$A = [BrO_3^-]$

$P = [HOBr]$

$X = [HBrO_2]$

$Y = [Br^-]$

$Z = [Ce^{4+}]$

$$\frac{dX}{dt} = k_1 AY - k_2 XY + k_3 AX - 2k_4 X^2$$

$$\frac{dY}{dt} = -k_1 AY - k_2 XY + f k_5 Z$$

$$\frac{dZ}{dt} = 2k_3 AX - k_5 Z$$

$X \to \frac{k_1 A}{k_2} x \qquad Z \to 2\frac{k_1 k_3 A^2}{k_2 k_5} z$

$Y \to \frac{k_3 A}{k_2} y \qquad t \to \frac{1}{k_1 A} t^*$

$A + Y \xrightarrow{k_3} X + P$

$X + Y \xrightarrow{k_2} 2P$

$A + X \xrightarrow{k_5} 2X + 2Z$

$2X \xrightarrow{k_4} A + P$

$Z \longrightarrow fY$

$K_1 = k_3 [H^+]^2 \sim 2\ M^{-1} s^{-1}$

$K_2 = k_2 [H^+] \sim 3 \times 10^6\ M^{-1} s^{-1}$

$K_3 = k_5 [H^+] \sim 40\ M^{-1} s^{-1}$

$K_4 = k_4 \sim 3 \times 10^3\ M^{-1} s^{-1}$

$K_5 = 0.6 [BrMA]\ M^{-1} s^{-1}$

$K_5 \approx 1.8 \times 10^{-2}\ s^{-1}$

w/ $[H^+] \approx 1\ M$

$[BrMA] \approx 0.03 M$

M is mole / liter

$A \approx 6 \times 10^{-2}\ M$

$$\frac{K_1 A}{K_2} \sim 4\times10^{-8}M$$

$$\frac{k_3 A}{K_2} \sim 0.8\times10^{-6}M$$

$$\frac{2k_1k_3A^2}{k_2k_5} \sim 1.1\times10^{-5}M$$

$$t \sim \frac{1}{k_1 A} \sim 8.3s$$

$\frac{1}{(H^+)}$

$$\varepsilon\dot{x} = x + y - xy - qx^2$$

$$\dot{y} = 2fz - y - xy$$

$$p\dot{z} = x - z$$

$$\frac{\varepsilon}{p}\frac{dx}{dt} = qy - xy + x(1-x)$$

$$\frac{q}{p}\frac{dy}{dt} = -qy - xy + 2fz$$

$\frac{1}{(H^+)^2}$

$$\frac{dz}{dt} = x - z$$

$$\varepsilon = k_1/k_3 \sim 0.05$$

$$\varepsilon \sim \frac{k_3[H^+]}{k_5}$$

$$p = k_1A/k_5 \sim 6.7$$

$$\frac{k_1 A}{k_5} = \frac{k_3[H^+]^2\cdot A}{0.6[BrMA]} = \frac{k_3}{0.6}\frac{[H^+]^2A}{[BrMA]}$$

$$q = 2k_1k_4/k_2k_3 \sim 10^{-4}$$

$$\frac{2k_1k_4}{k_2k_3} = \frac{2k_3\cancel{[H^+]^2}k_4}{k_2[\cancel{H^+}]\,k_5\cancel{[H^+]}} = \frac{2k_3k_4}{k_2k_5}$$

$\cancel{t_0 = P}$

$\cancel{\delta q = P\delta}$

$$\frac{\varepsilon}{p} = \hat{\varepsilon}$$

$$\frac{q}{p} = \delta$$

$$q = q$$

$$\partial_t X = A - (B+1)X + X^2 Y + D_X \nabla^2 X$$

$$\partial_t Y = BX - X^2 Y + D_Y \nabla^2 Y$$

set $D_X = D_Y = D$

$$X \Rightarrow \alpha x$$
$$Y \Rightarrow \beta y$$

$$\begin{cases} \alpha \partial_t x = A - \alpha(B+1)x + \alpha^2\beta x^2 y + \alpha D \nabla^2 x \\ \beta \partial_t y = \alpha B x - \alpha^2 \beta x^2 y + \beta D \nabla^2 y \end{cases}$$

$$\partial_t \to \gamma \partial_t$$

$$\begin{cases} \alpha\gamma \partial_t x = (A - \alpha B x) - \alpha x + \alpha^2\beta x^2 y + \alpha D \nabla^2 x \\ \beta\gamma \partial_t y = \alpha B x - \alpha^2\beta x^2 y + \beta D \nabla^2 y \end{cases}$$

$$\partial_t x = \frac{A\left(1 - \frac{\alpha B}{A} x\right)}{\alpha\gamma} + \frac{1}{\gamma}\left(-x\alpha + \alpha^2 \beta x^2 y\right) + \frac{D}{\gamma}\nabla^2 x$$

$$\alpha = \frac{A}{B} \qquad \alpha^2\beta = 1 \qquad \beta = \frac{B}{A} \qquad \frac{\alpha}{\beta} = \frac{A/B}{B^2/A^2} = \frac{A^2}{B^2}$$

$$\partial_t y = \frac{\alpha B}{\beta\gamma} x - \frac{\alpha^2 \cancel{\beta}}{\gamma \cancel{\beta}} x^2 y + \frac{\cancel{\beta}}{\gamma} D \nabla^2 y$$

$$= \frac{A^2}{B^2\gamma} x - \frac{A^2}{B^2\gamma} x^2 y + \frac{\cancel{\beta}}{\gamma} D \nabla^2 y$$

$$\partial_t y = \frac{A^2}{B^2\gamma}(x - x^2 y) + \frac{\cancel{\beta}}{\gamma} D \nabla^2 y$$

$$\partial_t x = \frac{A}{\alpha\gamma}(1-x) + \frac{\alpha}{\gamma}(-x+x^2y) + \frac{D}{\gamma}\nabla^2 x$$

$$\partial_t y = \frac{A^2}{B^2\gamma}(x-x^2y) + \frac{D}{\gamma}\nabla^2 y$$

Define $\frac{A}{\alpha\gamma} \equiv K$ $\quad \frac{\alpha}{\gamma} \equiv \beta$ $\quad \bar{\gamma} \equiv \frac{A^2}{B^2\gamma}$ $\quad \frac{D}{\gamma} \equiv \bar{D}$

get

$$\begin{cases} \partial_t x = K(1-x) + \beta(-x+x^2y) + \bar{D}\nabla^2 x \\ \partial_t y = \bar{\gamma}(x-x^2y) + \bar{D}\nabla^2 y \end{cases}$$