INTERMEDIATES E, SE, AND $\bar{E}$. BUT

$$E_0 = E + \bar{E} + SE$$

$$\frac{dSE}{dt} = k_1^+ S \cdot E - k_1^- SE - k_2 SE \simeq 0$$

$$\frac{d\bar{E}}{dt} = k_a^+ P \cdot \bar{E} - k_a^- E \simeq 0$$

$$\bar{E} = \frac{k_a^- E}{k_a^+ P} = \frac{E}{K_a P}$$

$$SE = \frac{k_1^+ S \cdot E}{k_1^- + k_2} = \frac{S \cdot E}{K_M}$$

$$E_0 = E\left[1 + \frac{S}{K_M} + \frac{1}{K_a P}\right] = \frac{E\left[K_a P(K_m + S) + K_m\right]}{K_a P K_m}$$

$$E = \frac{K_a K_M E_0 P}{K_m + K_a P(K_m + S)}$$

$$\text{rate} = k_2 SE = \frac{K_a (k_2 E_0) S \cdot P}{K_m + K_a P(K_m + S)}$$

$$\frac{d\bar{E}}{dt} = k_i^+ P \cdot E - k_i^- \bar{E} \quad \simeq 0$$

$$\frac{dSE}{dt} = k_1^+ S \cdot E - k_1^- SE - k_2 SE \quad \simeq 0$$

$$\bar{E} = K_i P \cdot E$$

$$SE = \frac{S \cdot E}{K_M}$$

$$E_0 = E\left[1 + K_i P + \frac{S}{K_M}\right]$$

$$E = \frac{K_M E_0}{K_M + S + K_M K_i P}$$

$$\text{rate} = k_2 SE = \frac{k_2 E_0 S}{K_M + S + K_M K_i P}$$

Eq (16) SLOW

$\Rightarrow$ rate $= k_2 [R^+][Y^-]$

INTERMEDIATES R^+

a) $\frac{dR^+}{dt} = k_1^+ RX - k_1^- X^- R^+ \simeq 0$

$$R^+ = \frac{K_1 RX}{X^-}$$

$$\boxed{\text{rate} = k_2 K_1 \frac{RX \cdot Y^-}{X^-}}$$

b) $\frac{dR^+}{dt} = k_1^+ RX - k_1^- X^- R^+ - k_2 Y^- \cdot R^+$

$$R^+ = \frac{k_1^+ RX}{k_1^- X^- + k_2 Y^-} = \frac{K_1 RX}{X^- + \frac{k_2}{k_1^-} Y^-}$$

$$\text{rate} = \frac{k_2 RX \cdot Y^-}{X^- + \frac{k_2}{k_1^-} Y^-}$$

c) $X^- \gg \frac{k_2}{k_1^-} Y^-$

b)

$$r_0 = k\bar{A}\bar{B}^2$$

$$k\bar{A}\bar{B}^2 = k_d\bar{B}$$

OR $$r_0 = k_d\bar{B} \Rightarrow \boxed{\bar{B} = \frac{r_0}{k_d}}$$

$$\boxed{\bar{A} = \frac{k_d}{k}\frac{1}{\bar{B}} = \frac{k_d}{k}\frac{k_d}{r_0} = \frac{k_d^2}{kr_0}}$$

c)

$$J = \begin{pmatrix} -k\bar{B}^2 & -2k\bar{A}\bar{B} \\ k\bar{B}^2 & 2k\bar{A}\bar{B} - k_d \end{pmatrix}$$

d)

$$J = \begin{pmatrix} -\frac{kr_0^2}{k_d^2} & -2\cancel{k}\frac{k_d^{\cancel{2}}}{\cancel{kr_0}}\frac{\cancel{r_0}}{\cancel{k_d}} = -2k_d \\ \frac{kr_0^2}{k_d^2} & k_d \end{pmatrix}$$

e)

$$\mathrm{tr}\,J = k_d - \frac{kr_0^2}{k_d^2} = 0$$

$$\boxed{k_d^3 = kr_0^2}$$

$$k_d = k^{1/3}r_0^{2/3}$$

b) $$r_0 = \frac{V\bar{B}}{K+\bar{B}}$$

$$r_0 K + r_0 \bar{B} = V\bar{B}$$

$$\boxed{\bar{B} = \frac{r_0 K}{V - r_0}} \Rightarrow V > r_0$$

$$\bar{A} = \frac{r_0}{k\bar{B}} = \frac{\cancel{r_0}}{k}\,\frac{(V-r_0)}{\cancel{r_0}K}$$

$$\boxed{\bar{A} = \frac{(V-r_0)}{kK}}$$

c) $$J = \begin{matrix} -k\bar{B} & -k\bar{A} \\ +k\bar{B} & \underbrace{kA - \frac{V}{K+\bar{B}}}_{0} + \frac{V\bar{B}}{(K+\bar{B})^2} \end{matrix}$$

$$J = \begin{pmatrix} -k\bar{B} & -k\bar{A} \\ k\bar{B} & \frac{V\bar{B}}{(K+\bar{B})^2} \end{pmatrix}$$

d) $$J = \begin{pmatrix} -\frac{k r_0 K}{V-r_0} & -\frac{(V-r_0)}{K} \\ \frac{k r_0 K}{V-r_0} & \frac{r_0^2}{V\bar{B}} = \frac{r_0^2}{V}\,\frac{(V-r_0)}{r_0 K} \end{pmatrix}$$

$$J = \begin{pmatrix} -\frac{kKr_0}{V-r_0} & -\frac{(\cancel{V}-r_0)}{K} \\ \frac{kKr_0}{V-r_0} & \frac{r_0(V-r_0)}{VK} \end{pmatrix}$$

q) $$\mathrm{tr}J = \frac{r_0(V-r_0)}{VK} - \frac{kKr_0}{V-r_0}$$

$$= \frac{r_0(V-r_0)^2 - kK^2 r_0 V}{VK(V-r_0)}$$

$$(V-r_0)^2 = kK^2 V$$

$$V - r_0 = \sqrt{kV}\,K$$

$$\boxed{K_c = \frac{V-r_0}{\sqrt{kV}}}$$