Class – B.Sc. Part II (Honours)
Paper – III C
Subject – chemistry
Topic – Lactic acid
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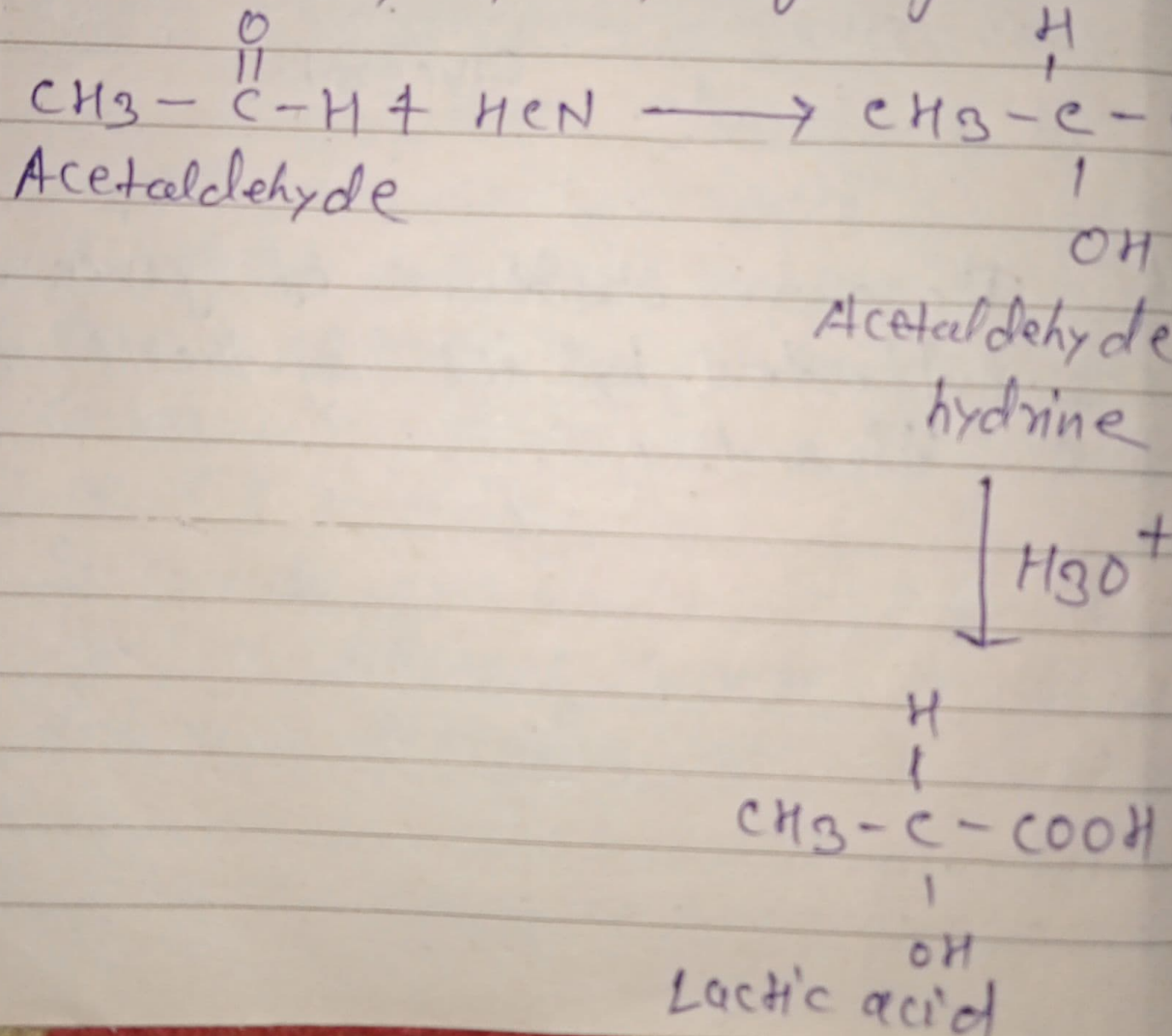
Lactic acid [$CH_3-CHOH-COOH$]
(2-hydroxy propanoic acid)

Methods of preparation :-

(1) <u>From Acetaldehyde</u> :- Acetaldehyde reacts with HCN followed by hydrolysis giving lactic acid.



(2) By the oxidation of Propylene glycol :-

Propylene glycol on oxid^n gives lactic acid

$$\begin{array}{c} CH_3 \\ | \\ CHOH \\ | \\ CH_2OH \end{array} \xrightarrow{[O]} \begin{array}{c} CH_3 \\ | \\ CHOH \\ | \\ COOH \end{array}$$

Propylene glycol Lactic acid

(3) From Alanine :- Alanine on treatment with nitrous acid at $0^0 - 5^0C$ leads to the formation of lactic acid.

$$\underset{\text{Alanine}}{CH_3-CH(NH_2)-COOH} + HNO_2 \longrightarrow \underset{\text{Lactic acid}}{\begin{array}{c} CH_3 \\ | \\ CHOH \\ | \\ COOH \end{array}} + N_2 + H_2O$$

(4) Synthesis :- Synthesis of lactic acid is done by acetaldehyde which in turn is obtained by passing acetylene in dil. H_2SO_4 containing mercuric salt (as catalyst). Acetaldehyde is reacts with HCN to give acetaldehyde cyanohydrine which is hydrolysed

into lactic acid.

$$2C + H_2 \xrightarrow[\text{arc}]{\text{electric}} \underset{\text{Acetylene}}{C_2H_2} \xrightarrow[Hg^{+2}]{H_2SO_4} CH_3CHO$$

$$CH_3CHO \xrightarrow{HCN} CH_3CH(OH)CN$$

Acetaldehyde-cyanohydrine

$$CH_3CH(OH)CN \xrightarrow{H_3O^+} CH_3CH(OH)COOH$$

Lactic acid

(5) Fermentation of cane sugar :— (commercial method)

This method consist in the following steps :—

a. A dilute solution of cane sugar or glucose is treated with Bacillus acidi-laevolactiti (B.A.L) and the solⁿ is mentained as 35-40°c

b. $CaCO_3$ is added from time to time in order to neutralise, the lactic acid form into calcium salt.

c. After 8-10 days the reaction becomes complete and the solution is warmed, filtered and the calcium lactate is decomposed with calculated amount of H_2SO_4 to give lactic acid.

$$\underset{\text{Glucose}}{C_6H_{12}O_6} \xrightarrow{\text{Fermentation}} \underset{\text{methyl glyoxal}}{CH_3 \cdot CO \cdot CHO}$$

$$CH_3 \cdot CO \cdot CHO \xrightarrow{2H_2O} CH_3CH(OH)COOH$$

Lactic acid

$$2\,CH_3CH(OH)COOH + CaCO_3 \longrightarrow$$

$$H_2O + CO_2 + (CH_3CH(OH)COO)_2Ca$$

calcium lactate

$$(CH_3CHOHCOO)_2Ca + H_2SO_4 \longrightarrow$$

$$2\,CH_3CHOHCOOH + CaSO_4$$

Lactic acid