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Biochemical Reaction Network Model

Recall. $X_i(t)$: # molecules of species i at time t , $i=1, \dots, n$.

$$X(t) = X(0) + SR(t), \quad R_k(t) = N_k \left(\int_0^t \lambda_k(X(s)) ds \right).$$

Examples of $\lambda_k(x)$ - mass action kinetics

1. $A_1 + A_2 \rightarrow A_3$. $\lambda_1(x) = \kappa_1 X_1 X_2$, where κ_1 is called the reaction rate constant.

2. $A_1 + A_1 \rightarrow A_2$. $\lambda_2(x) = \kappa_2 X_1 (X_1 - 1)$.

3. $\nu \rightarrow \nu'$. $\sum_{i=1}^n \nu_i A_i \rightarrow \sum_{i=1}^n \nu'_i A_i$. $\lambda_3(x) = \kappa_3 \prod_{i=1}^n \nu_i! \binom{x_i}{\nu_i}$.

Let V be the volume that molecules are in.



↑

doesn't depend on volume



↑

$\propto \frac{1}{V}$

$$\nu \rightarrow \nu'. \text{ Let } m = \sum_{i=1}^n \nu_i. \quad \lambda_3(x) = \kappa_3 \prod_{i=1}^n \nu_i! \binom{x_i}{\nu_i}$$

↑
 $\propto \frac{1}{V^{m-1}}$

Want to put Avogadro's no. in and get concentration in λ .