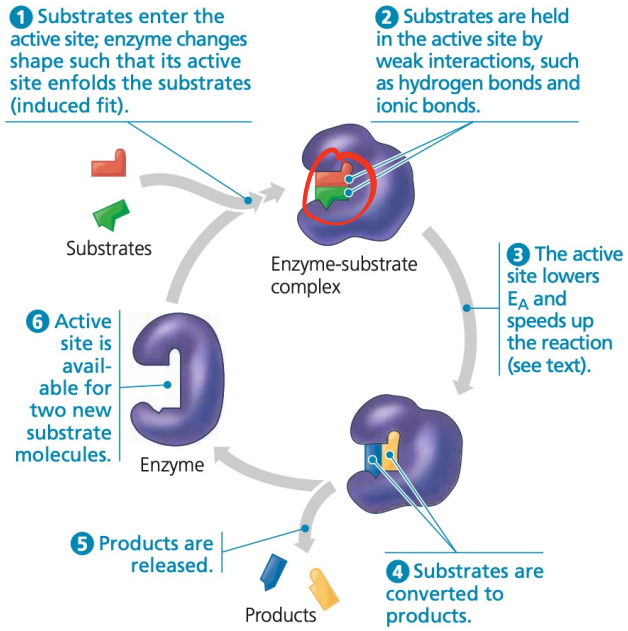
Enzyme Kinetics

Switch

$A \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} B$

$aA + bB \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} cC$



$$E + S \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} C \xrightarrow{k_2} E + P$$

$$\rightarrow \frac{dE}{dt} = -k_1 ES + k_{-1} C + k_2 C$$

$$\frac{dS}{dt} = -k_1 ES + k_{-1} C$$

$$\rightarrow \frac{dC}{dt} = k_1 ES - k_{-1} C - k_2 C$$

$$\frac{dP}{dt} = k_2 C$$

Conservation statements

$$E_0 = E(t) + C(t)$$

$$S + P + C = S_0$$

$$E(t) = E_0 - C(t)$$

$$\frac{dS}{dt} = -k_1 (E_0 - C) S + k_{-1} C$$

$$\frac{dC}{dt} = k_1 (E_0 - C) S - (k_{-1} + k_2) C$$

1. E-S complex C is formed rapidly.
2. E is working at full capacity

Quasi-steady state assumptions

$$\frac{dc}{dt} \approx 0$$

$$0 = K_1(E_0 - C)S - (K_{-1} + K_2)C$$

$$C = \frac{E_0 S(t)}{K_m + S(t)}$$

$$C(t) = \beta t + S$$

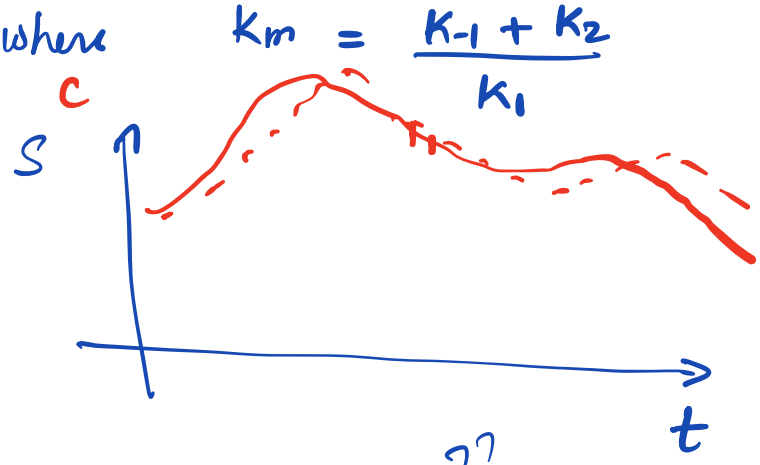
$$\frac{dP}{dt} = K_2 C$$

rate of the reaction

$$\left[\frac{dP}{dt} = \frac{K_2 E_0 S}{K_m + S}\right]$$

$S >> K_m$

where $K_m = \frac{K_{-1} + K_2}{K_1}$



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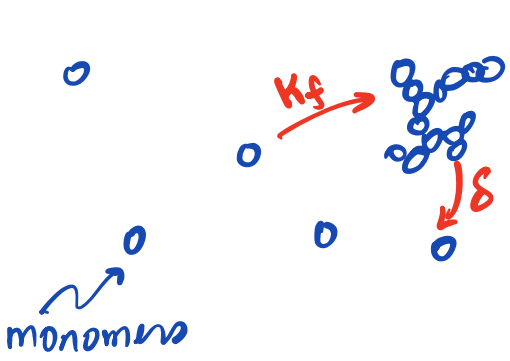
$$\left[\frac{dP}{dt} = \frac{V_{max} S}{K_m + S}\right]$$

Michaelis-Menten Kinetics.

Polymerization.



$C(t)$ = conc. of monomers at time t

$F(t)$ = conc. of polymer (monomer sub. units) at time t

A = total amount of material.

$$\left[\frac{dC}{dt} = -K_f C F + \delta F\right]$$

$$\left[\frac{dF}{dt} = K_f C F - \delta F\right]$$

$C(t) + F(t) = A$

Derive conditions for formation of a polymer.