representation:

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

- **21.3 Why is ethylamine $CH_3-CH_2-NH_2$ called an organic compound?**
  - Because it is a covalently bonded compound containing a hydrocarbon chain ($C-H$ backbone) linked to an amino functional group ($-NH_2$).
- **21.4 Write down the formula of an ester called ethyl methanoate.**
  - Condensed formula: $H-C(=O)-O-CH_2-CH_3$ or $HCOOCH_2CH_3$.
- **21.5 Define structural isomerism.**
  - Structural isomerism is the phenomenon in which compounds have the same molecular formula but different structural arrangements of atoms in their molecules.
- **21.6 Give IUPAC name to $CH_3-CH_2-CH_2-CH_3$.**
  - **Butane** (or n-butane).
- **21.7 What is common in carboxyl group, amide functional group and ester functional group?**
  - All three functional groups contain a **carbonyl group** ($-C(=O)-$) attached directly to a carbon atom in the skeleton.

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C. Constructed Response Questions

- **21.1 Why the members of a homologous series have similar chemical properties?**
    - Because all members of a homologous series possess the **same functional group**, which determines the chemical reactivity and characteristic chemical reactions of the compounds.
- **21.2 How are the properties of 2-methylpropane different from n-butane, both containing the same number of carbon atoms?**
    - Although both share the molecular formula C_4H_{10}, 2-methylpropane is branched while n-butane is a straight chain. 2-methylpropane has a lower boiling point due to a more compact spherical shape that reduces intermolecular surface area and Van der Waals forces.
- **21.3 Write down the structural formulae of isomers shown by saturated hydrocarbon containing five carbon atoms.**
    - Pentane (C_5H_{12}) has 3 structural isomers:
        1. **n-Pentane:** $CH_3 - CH_2 - CH_2 - CH_2 - CH_3$
        2. **Isopentane (2-methylbutane):** $CH_3 - CH(CH_3) - CH_2 - CH_3$
        3. **Neopentane (2,2-dimethylpropane):** $C(CH_3)_4$
- **21.4 Write down the structural formulae of the isomers shown by butene.**
    - Butene (C_4H_8) has the following structural position and chain isomers:
        1. **But-1-ene:** $CH_2 = CH - CH_2 - CH_3$
        2. **But-2-ene:** $CH_3 - CH = CH - CH_3$
        3. **2-Methylprop-1-ene:** $CH_2 = C(CH_3) - CH_3$
- **21.5 Explain the difference among functional groups present in aldehyde, ketone and carboxylic acid.**
    - **Aldehyde ($-CHO$):** The carbonyl carbon is bonded to at least one hydrogen atom ($-C(=O) - H$).
    - **Ketone ($-CO -$):** The carbonyl carbon is bonded to two carbon atoms ($-C(=O) -$).
    - **Carboxylic acid ($-COOH$):** The carbonyl carbon is directly bonded to a hydroxyl group ($-C(=O) - OH$).

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D. Descriptive Questions

- **21.1 What is an organic compound? How organic compounds are classified based on the type of carbon chain present in them?**
    - **Organic Compounds:** Covalent compounds of carbon and hydrogen (hydrocarbons) and their derivatives.
    - **Classification based on carbon chain:**
        1. **Open-chain (Acyclic / Aliphatic) Compounds:** Carbon atoms are linked in continuous straight or branched chains (e.g., alkanes, alkenes, alkynes).
        2. **Closed-chain (Cyclic) Compounds:** Carbon atoms are joined to form rings:
            - *Homocyclic / Carbocyclic:* Rings made up solely of carbon atoms (further divided into Alicyclic and Aromatic like benzene).
            - *Heterocyclic:* Rings containing one or more non-carbon atoms (such as O, N, or S) alongside carbon.
- **21.2 Explain structural formula giving examples.**
    - A **structural formula** shows the exact spatial arrangement and direct connectivity of all atoms and covalent bonds within a molecule.
    - *Example 1:* Methane (CH_4) showing 4 single $C-H$ bonds around a central carbon atom.
    - *Example 2:* Propane (C_3H_8): $H_3C-CH_2-CH_3$.
- **21.3 Write down five characteristics of a homologous series.**
    1. All members can be represented by a single **general chemical formula**.
    2. Adjacent members differ by a constant unit of $-CH_2-$ (methylene group) and 14 a.m.u. in molar mass.
    3. All members possess the **same functional group** and show similar chemical properties.
    4. Physical properties (boiling point, density, melting point) change gradually with increasing molar mass.
    5. All members can be prepared using similar general synthetic methods.
- **21.4 Give IUPAC rules for naming alcohols.**
    1. **Select the longest carbon chain** containing the hydroxyl group ($-OH$) as the parent alkane.
    2. Change the suffix of the parent alkane name from **"-e" to "-ol"** (e.g., propane becomes propanol).
    3. **Number the carbon chain** starting from the end closer to the $-OH$ group to give it the lowest possible locant.
    4. State the position of the $-OH$ group by inserting its number before the suffix or name (e.g., propan-2-ol).
    5. Name and number any alkyl substituents alphabetically as prefixes.

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- **21.5 Name the following compounds:**
  - **(a)** $CH_3 - CH_2 - CH_2OH$ ⟶ **Propan-1-ol**
  - **(b)** $CH_3 - CH_2 - CHO$ ⟶ **Propanal**
  - **(c)** $CH_3 - CH_2 - CH_2 - COOH$ ⟶ **Butanoic acid**
  - **(d)** $CH_3 - CH_2 - CO - O - CH_3$ ⟶ **Methyl propanoate**

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