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MATRIC NO: 191MHS01/321

DEPARTMENT: MBBS

### QUESTION 1

- i)  $\text{HCOOH} \rightarrow$  Methanoic acid
- ii)  $\text{HOOCCH}_2\text{CH}_2\text{CH}_2\text{COOH} \rightarrow$  Pentan-1,5-dioic acid
- iii)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH} \rightarrow$  Butanoic acid
- iv)  $\text{HO}_2\text{C}-\text{CO}_2\text{H} \rightarrow$  Ethanedioic acid
- v)  $\text{CH}_3(\text{CH}_2)_4\text{COOH} \rightarrow$  Hexanoic acid
- vi)  $\text{CH}_3\text{CH}=\text{CHCH}_2\text{CH}_2\text{COOH} \rightarrow$  Hex-4-enoic acid.

### QUESTION 2

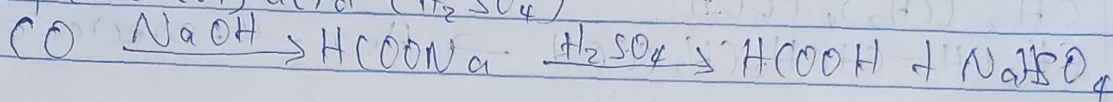
- i) Physical appearances: All simple aliphatic carboxylic acids up to  $\text{C}_{10}$  are liquids at room temperature. Most other carboxylic acids are solid at room temperature although anhydrous carboxylic acid (acetic acid) also known as glacial ethanoic acid freezes to an ice-like solid below the room temperature.
- ii) Boiling point: Boiling point increases with increasing relative molecular mass. Aromatic carboxylic acids are 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 molecules are soluble in water; this largely due to their 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.

### QUESTION 3

Two industrial preparations of carboxylic acids are

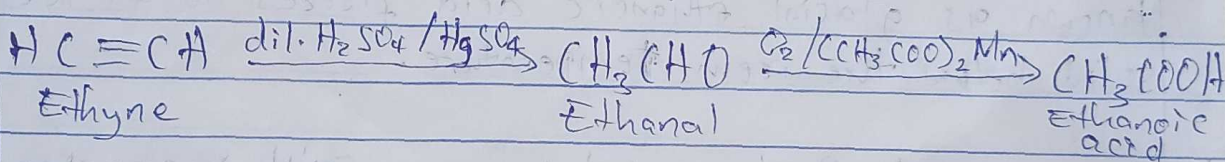
1. From Carbon (II) oxide;

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 reaction with tetraoxo-sulphate (VI) acid ( $H_2SO_4$ )



2 From Ethanal.

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

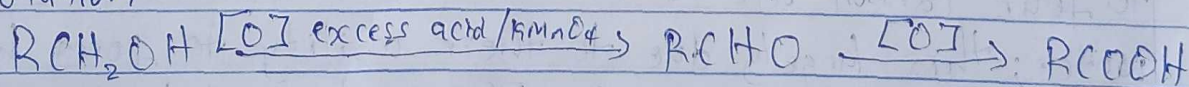


### QUESTION 4

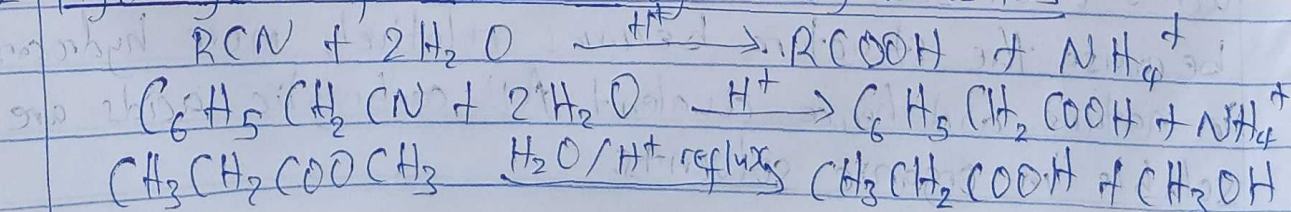
Synthetic preparation of carboxylic acid

1. Oxidation of primary alcohols and aldehydes

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

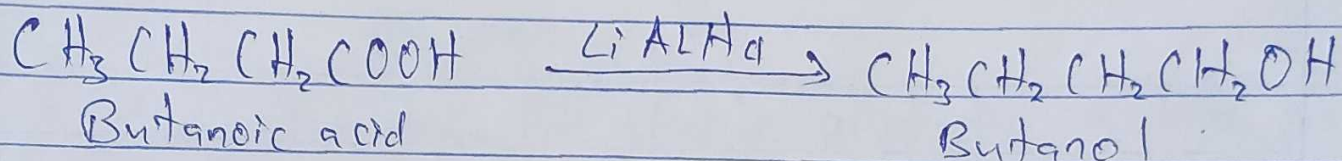
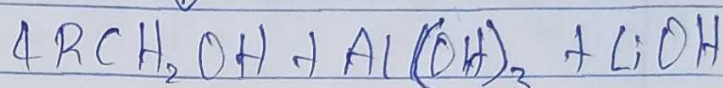
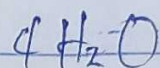
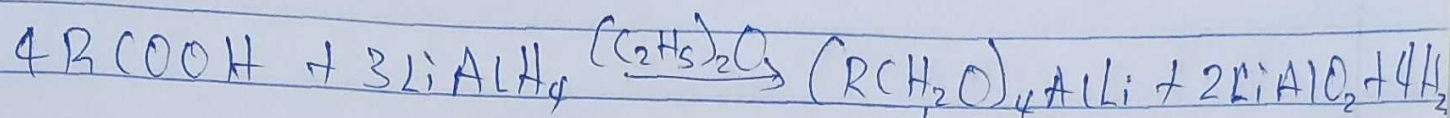


2. Hydrolysis of nitriles (cyanides) or esters

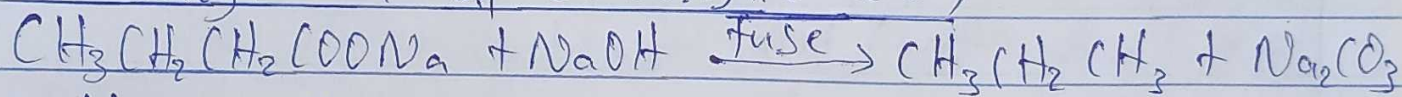


## QUESTION 5

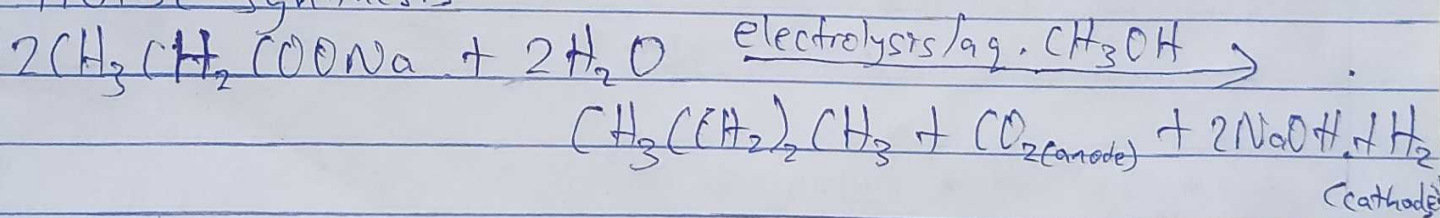
i) Reduction of carboxylic acid;



ii) Decarboxylation of carboxylic acid;



• Kolbe synthesis



iii) Esterification of carboxylic acid;

