

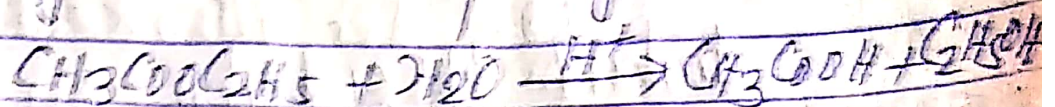
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Seg - I (H) - Chemical Kinetics
Topics — Kinetics of hydrolysis of ethyl-Acetate in acidic-Medium & Zero-order-Reaction

Hydrolysis of Ester (ethyl-Acetate) in acidic-Medium

Ethyl-Acetate hydrolyse as



The amount of CH_3COOH can be calculated by titration against standard NaOH solution. But being an acid-catalysed reaction, the acid present originally as a catalyst also reacts with NaOH solution. Hence for the same volume of reaction mixture withdrawn at different times

Experimental - Observation -

Volume of NaOH soln. used initially at Zero-time (V ₀)	}	Amount of acid used in Catalyst only (CH_3COOH) - 0

Again

Volume of NaOH solution
used at any instant
of time (V_t)

Amount of
acid present
as Catalyst +
 CH_3COOH formed

Combining above both statement (2)

Amount of CH_3COOH
produced at any
instant of time } $\propto (V_t - V_0)$ (3)

We see from Reaction that
Amount of CH_3COOH produced is
the Amount of CH_3COONa react(n)

Hence $(V_t - V_0) \propto n$ (4)

Volume of NaOH solution
used after the reaction
has takes place for a
long-time or infinite-time
(V_∞)

Amount of
acid present
as Catalyst
+
Maximum
amount of
 CH_3COOH produced

Maximum Amount of
 CH_3COOH produced $\propto (V_\infty - V_0)$ (5)

(6)

But the instantaneous amount of H_2O produced } $\propto$ { initial conc of reactants }

Thus $(V_\infty - V_0) \propto a$

Eqn (V) & (VI) $\sim$

$$(a-x) \propto (V_\infty - V_0) \quad (V_1 - V_0)$$

$$\text{or, } (a-x) \propto (V_\infty - V_1) \quad (1)$$

Putting the value of a & $(a-x)$ in first order rate equation,

$$k = \frac{2.303}{t} \log \frac{a}{(a-x)}$$

$$\text{or, } \boxed{k = \frac{2.303}{t} \log \frac{V_\infty - V_0}{(V_\infty - V_1)}}$$

Zero-Order Reaction:

Those reaction in which order of reaction is independent upon the concentration of the reactant. Its rate is proportional to zero power of the concentration of reaction.

For the reaction
 $A \rightarrow \text{Product}$

Its rate is expressed.

$$-\frac{dx}{dt} = k[A]^0 = k[a]^0$$

Where a is initial concn of A

$$\text{Thus } dx = k \cdot dt$$

Upon Integration $\int dx = k \cdot \int dt$

$$x = kt + C \quad \left(C = \text{Integ. Const} \right)$$

$$\text{When } t=0, x=0$$

$$\text{Thus } C=0$$

$$\text{Hence } \boxed{x = kt}$$

Characteristics of Zero order Rxn.

(a) Unit of k , $k = \frac{dx}{dt} = \text{mol/lit Time}^{-1}$

(b) Half-life Period: - When $t = t_{1/2}$, $x = \frac{a}{2}$

$$t_{1/2} = \frac{k \cdot a}{2k}$$

Half life $\propto$ Initial concn

(c) Example of Zero order Rxn

