1. i. $HCOOH$ - Methanoic acid

ii. $HOOCCH_2CH_2CH_2COOH$ - Pentan-1,5-dioic acid

iii. $CH_3CH_2CH_2COOH$ - Butanoic acid

iv. $CH_3(CH_2)_4COOH$ - Heptanoic acid

v. $CH_3CH=CHCH_2CH_2COOH$ - Hex-4-enoic acid

2. i. Physical appearance: from C1 - C10 are liquids at room temperature (aliphatic carboxylic acids) some are also solid at room temperature

ii. Boiling point: This physical property increases with relative molecular mass but it is also important to note that the aromatic carboxylic acids have higher boiling point than the aliphatic carboxylic acid

iii. solubility: Decreases with increase in relative molecular mass. All carboxylic acids are soluble in organic solvent

3] i) From ethanol: Ethanoic acid is obtained by the liquid phase air oxidation of 5% solution of ethanol using manganese (II) ethanoate catalyst.

$HC \equiv CH \xrightarrow[H_2SO_4]{H_2O} CH_2 = CHOH \longrightarrow CH_3CHO \xrightarrow{O_2/(CH_3COO)_2Mn} CH_3COOH$

ii) From Carbon (II) Oxide: Methanoic acid is formed by reaction carbon (II) oxide with sodium hydroxide. This gives on NaCOOH which contains a free carboxylic acid that can be liberated by action of H_2SO_4

$CO + NaOH \longrightarrow HCOONa \xrightarrow{H_2SO_4} HCOOH + NaHSO_4$

4) i) Oxidation of Aldehydes: Aldehydes are gotten from oxidation of primary alkanols and on further oxidation aldehydes are oxidized to alkanoic acid

$RCH_2OH \xrightarrow[\text{excess acid/KMnO}_4]{[O]} RCHO \xrightarrow{[O]} RCOOH$

ii) Hydrolysis of esters: Esters are alkanoate formed from the reaction between alkanol and alkanoic acid. It is important to note that the reaction is an equilibrium reaction hence on hydrolysis would (alkanoate) I give back its reactants. $CH_3CH_2COOCH_3 \xrightarrow[\text{reflux}]{H_2O/H^+} CH_3CH_2COOH + CH_3OH$

5 i) Reduction : $CH_3CH_2CH_2COOH \xrightarrow{LiAlH_4} CH_3CH_2CH_2CH_2OH$

ii) Decarboxylation:

$CH_3CH_2CH_2COONa + NaOH \xrightarrow{Fuse} CH_3CH_2CH_3 + Na_2CO_3$

iii) Esterification

$CH_3CH_2CH_2COOH + CH_3CH_2CH_2OH \rightleftharpoons CH_3CH_2CH_2COOCH_2CH_2CH_3 + H_2O$