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DEPARTMENT: COMPUTER ENGINEERING  
COURSE: CHM 102  
MATIC NO: 19/Eng02/011  
ASSIGNMENT

1) Give the IUPAC names of the following compounds:

i)  $\text{HCOOH}$  — Meth Methanoic acid

ii)  $\text{HOOCCH}_2\text{CH}_2\text{CH}_2\text{COOH}$  — Pentan-1,5-dioic acid

iii)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$  — Butanoic acid

iv)  $\text{CH}_3(\text{CH}_2)_4\text{COOH}$  — Hexanoic acid

v)  $\text{CH}_3\text{CH}=\text{CHCH}_2\text{CH}_2\text{COOH}$  — Hexan-4-enoic acid.

2) Discuss briefly the physical properties of carboxylic acids under the following headings.

i) Physical appearance: — All simple aliphatic carboxylic acids up to  $\text{C}_{10}$  are liquids at room temperature. Most other carboxylic acids are solid at room temperature although anhydrous carboxylic acid (acetic acid) also known as glacial ethanoic acid freezes to an ice-like solid below the room temperature.

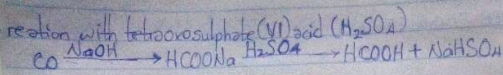
ii) Boiling points: — Boiling point increases with increasing relative molecular mass. Aromatic carboxylic acids are solid at room temperature although anhydrous aromatic crystalline solids and have higher melting points than their aliphatic counterparts of comparable relative molecular mass.

iii) Solubility: — Lower molecular mass carboxylic acids with up to four carbon atoms in their molecule are soluble in water; this is largely due to their ability to form hydrogen bonds with water molecules. The water solubility of the acid 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 2 industrial preparations of carboxylic acids.

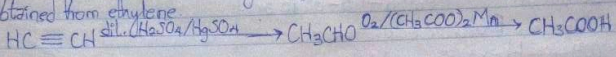
i) From carbon (II) oxide

Methanoic acid (formic acid) is manufactured by adding carbon (II) oxide under pressure to hot aqueous solution of sodium hydroxide. The free carboxylic acid is liberated by careful



2) (i) From ethanol

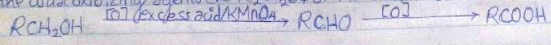
Ethanoic acid is obtained commercially by the liquid phase air oxidation of 5% solution of ethanol to ethanoic acid using manganite (II) ethanoate catalyst. Ethanol itself is obtained from ethylene



4) With equations and brief explanation discuss the synthetic preparation of carboxylic acid.

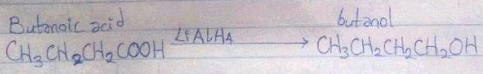
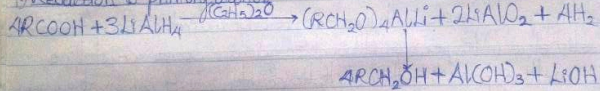
i) Oxidation of primary alcohols and aldehydes.

Oxidation of primary alcohols and aldehydes can be used to prepare carboxylic acid using the usual oxidizing agents (i.e.  $K_2Cr_2O_7$  or  $KMnO_4$ ) in acidic solution.

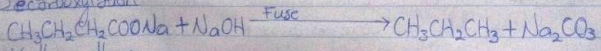


5) With chemical equation only, outline the reduction, decarboxylation and esterification of carboxylic acid.

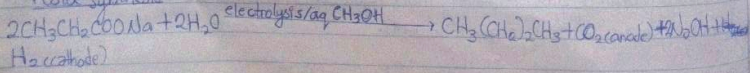
i) Reduction to primary alcohol



ii) Decarboxylation



Kolbe synthesis



iii) Esterification

