Chapter 5

In multistep reactions, there can be a variety of possibilities. The energy of the transition states and intermediates can be different. This will have an impact on the rates of different processes.

In the reaction of A ---> B ---> C described below, the transition state between A and B is higher than the TS between B and C. Therefore, the first will be the slowest step (the highest mountain to climb). We call this the Rate Determining Step.

We can look at the same reaction where the second step is slower than the first (the rate determining step is the transformation of B to C). In more complicated reactions, the reaction diagram can tell you which pathway will predominate in a given sequence.
CHAPTER 6

- **Alkenes** - compounds which contain a double bond - they are industrially important
  - Ethylene (ethene) - 26 million tons/year -- mostly for polyethylene.
  - Propylene (propene) - 14 million tons/year

- Small alkenes are prepared from hydrocarbons - heated to 900 degrees C - hydrocarbons are cracked into small alkenes, hydrogen gas, and methane

- Alkenes are unsaturated - they have less hydrogens than alkanes -- note that cycloalkanes are also unsaturated as you have to lose two hydrogens to form the ring

- **Degree of Unsaturation** - the number of rings and double bonds in a molecule

  The degree of unsaturation can be calculated by subtracting the actual number of H's from the number of H's that would be present if the molecule were completely saturated (2n+2) and this divided by 2. Because halogens (F, Cl, Br, I) in a formula replace one H, they must be added to the number of H's. Likewise, replacement of a H with a Nitrogen would add an additional H, so one must be subtracted for each N (or P, etc). Oxygens do not affect the number of H's, so do not need to be considered.

\[
DU = \frac{\left(\# \text{ of H's if the molecule were completely saturated}\right) - \left(\# \text{ of actual H's}\right)}{2}
\]

\[
DU = \frac{2n+2 - \left(\# \text{ H's} + \# \text{ X's} - \# \text{ N's}\right)}{2}
\]