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Department: Medical laboratory Science
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1. $HOOCCH_2CH_2CH_2COOH$ - pentan-1,5-dioic acid
$CH_3CH_2CHCOOH$ - Butanoic acid
HO_2C-CO_2H - Ethanedioic acid
$CH_3(CH_2)_4COOH$ - Hexanoic acid
$CH_3CH=CHCH_2CH_2COOH$ - Hex-4-eneoic acid

2. Physical Apperance: All simple, aliphatic carboxylic acids up to C_{10} are liquid at room temperature. Most other carboxylic are solid at room temperature although annhydrous carboxylic acid (acetic acid) also known as glacial ethanoic acid freezes to an ice like solid below the room temperature.
- Boiling points: Boiling points increases with increasing relative molecular mass. Aromatic carboxylic acids are crystaline solids have higher melting points than their aliphatic counterparts of comparable relative molecular mass.
- 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.

3. from CO_2: Methanoic acid is manufactured by adding CO_2 under pressure to hot aqueous solution of sodium hydroxide. The free carboxylic acid is liberated by careful reaction with tetraoxosulphate(VI) acid "(H_2SO_4).
from ethanol: ethanoic acid is obtained commercially by the liquid phase air-oxidation of 5% solution of ethanal to ethanoic acid using magnesium(II) ethanoate catalyst. Ethanal itself is obtained from ethylene.

$$HC\equiv CH \xrightarrow{\text{Dilute } H_2SO_4 / HgSO_4} CH_3CHO \xrightarrow{O_2(CH_3COO)_2Mn} CH_3COOH$$

- Oxidation of primary alcohols and alhedhydes: Oxidation of primary alohols and aldehydes can be used to prepare carboxylic acids using the usual oxidizing agents in acidic solution.

$RCH_2OH \longrightarrow RCHO \longrightarrow RCOOH$

Carbonation of Gingard reagent: Aliphatic carboxylic acids are obtained by bubbling carbon(IV) oxide into the Gingnard reagent and then hydrolyzed with dilute acid.

$RMgBr + CO_2 \longrightarrow RCOOMgBr \longrightarrow RCOOH + MgBrOH$

Hydrolysis of nitriles (cyanides) or esters.

$RCN + 2H_2O \xrightarrow{H^+} RCOOH + NH_4^+ RCOO_4 \longrightarrow RCOOH + R'OH$.

$C_6H_5CH_2CN + 2H_2O \longrightarrow C_6H_5CH_2COOH + NH_4^+$

$CH_3CH_2COOHCH_3 \longrightarrow CH_3CH_2COOH + CH_3OH$

$4RCOOH + 3LiAlH_4 \longrightarrow (RCH_2O)_4AlLi + 2LiAlO_2 + 4H_2$

$4H_2O$

$4RCH_2OH + Al(OH)_3 + LiOH$

$CH_3CH_2CH_2COOH \longrightarrow CH_3CH_2CH_2CH_2OH$

- Butanic acid
- Butanol

- Decarboxylation

$CH_3CH_2CH_2COONa + NaOH \longrightarrow CH_3CH_2CH_3 \longrightarrow Na_2CO_3$

$2CH_3CH_2COONa + 2H_2O \longrightarrow CH_3(CH_2)_2CH_3 + CO_2 + 2NaOH + H_2$

$CH_3CH_2CH_2COOH + CH_3CH_2CH_2OH \longrightarrow CH_3CH_2CH_2COOCH_2CH_2CH_3 + H_2O$