

AP Chemistry
Thou Shalt Not Forget
Credit: Dan Reid

Kinetics

1. In order for a reaction to occur, particles must collide at the correct orientation & with a minimum energy to break bonds...(This minimum energy is called the activation energy...the height of the “hill”.)
2. How to write a rate law for an elementary step... $2A + B \rightarrow C + D$ Rate = $k[A]^2[B]^1$
3. Rate constant (k) Units: 1st order = s^{-1} ; 2nd order = $M^{-1}s^{-1}$
4. Graphs: 1st order is linear for $\ln[A]$ vs time; 2nd order is linear for $1/[A]$ vs time ... Absolute value of the slope = k
5. Ways to speed up a reaction: (1) Add a catalyst...lowers the activation energy (2) Increase reactant concentration...more collisions (3) Increase surface area...more collisions (4) Increase pressure of gases...increases the concentration of the gas, so there are more collisions (5) increase temperature...more collisions AND more of them have the minimum activation energy.
6. $\frac{1}{2}$ life for a 1st order process: $t_{1/2} = 0.693/k$
7. A 1st order reaction has a constant half-life regardless of the initial concentration. (Radioactive decay is a 1st order process.)
8. The taller the “hill” (or activation energy) the slower the reaction.
9. The slow step (rate-determining step) will dictate the speed of the reaction, and this step will determine the rate law.
10. Reaction Mechanisms: Intermediates are produced in one step and used up in a later step.
11. Reaction Mechanisms: Catalysts are used up in one step, and produced in a later step.