1 | **What are kinetics:**

- how fast a reaction proceeds

2 | **Why care?**

- Real world application: if you want to make a chemical (say some sort of medicine), then you will want to make it faster so you can keep with the demand of the product.

- Kinetics is the study of the speed of reactions, so you can apply it to speeding the production of your medicine

3 | **Basis of kinetics:**

- collision theory

4 | **Collision theory:**

- particles must collide before a reaction can take place

- not all collisions lead to a reaction

- reactants must posses at least a minimun amount of energy - **Activation energy**

- **Steric effect** : particles must approach each other in a certain way

5 | **Qualitative side to kinetics:**

5.1 | **according to collision theory, for a faster recation, you want:**

5.1.1 | **more frequent collisions**

- more speed

- more particles

5.1.2 | **more successful collisions**

- more energy

- lower activation energy

5.2 | **what this looks like**

5.2.1 | **increase the surface area**

- this way more particles are exposed

- powdered solids react faster than larger lumps

5.2.2 | **increase the temperature**

- more kinetic energy to your particles

- this increases the speed of your particles

- this increases frequency of collisions

- the extrac kinetic energy also allows the particles to get over the activation energy thershold

    – Boltzman distribution

5.2.3 | **shine light**

- same as temperature, just a different source of energy

5.2.4 | **add a catalyst**

### 5.2.5 | **increase the pressure of gases**

- when you increase the pressure of the vessel you are essentially decreasing the volume of the vessel

- this means your molecules are going to interact with each other more often

- this will increase the frequency of collisions

5.2.6 | **increase the concentration of reactants**

- you can also increase the amount of the reactants, this leaves a higher chance of collision which will lead to more collisions and thus a faster reaction

6 | **Quantitative side to kinetics:**

6.1 | **rate of a reaction:**
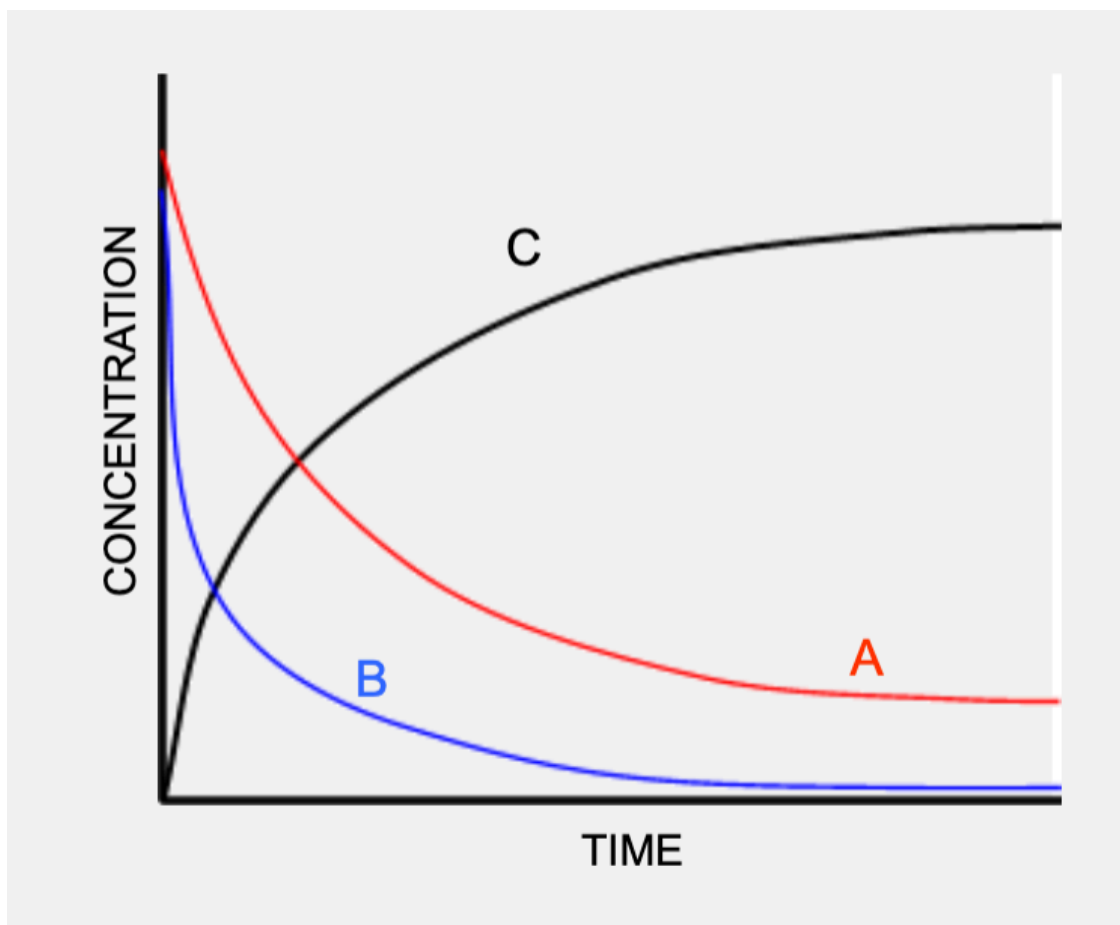
- the reaction starts off fast and then asymptotically gets slower

- this is because as time goes on there will be less and less reactant particals to collide with and keep the reaction going.

- the rate of the reaction would be the derivative of the C curve

- the **initial rate** of a reaction is the slope af the very begining of the curve

6.2 | **The initial reaction rate equation:**

- $r = k[A]^x[B]^y$, where:

  - k is a constant, depends on the reaction
  - [A] is the concentration of A
  - [B] is the concentration of B
  - x is an exponent that change based on the reaction
  - y is an exponent that changes based on the reaction

- unit of the rate of an equation: mol/dm^3/s

6.3 | **Order of a reaction:**

- $x + y$, where x and y are what was from the rate equation

7 | **Given the graph of concentration (of one chemical) vs time:**

- you can look at the shape to get the order of the concentration

- if you have a line (linear) that points downward then you have an order of 0

- if you have a curve, that curves downward you have an order of 1

- if you have a half of a parabola that points upward, then you have an order of 2

8 | **Arrhenius Equation:**

- $k = Ae^{-\frac{E_a}{RT}}$
    - Where k is the rate constant
    - A is pre-expoential factor (frequency collision factor)
    - e is the constant
    - E_a is activation energy
    - R is a constant, 8.31 J/mol
    - T is temperature (in kelvin)