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1 $HCOOH$ - methanoic acid.
$HOOCCH_2CH_2CH_2COOH$ - Pentan-1,5-dioic acid
HO_2C-CO_2H - Ethanedioic acid.
$CH_3(CH_2)_4COOH$ - Hexanoic acid.
$CH_3CH=CHCH_2CH_2COOH$ = Hex-4-eneoic acid.
$CH_3CH_2CH_2COOH$. Butanoic acid

2.) Physical appearance.
All simple aliphatic carboxylic acids up to C_{10} are liquids at room temperature. Most other carboxyl 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 points increases with increasing relative molecular mass. Aromatic carboxylic acids are crystalline solids and have higher melting point 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 is largely due to their ability to form hydrogen bonds with water molecules. The water solubility of the acids decreases of the

relative molecular mass increases because the structure becomes relatively more hydrocarbon in nature and have covalent.

3) from Carbon (II) oxide

It is made by the action of sulfuric acid upon Sodium formate which is produced from Carbon monoxide and sodium hydroxide.

$$CO + NaOH \xrightarrow{H_2O} HCOONa \rightarrow HCOOH$$

Carbon monoxide; sodium hydroxide; Sodium formate; methanoic acid.

ii) 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.

$$HC \equiv CH \xrightarrow{dil.\ H_2SO_4} CH_3CHO \xrightarrow{O_2/(CH_3COO)_2Mn} CH_3COOH$$

iii) Oxidation of primary alcohols and aldehydes.

With the use of oxidizing agent such as $K_2Cr_2O_7$ or $KMnO_4$ in acidic solution, Carboxylic acids can be prepared from the oxidation of primary alcohols and aldehydes.

$$CH_3CH_2OH + 2[O] \xrightarrow[\text{acid}]{\text{excess } / KMnO_4} CH_3CHO + H_2O$$

$$CH_3CHO \xrightarrow{[O]} CH_3COOH$$

1) Carbonation of grinard reagent

Aliphatic carboxylic acids are obtained by bubbling carbon(IV) oxide into the grignard reagent and then hydrolysed with dilute acid.

i) $C_6H_5MgBr + CO_2 \longrightarrow CH_3CH_2C(=O)-O-MgBr$

ii) $CH_3CH_2C(=O)-O-MgBr + H_2O \xrightarrow{H_3O^+} CH_3CH_2C(=O)-O-H + Mg(OH)Br$

5) Reduction to primary alcohol.

$CH_3CH_2CH_2COOH \xrightarrow{LiAlH_4} CH_3CH_2CH_2CH_2OH$

Butanoic acid — Butanol.

iv) Esterification

$CH_3CH_2CH_2COOH + CH_3CH_2CH_2OH \longleftrightarrow CH_3CH_2CH_2COOCH_2CH_2CH_3 + H_2O$

iii) Decarboxylation.

$CH_3CH_2CH_2COONa + NaOH \longrightarrow CH_3CH_2CH_3 + Na_2CO_3$