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1a $HCOOH$ - Methanoic acid
b $HOOCCH_2CH_2CH_2COOH$ - Pentan-1,5-dioic acid
c $CH_3CH_2CH_2COOH$ - Butanoic acid
d. $CH_3(CH_2)_4COOH$ - Hexanoic acid
e $CH_3CH=CHCH_2CH_2COOH$ - Hex-4-eneoic acid

2i Physical appearance
All simple aliphatic carboxylic acids up to C_{10} are liquid at room temperature. Most other carboxylic acid are solid at room temperature although anhydrous carboxylic acid freezes to an ice like solid below room temperature

ii Boiling point
Boiling point increases with increasing relative molecular mass. Aromatic carboxylic acids are crystalline solid and have higher melting points than their aliphatic counterparts with same molecular mass.

iii Solubility
Lower molecular mass carboxylic acids with up to four carbon atoms in their molecules are soluble in water. The water solubility of the acids decrease as the relative molecular mass increase because the structure becomes relatively more hydrocarbon in nature and hence covalent.

3i: From carbon(II)oxide

CO is added under pressure to hot aqueous solution of sodium hydroxide. The free carboxylic acid is liberated by reaction with tetraoxosulphate(VI)acid (H_2SO_4)

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

From ethanal:

Ethanoic acid is obtained by the liquid-phase air oxidation of 5% solution of ethanal to ethanoic acid by using manganite(II)ethanoate cata

$$HC\equiv \xrightarrow{dil\ H_2SO_4/HgSO_4} CH_3CHO \xrightarrow{(CH_3COO)_2Mg} CH_3COOH$$

4i Oxidation of primary alcohol and aldehydes.

Oxidation of primary alcohols and aldehyde can be used to prepare carboxylic acids using the usual oxidizing agent in acidic solution

$$CH_3CHO + [O] \longrightarrow CH_3COOH$$

ii Carbonation of Grignard reagent

Aliphatic carboxylic are obtained by carbon(IV)oxide into the Grignard reagent and then hydrolyzed with dilute acid.

$$C_2H_5MgBr + CO_2 \longrightarrow C_2H_5COOH$$

iii Hydrolysis of nitriles (cynaides) or esters.

$$CH_3CH_2COOH_3 + \xrightarrow{H_2O/H^+ \text{ reflux}} CH_3CH_2COOH + CH_3OH$$

5; Reduction of carboxylic acid

$$CH_3CH_2CH_2COOH \xrightarrow{LiAlH_4} CH_3CH_2CH_2CH_2OH$$

Butanoic acid — Butanol

ii Decarboxylation

$$CH_3CH_2CH_2COONa + NaOH \xrightarrow{\text{fuse}} CH_3CH_2CH_3 + Na_2CO_3$$

iii Esterification

$$CH_3CH_2CH_2COOH + CH_3CH_2CH_2OH \longleftrightarrow CH_3CH_2CH_2COOCH_2CH_2CH_3 + H_2$$