- chemical Kinetics deals with the study of reaction rates
- chemical kinetics seeks to answer how fast, how changes in condition affect the reaction, and what pathways the reaction follows (how do we go from reactants to products?)

Rate of a Chemical Reaction

Reaction rate is measured in terms of the changes in concentration of reactants or product per unit of time. For the general reaction $A \rightarrow B$, we measure the concentration of A at t_1 and t_2

- rate = change in concentration/time

- [reactant or product]$_f$ -[reactants or product]$_i$/$t_f - t_1$

- the rate of appearance and disappearance for each reactant and product should be the same if you take the molar ratio into account

By convention, reaction rate is defined as a positive quantity. (rates of disappearance multiplied by -1), and reaction rates are stoichiometry dependent, while rates of appearance/disappearance are stoichiometry independent.

In general, if $aA + bB \rightarrow cC + dD$, then

$$\text{rate } = -\frac{1}{a}\frac{\Delta[A]}{\Delta t} = -\frac{1}{b}\frac{\Delta[B]}{\Delta t} = \frac{1}{c}\frac{\Delta[C]}{\Delta t} = \frac{1}{d}\frac{\Delta[D]}{\Delta t}$$

As we can see the rate of dissapearance above are negative, while the rate of appearance is positive.

The units are in M/s, where M is the molarity (also written as Ms^{-1}).

Consumption, Production
Currently only looking at the rate of the forward reaction even if the reaction is in equilibrium.

Chemical Reaction Rate

- Concentrations of a reactant and product as a function of time for the reaction

There are three rates of chemical reaction

1. Average Rate

- simply the change of concentration over the change of time

2. Instantaneous Rate

- the rate of reaction at any given point instead of the average between two points
- don't need to know how to find the derivative of the function
- as the reaction proceeds, the rate of the reaction slows as more product is formed

3. Initial rate

- the rate at t=0, when no product is present

- initial rate is a type of instantaneous rate

- always has to specify time when talking about the reaction rate