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1a) Methanoic acid

b) Pentan-1, 4, dioic acid

c) Butanedioic acid

d) Ethanedioic acid

e) Pentanedioic acid

2a) Physical appearance

- Carboxylic acids up to C_{10} are liquids at room temperature the ones with higher molecular mass are solids at room temperature except glacial ethanoic acid which freezes below room temperature

b) Boiling point - With increasing molecular mass, their boiling increases

c) Solubility - The solubility decreases with increasing molecular mass because their hydrocarbon increases, thus making them covalent. All carboxylic acids are soluble in organic solvents.

3) Two industrial preparations of carboxylic acids are:

1) from carbon (ii) oxide - Carbon(ii)oxide reacts with a hot aqueous solution of sodium hydroxide.

Addition of H_2SO_4 releases the free forming carboxylic acids.

e.g $CO + NaOH \rightarrow HCOONa$

$HCOONa + H_2SO_4 \rightarrow HCOOH + NaHSO_4$.

2) from petroleum

- Liquid phase air oxidation of C_5-C_7 alkenes with high temperature and pressure produces C_5-C_7 carboxylic acids.

4) The synthetic preparation of carboxylic acid.

- Oxidation of primary alcohols and aldehydes.

This can be used to prepare carboxylic acids using $K_2Cr_2O_7$ / $KMnO_4$ in acidic solution.

$$RCH_2OH \xrightarrow{KMnO_4} RCOOH$$

2) hydrolysis of ester:

$$C_2H_5COOCH_3 \xrightarrow{H_2O} C_2H_5COOH + C_2H_3OH$$

3) The chemical reactions

1) Decarboxylation — This involves removal of the carboxyl group from the acid to give a hydrocarbon or its derivative.

Thermal decarboxylation.

$$C_2H_5COONa + NaOH \rightarrow C_2H_6 + Na_2CO_3$$

Esterification - In the presence of strong acid catalyst, carbo
ds react with alcohol to form esters.

$$C_2H_5COOH + CH_3OH \longrightarrow C_2H_5COOC_2H_4 + H_2O$$