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Course title: General Chemistry II

Answers

- 1) a) $\text{HCOOH} \rightarrow$ methanoic acid
- b) $\text{HOOCCH}_2\text{CH}_2\text{CH}_2\text{COOH} \rightarrow$ Pentan-1,5-dioic acid
- c) $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH} \rightarrow$ Butanoic acid
- d) $\text{HO}_2\text{C}-\text{CO}_2\text{H} \rightarrow$ Ethanedioic acid
- e) $\text{CH}_3(\text{CH}_2)_4\text{COOH} \rightarrow$ Hexanoic acid
- f) $\text{CH}_3\text{CH}=\text{CHCH}_2\text{COOH} \rightarrow$ Hex-4-enoic acid

2) a)

2) Discuss briefly the physical properties of Carboxylic Acids under the following headings: Physical appearance, boiling points & solubility.

Answers

a) Physical appearance.

All simple aliphatic carboxylic acids up to 10 are liquid at room temperature. Most other carboxylic acids are solid at room temperature.

b) Boiling point: This increases with increasing relative molecular mass. Aromatic carboxylic acids are crystalline solids and liquid has higher melting points than their aliphatic counterparts of comparable relative molecular mass.

c) Solubility: Lower molecular mass carboxylic acids with up to

Low carbon atoms in their molecules are soluble in water, this is due to their large ability to form hydrogen bonds with water molecules.

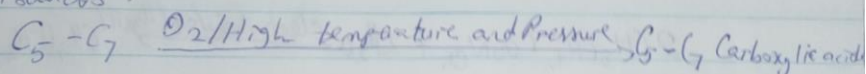
The water solubility of the acids decreases as the relative molecular mass increases because the structure becomes relatively more hydrocarbon in nature and hence covalent. All carboxylic acids are soluble in organic solvents.

3) Write two industrial preparation of Carboxylic acids.

Answers

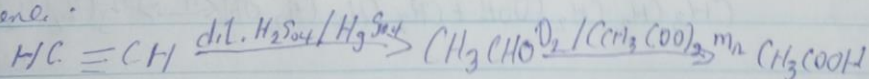
a) From petroleum

Liquid phase air oxidation of C_5-C_7 alkanes, obtainable from petroleum of high temperature and pressure will give C_5-C_7 Carboxylic acids with propanoic, propanoic and butanoic acids as by-products.



b) From ethanal

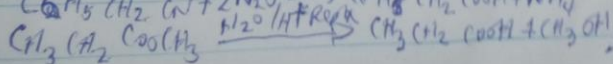
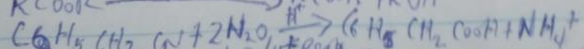
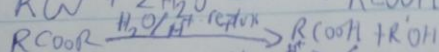
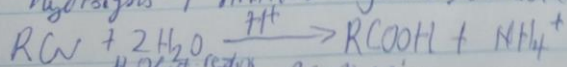
Ethanoic acid is obtained commercially by the liquid phase air-oxidation of 5% solution of ethanol to ethanoic acid using manganese(II) ethanoate catalyst. Ethanol itself is obtained from ethylene.



4) With equation and brief explanation, discuss the synthetic preparation of Carboxylic acid.

Answers

Hydrolysis of nitriles (cyanides) or esters

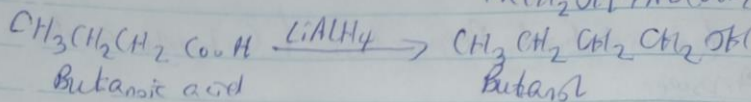
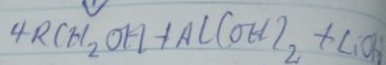
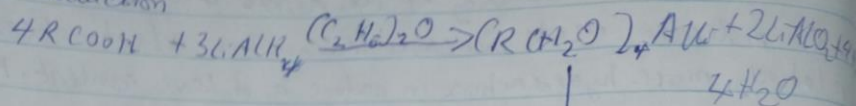


R = alkyl or aryl
R' = alkyl

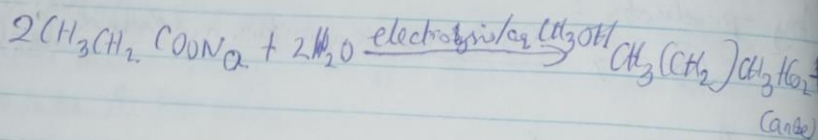
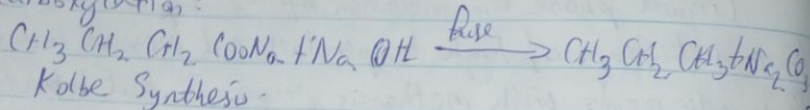
5) With chemical equation only outline the reduction, decarboxylation and esterification of Carboxylic acid.

Answer

a. Reduction



b. Decarboxylation:



c. Esterification

