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Answers	
Organic Compounds	IUPAC Names
i) HCOOH	Methanoic acid
ii) $\text{H}_2\text{C}_2\text{H}_2\text{O}_2$	Pentamethylene dioic acid
iii) $\text{C}_2\text{H}_5\text{COOH}$	Butanoic acid
iv) $\text{H}_2\text{C}=\text{CO}_2\text{H}$	Ethanedioic acid
v) $\text{C}_2\text{H}_5\text{C}_2\text{H}_4\text{COOH}$	Hexanoic acid
vi) $\text{C}_6\text{H}_5\text{CH}_2\text{COOH}$	Hex-4-enoic acid

2. PHYSICAL PROPERTIES OF CARBOXYLIC ACIDS

1. PHYSICAL APPEARANCE

All simple aliphatic carboxylic acids up to 10 are liquids at room temperature. Most other carboxylic acids are solid at room temperature although anhydrous acetic acid is also known as glacial ethanoic acid. Glacial ethanoic acid freezes to an ice-like solid below the room temperature.

ii) Boiling point

Boiling point increases with increasing relative molecular mass. Aliphatic carboxylic acids are crystalline solids and have higher melting points 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

As the relative molecular mass increases because the structure becomes relatively more hydrocarbon in nature and hence volatile. All carboxylic acids are soluble in water.

6 INDUSTRIAL PREPARATIONS OF CARBOXYLIC ACIDS

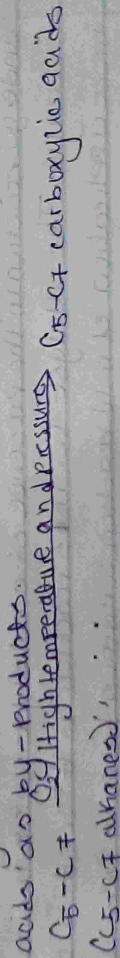
1 FROM CARBON DIOXIDE

Methanoic acid (formic acid) is manufactured by adding carbon dioxide 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)



ii) FROM PETROLEUM

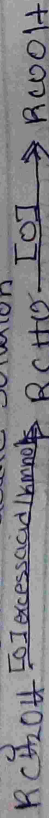
Liquid phase air oxidation of C₅-C₇ alkanes, obtainable from petroleum of high temperature and pressure will give C₅-C₇ carboxylic acids with methanoic, propanoic and butanedioic acids as by-products.



4 SYNTHETIC PREPARATION OF CARBOXYLIC ACIDS

1) OXIDATION OF PRIMARY ALCOHOLS AND ALDEHYDES

Oxidation of primary alcohols and aldehydes can be used to prepare carboxylic acids using the usual oxidizing agents like $K_2Cr_2O_7$ (potassium dichromate: Cr(VI)) or $KMnO_4$ (potassium manganate: Cr(VII)) in acidic solution



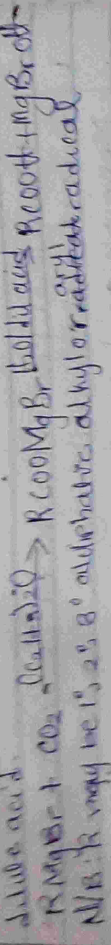
Example: OXIDATION OF ETHANOL TO ETHANOIC ACID



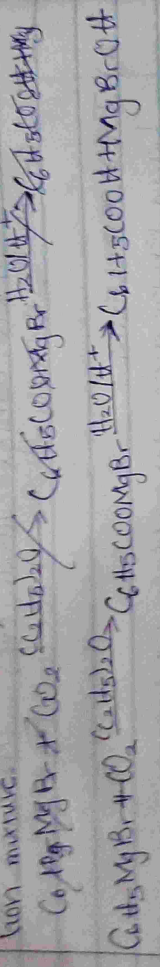
CH₃CO
 2) DECKE
 CH₃CO
 K₂CO₃
 2) CH₃

2 CARBONATION OF GRIGNARD REAGENT

Aliphatic carboxylic acids are obtained by bubbling carbon dioxide into the Grignard reagent and then hydrolysed with dilute acid.



In the preparation of benzoic acid, the reagent is added to solid carbon dioxide (dry ice) which also serves as a coolant in the reaction mixture.

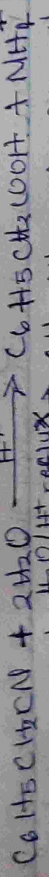


3 HYDROLYSIS OF NITRILES (CYANIDES) OR ESTERS

Nitriles undergo hydrolysis to form amides. The amides further undergo reaction in the presence of a catalyst which then to form carboxylic. The catalyst for this reaction is H⁺ or OH⁻. Further more application of mild reaction condition helps in ceasing the reaction in the amide stage.

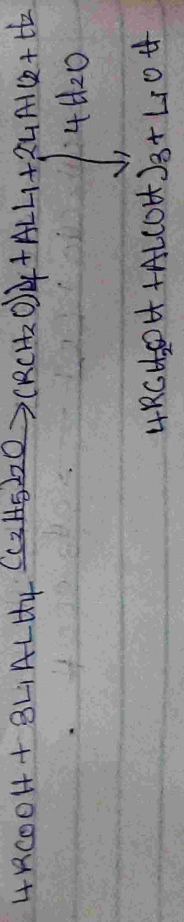


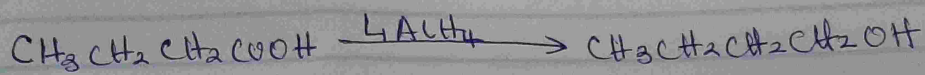
CR = alkyl or aryl radical.



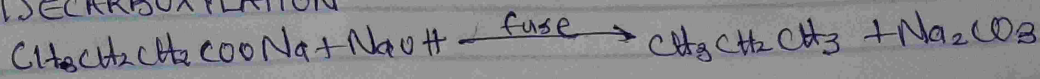
5 CHEMICAL REACTIONS

1 REDUCTION TO PRIMARY ALCOHOL

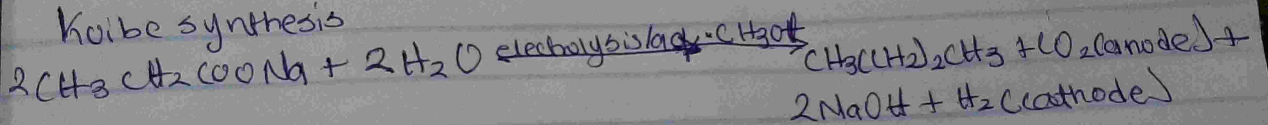




2) DECARBOXYLATION



Knoevenagel synthesis



3) ESTERIFICATION

