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19 | ENG05 | 048

MECHATRONICS ENGINEERING

~~MECH~~ CHM102 ASSIGNMENT

~~ELIJAH~~

(1) Give the IUPAC names of the following compounds:

HCOOH — Methanoic acid.

$\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$ — Butanoic acid.

$\text{HOOCCH}_2\text{CH}_2\text{CH}_2\text{COOH}$ — Pentan-1,5-dioic acid.

$\text{HO}_2\text{C}-\text{CO}_2\text{H}$ — Ethanedioic acid.

$\text{CH}_3(\text{CH}_2)_4\text{COOH}$ — Hexanoic acid.

$\text{CH}_3\text{CH}=\text{CHCH}_2\text{CH}_2\text{COOH}$ — Hex-4-enoic acid.

(2) Discuss briefly the physical properties of Carboxylic acids under the following headings:

(i) Physical Appearance: All simple aliphatic Carboxylic acids up to C_{10} are liquid 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 points: It increases with increasing relative molecular mass. Aromatic Carboxylic acids are crystalline solids and have higher melting points than their aliphatic counterparts of comparable relative molecular mass.

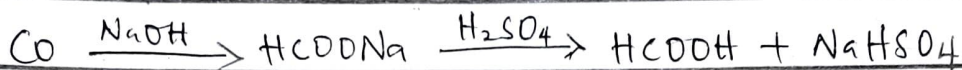
(iii) Solubility: Lower molecular mass Carboxylic acids with up to four Carbon atoms in their molecules are soluble in water; this is largely due to their ability to form hydrogen bonds with water molecules. The water solubility of the acids decreases as the relative molecular mass

(3) Write two industrial preparations of Carboxylic acids.

* INDUSTRIAL PREPARATIONS

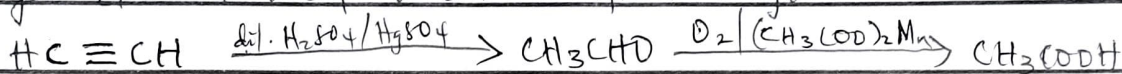
(1) From Carbon (II) Oxide

Methanoic acid (formic acid) is manufactured by adding (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).



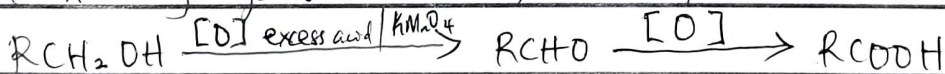
(2) From Ethanol

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



(4) With equations and brief explanation discuss the synthetic preparation of Carboxylic acid.

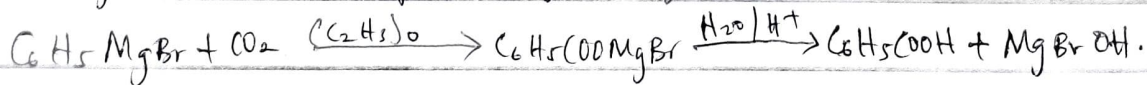
(1) Oxidation of primary alcohols and aldehydes: Oxidation of primary alcohols and aldehydes can be used to prepare carboxylic acids using the usual oxidizing agents (i.e. $K_2Cr_2O_7$ or $KMnO_4$) in acidic solution.



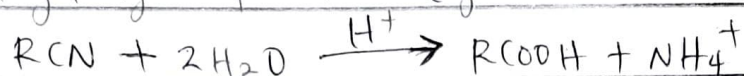
(2) Carbonation of Grignard Reagent: Aliphatic Carboxylic acids are obtained by bubbling Carbon (IV) Oxide into ~~the~~ the Grignard reagent and then hydrolyzed with dilute acid.



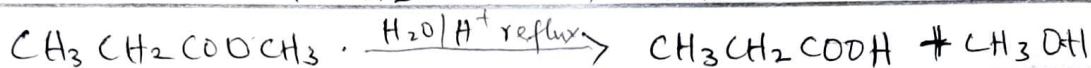
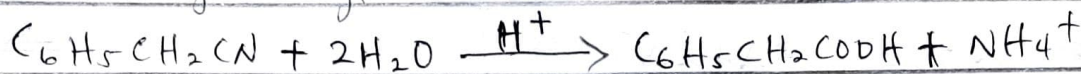
R may be 1°, 2°, 3° aliphatic alkyl or aryl radical.



(3) Hydrolysis of nitriles (cyanides) or esters.



(R = alkyl or aryl radical)



(5) With chemical equation only, outline the reduction, decarboxylation and esterification of carboxylic acid.

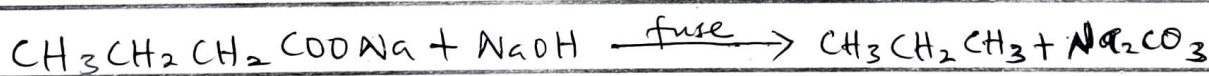
(1) Reduction ~~of~~ ^{to} primary alcohol:



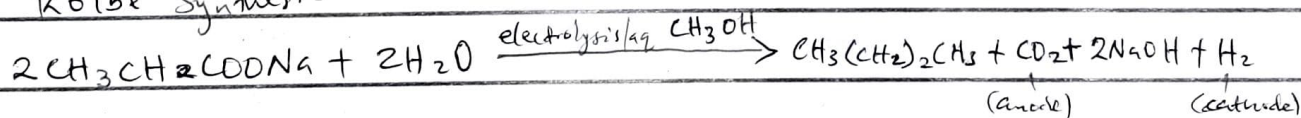
Butanoic Acid

Butanol.

(2) Decarboxylation:



Kolbe Synthesis



(3) Esterification:

