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MATRIC NO.: 19/MHS06/022

DEPARTMENT: MEDICAL LABOURATORY SCIENCE

COURSE TITLE: GENERAL CHEMISTRY II

COURSE CODE: CHM 102

ASSIGNMENT TITLE: ASSIGNMENT ON CARBOXYLIC ACID

ANSWERS

1. a. HCOOH – Methanoic acid
- b. $\text{HOOCCH}_2\text{CH}_2\text{CH}_2\text{COOH}$ – Pentan-1,5-dioic acid
- c. $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$ – Butanoic acid
- d. $\text{HO}_2\text{C}-\text{CO}_2\text{H}$ – Ethanedioic acid
- e. $\text{CH}_3(\text{CH}_2)_4\text{COOH}$ – Hexanoic acid
- f. $\text{CH}_3\text{CH}=\text{CHCH}_2\text{CH}_2\text{COOH}$ – Hex-4-eneoic acid

2. PROPERTIES

I. PHYSICAL APPEARANCE

All simple aliphatic carboxylic acids up to C_{10} are liquids at room temperature. Most other carboxylic 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 POINT

Boiling point increases with increasing relative molecular mass. Aromatic aliphatic counterparts of comparable relative molecular mass.

III. SOLUBILITY

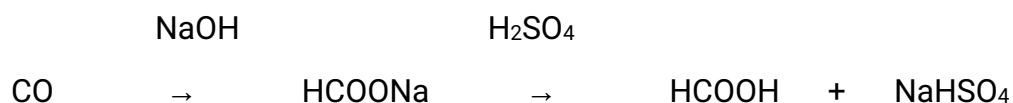
Lower molecular mass carboxylic acids with up to four carbon atoms in their molecules are soluble in water; this largely due to their ability to form hydrogen bonds with water molecules. The water solubility of the acids

decreases as the relative molecular mass increases because the structure becomes relatively more hydrocarbon in nature and hence covalent. All carboxylic acids are soluble in organic solvents.

3. INDUSTRIAL PREPARATION

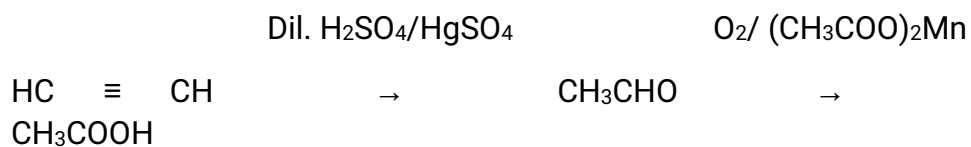
I. FROM CARBON(II) OXIDE

Methanoic acid (formic acid) is manufactured by adding carbon(II)oxide 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 ETHANOL

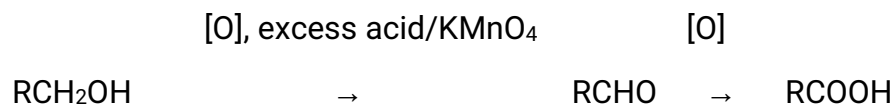
Ethanoic acid is obtained commercially by the liquid phase air-oxidation of 5% solution of ethanol to ethanoic acid using manganite (II) ethanoate catalyst. Ethanal itself is obtained from ethylene.



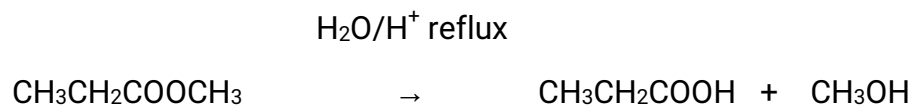
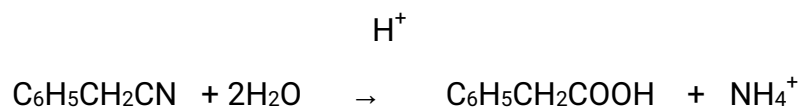
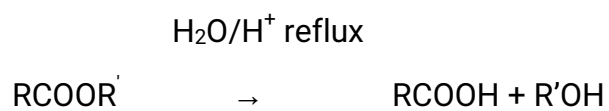
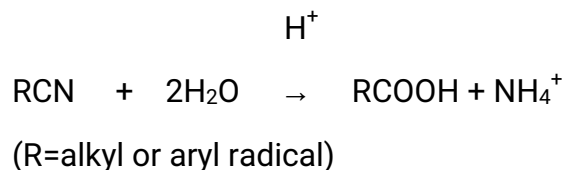
4. SYNTHETIC PREPARATION

I. OXIDATION OF PRIMARY ALCOHOLS AND ALDEHYDES

Oxidation of primary alcohols and aldehydes can be used to prepare carboxylic acids using the usual oxidizing agents (i.e. $\text{K}_2\text{Cr}_2\text{O}_7$ or KMnO_4) in acidic solution

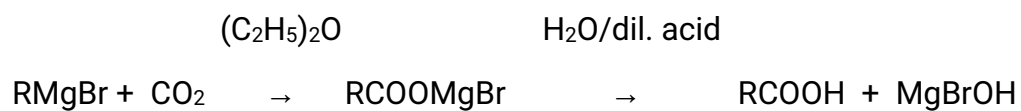


II. HYDROLYSIS OF NITRILES (CYANIDES) OR ESTERS



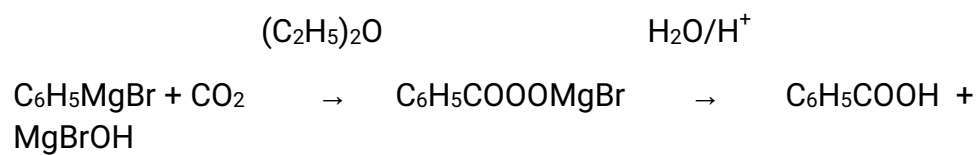
III. CARBONATION OF GRIGNARD REAGENT

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

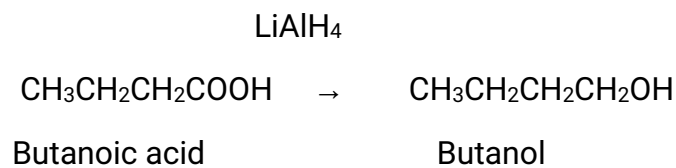
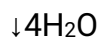
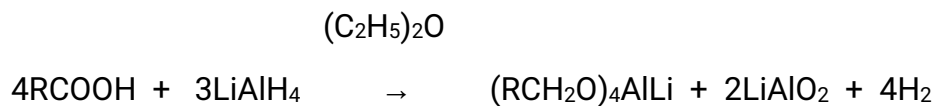


R may be 1°, 2°, 3° aliphatic alkyl or aryl radical

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



5. REDUCTION TO PRIMARY ALCOHOL



DECARBOXYLATION

fuse



Kolbe synthesis

Electrolysis/aq. CH_3OH



ESTERIFICATION

