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Assignment

1. Give the IUPAC names of the following compounds
(a) HCOOH (b) HOOCCH₂CH₂CH₂COOH
(c) CH₃CH₂CH₂COOH (d) HO₂C-CO₂H
(e) CH₃(CH₂)₄COOH (f) CH₃CH=CHCH₂CH₂COOH
2. Discuss briefly the physical properties of carboxylic acids under the following headings
 - i. Physical appearance
 - ii. Boiling point
 - iii. Solubility
3. Write two industrial preparations of carboxylic acids
4. With equations and brief explanation discuss the synthetic preparation of carboxylic acid
5. With chemical equation only, outline the reduction, decarboxylation and esterification of carboxylic acid

SOLUTION

- 1(a) HCOOH :- Methanoic acid
1(b) HOOCCH₂CH₂CH₂COOH :- Pentan-1,5-dioic acid
1(c) CH₃CH₂CH₂COOH:- Butanoic acid
1(d) HO₂C-CO₂H:- Ethanedioic acid
1(e) CH₃(CH₂)₄COOH:- Hexanoic acid
1(f) CH₃CH=CHCH₂CH₂COOH:- Hex-4-eneoic acid

2(i) **Physical appearance:** All simple aliphatic carboxylic acid up to C₁₀ are liquid at room temperature. Most other carboxylic acid are solid at room temperature although anhydrous carboxylic acid also known as glacial ethanoic acid freezes to an ice like solid below room temperature

2 (ii) **Boiling point:** Boiling point increases with relative molecular mass. Aromatic carboxylic acid are crystalline solid and have higher melting point than their aliphatic counterparts of comparable relative molecular mass.

2(iii) **Solubility:** Lower molecular mass carboxylic acid with up to four carbon atom in their molecules are soluble in water this largely due to their ability to form hydrogen bond with molecules. The water

solubility of the acid decreases as the relative molecular mass increase because the structure becomes relatively more hydrocarbon in nature and hence covalent. All carboxylic acid are soluble in organic solvents.

3(a) From carbon (II) oxide: Methanoic acid is manufactured by adding carbon(II) oxide under pressure to get aqueous solution of sodium hydroxide. The free carboxylic acid is liberated by careful reaction with tetraoxosulphate(VI) acid (H₂SO₄)



3(b) From ethanol: Ethanoic acid is obtained commercially by the liquid phase air oxidation of 5% solution of ethanol to ethanoic acid using manganite (II) ethanoate catalyst. Ethanal itself is obtained from ethylene



4. **Using the oxidation of primary alcohol and aldehydes:** oxidation of primary alcohol and aldehydes can be used to prepare carboxylic acid using the usual oxidizing agent(i.e K₂Cr₂O₇ or KMnO₄) in acidic solution



5(a) **reduction**



5(b) **Decarboxylation**



5(c) **Esterification**

