

$$\frac{d[A]}{[A]} = -k_n dt \rightarrow \int_{[A]_0}^{[A]} \frac{d[A]}{[A]} = -k_n \int_0^t dt$$

$$\ln[A] \Big|_{[A]_0}^{[A]} = -k_n t$$

$$\ln[A] - \ln[A]_0 = -k_n t$$

$$\ln \left[\frac{[A]}{[A]_0} \right] = -k_n t$$

$$\frac{[A]}{[A]_0} = e^{-k_n t}$$

$$[A] = [A]_0 e^{-k_n t}$$

$$\frac{d[A]}{dt} = -k_r[A]^2$$

$$\int_{[A]_0}^{[A]} \frac{d[A]}{[A]^2} = -k_r \int_0^t dt$$

$$-\frac{1}{[A]} \Big|_{[A]_0}^{[A]} = -k_r t$$

$$\frac{1}{[A]} - \frac{1}{[A]_0} = k_r t$$

$$\frac{1}{[A]} = k_r t + \frac{1}{[A]_0}$$

$$\frac{1}{[A]} = \frac{k_r t [A]_0 + 1}{[A]_0}$$

$$[A] = \frac{[A]_0}{1 + k_r t [A]_0} //$$

$$[A] = [A]_0 e^{-k_r t}$$

$$\frac{[A]_0}{2} = [A]_0 e^{-k_r t_{1/2}}$$

$$\frac{1}{2} = e^{-k_r t_{1/2}}$$

$$\ln\left(\frac{1}{2}\right) = -k_r t_{1/2}$$

$$\ln 1 - \ln 2 = -k_r t_{1/2}$$

$$\ln 2 = k_r t_{1/2}$$

$$t_{1/2} = \frac{\ln 2}{k_r}$$

1st
Order

$$[A] = \frac{[A]_0}{1 + k_r t [A]_0} \quad 2^{\text{nd}} \text{ order}$$

$$\frac{\cancel{[A]_0}}{2} = \frac{\cancel{[A]_0}}{1 + k_r t_{1/2} [A]_0}$$

$$\frac{1}{2} = \frac{1}{1 + k_r t_{1/2} [A]_0}$$

$$1 + k_r t_{1/2} [A]_0 = 2$$

$$k_r t_{1/2} [A]_0 = 1$$

$$t_{1/2} = \frac{1}{k_r [A]_0}$$

$$\frac{d[A]}{dt} = -k_r [A][B] \quad A+B \rightarrow P$$

$$\hookrightarrow = [B]_0 - x$$

$$\hookrightarrow = [A]_0 - x$$

$$\frac{d[A]}{dt} = -k_r ([A]_0 - x)([B]_0 - x)$$

$$\hookrightarrow \frac{d[A]}{dt} = \frac{d([A]_0 - x)}{dt} = -\frac{dx}{dt}$$

$$-\frac{dx}{dt} = -k_r ([A]_0 - x)([B]_0 - x)$$

$$\frac{dx}{([A]_0 - x)([B]_0 - x)} = k_r dt$$

$$* \frac{1}{(a-x)(b-x)} = \frac{1}{b-a} \left(\frac{1}{a-x} - \frac{1}{b-x} \right) \quad \leftarrow$$

$$\hookrightarrow \frac{1}{(a-x)(b-x)} = \frac{N}{a-x} + \frac{M}{b-x}$$

$$\int \frac{1}{b-a} \left(\frac{1}{a-x} - \frac{1}{b-x} \right) dx =$$

$$= \frac{1}{b-a} \left[\int \frac{dx}{a-x} - \int \frac{dx}{b-x} \right] =$$

$$\ln(a-x) = \ln \frac{1}{a-x}$$

$$= \frac{1}{b-a} \left[\ln \frac{1}{a-x} - \ln \frac{1}{b-x} \right] + \text{cte}$$

Entégration

$$\int_0^x \frac{dx}{([A]_0 - x)([B]_0 - x)} = \frac{1}{[B]_0 - [A]_0} \left[\ln \frac{1}{[A]_0 - x} - \ln \frac{1}{[B]_0 - x} \right]_0^x$$

$$= \frac{1}{[B]_0 - [A]_0} \left\{ \left[\ln \frac{1}{[A]_0 - x} - \ln \frac{1}{[B]_0 - x} \right] - \right.$$

$$\left. - \left[\ln \frac{1}{[A]_0} - \ln \frac{1}{[B]_0} \right] \right\} =$$

$$= \frac{1}{[B]_0 - [A]_0} \left[\ln \frac{[A]_0}{[A]_0 - x} - \ln \frac{[B]_0}{[B]_0 - x} \right] =$$

$$\underbrace{[A]_0 - x}_{\rightarrow [A]} \quad \underbrace{[B]_0 - x}_{\rightarrow [B]}$$

$$= \frac{1}{[B]_0 - [A]_0} \left[\ln \frac{[A]_0}{[A]} - \ln \frac{[B]_0}{[B]} \right] =$$

$$= \frac{1}{[B]_0 - [A]_0} \ln \frac{[A]_0/[A]}{[B]_0/[B]}$$

Voltaando

$$\int_0^x \frac{dx}{([A]_0 - x)([B]_0 - x)} = k_r \int_0^t dt$$

$$\frac{1}{[B]_0 - [A]_0} \ln \frac{[A]_0/[A]}{[B]_0/[B]} = k_r t$$

$$\ln \left(\frac{[A]_0/[A]}{[B]_0/[B]} \right) = k_r t ([B]_0 - [A]_0)$$