Problem set answers – Kinetics.

1. Rapid equilibrium – random

$$E + A \rightleftharpoons EA \quad K_1$$
$$E + B \rightleftharpoons EB \quad K_2$$
$$\left.\begin{array}{l} EA + B \rightleftharpoons EAB \quad K_3 \\ EB + A \rightleftharpoons EAB \end{array}\right] \xrightarrow{k} \text{products}$$

$K_1 K_3 = K_2 K_4$ by definition

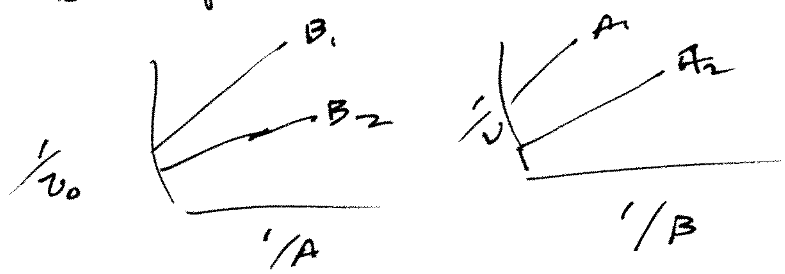
$$v_0 = k(EAB) = \frac{k(EA)(B)}{K_3} = \frac{k(E)(A)(B)}{K_1 K_3}$$

$$E_0 = E + EA + EB + EAB$$
$$= E\left(1 + \frac{A}{K_1} + \frac{B}{K_2} + \frac{A \cdot B}{K_1 K_3}\right)$$

$$v_0 = \frac{k(E)_0(A)(B)/K_1 K_3}{1 + \frac{A}{K_1} + \frac{B}{K_2} + \frac{A \cdot B}{K_1 K_3}}$$

$$= \frac{k(E)_0}{1 + \frac{K_3}{B} + \frac{K_4}{A} + \frac{K_1 K_3}{A \cdot B}}$$

Double reciprocal plots will look like This



b) Rapid equil. ordered

$$E + A \rightleftharpoons EA \quad K_1$$

$$EA + B \rightleftharpoons EAB \quad K_3 \xrightarrow{k} \text{products}$$

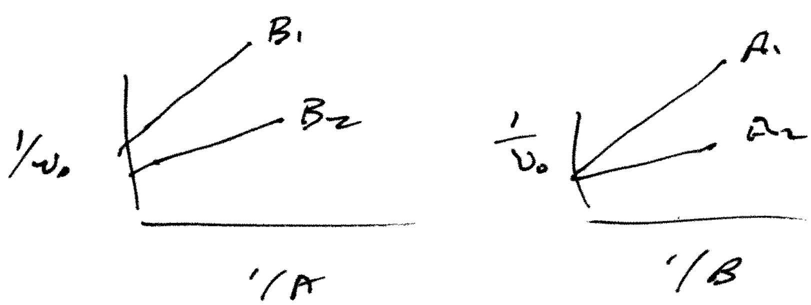
$$v_0 = k_3(EAB) = \frac{k(EA)(B)}{K_3} = \frac{k(E)(A)(B)}{K_1 K_3}$$

$$E_0 = E + EA + EAB$$

$$= E\left(1 + \frac{A}{K_1} + \frac{A \cdot B}{K_1 K_3}\right)$$

$$v_0 = \frac{k(E_0)(A)(B)/K_1K_3}{1 + \frac{A}{K_1} + \frac{A \cdot B}{K_1 K_3}}$$

$$= \frac{k(E)_0}{1 + \frac{K_3}{B} + \frac{K_1 K_3}{A \cdot B}}$$

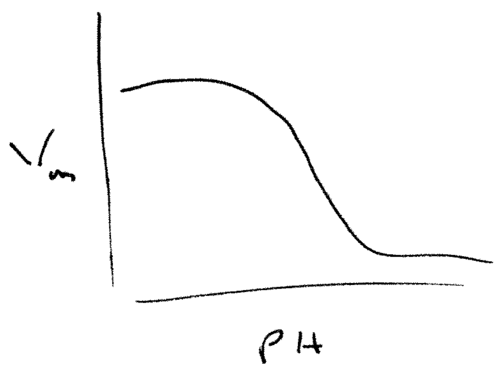


c)

$$v_0 = \frac{k(E)_0}{1 + \frac{K_H}{H^+} + \frac{K_4}{A} + \frac{K_H}{H^+} \cdot \frac{K_1}{A}}$$

$$= \frac{k(E)_0 / \left(1 + \frac{K_H}{H^+}\right)}{1 + \frac{\frac{K_4}{A}\left(1 + \frac{K_1}{K_4}\frac{K_H}{H^+}\right)}{1 + \frac{K_H}{H^+}}}$$

so that $V_{max} = \frac{k(E)_0}{1 + \frac{K_H}{H^+}}$



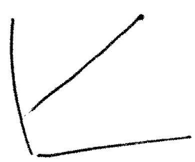
2.

$$v_0 = \frac{\alpha(1+\alpha)^3 + Lc\alpha(1+c\alpha)^3}{(1+\alpha)^4 + L(1+c\alpha)^4}$$

need to set up this equation and change values of L.

If $L = 0$, i.e., all in tight binding form:

$$v_0 = \frac{\alpha}{1+\alpha} = \text{Michaelis-Menten behavior.}$$

3. λ_1  $[A]$ λ_2  $[A]$

slope $= k_1$

intercept $= k_{-1} + k_2 + k_{-2}$

at high A, $\lambda_2 = k_2 + k_{-2}$

etc.

4.

5. $K_m = 20\,\mu M$

$V_m / E_0 = 10\ s^{-1}$