

Gen-Chem #5: Thermodynamic Escapade

Sup, gang. This is our last gen-chem stop, and then we launch head first into carbon and all of its mysteries. But first things first.

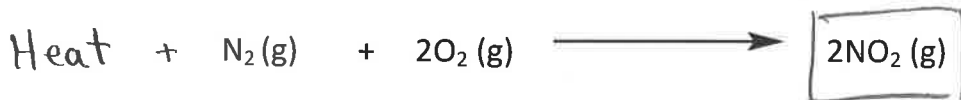
1.) Our first order of business is to tackle Le Chatlier's Principle. Listed below are several balanced chemical equations that are at equilibrium. I will introduce a disruption to the equilibrium, and it's your job to tell me whether the **products** or **reactants** are favored at the new equilibrium.

a.) Increase in pressure

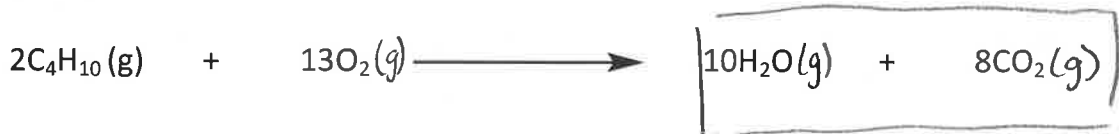
Less moles
of gas



b.) Increase in temperature; $\Delta H_{\text{rxn}} = 20 \text{ J/mol}$



c.) Decrease in pressure

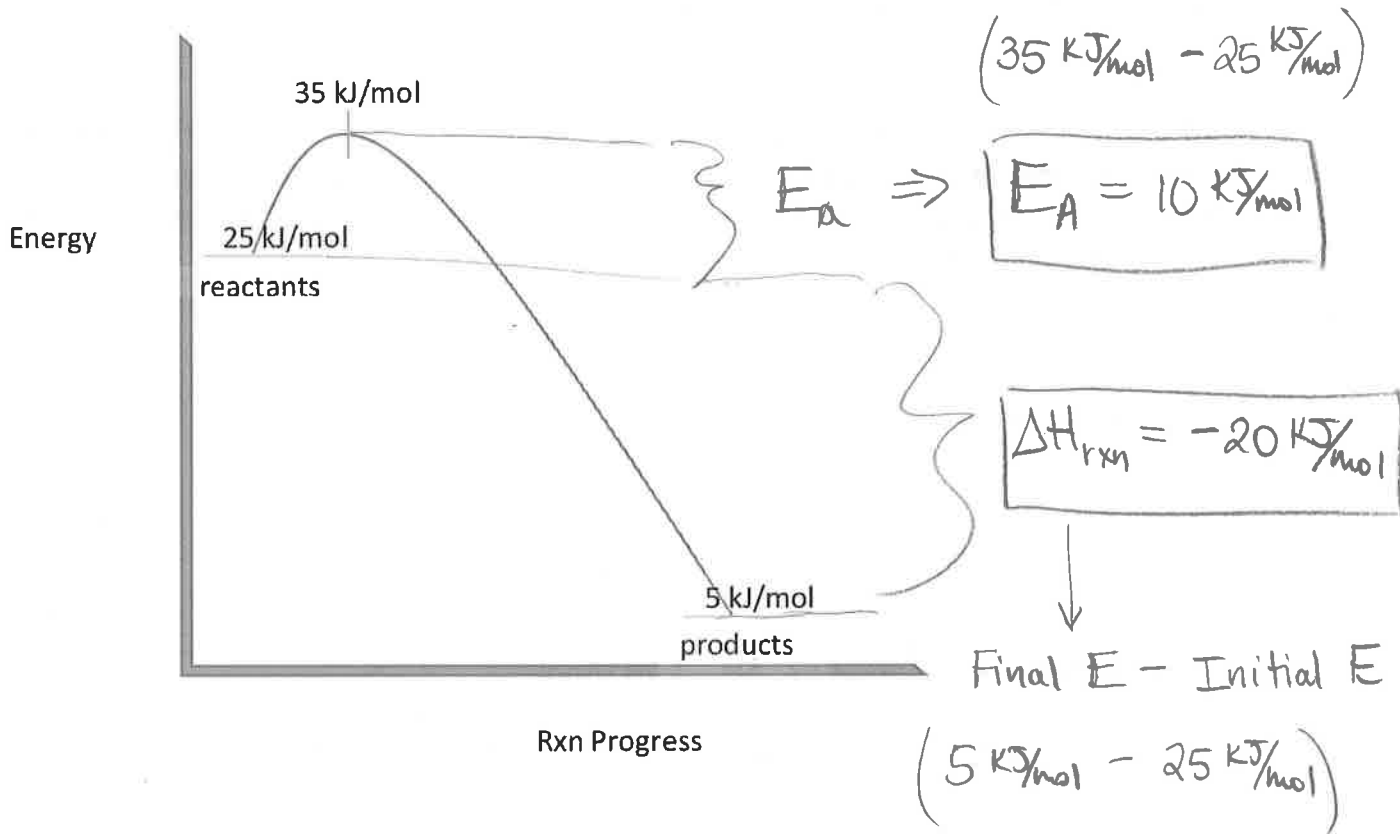


More moles of
gas

d.) Increase in temperature; $\Delta H_{\text{rxn}} = -395 \text{ kJ/mol}$

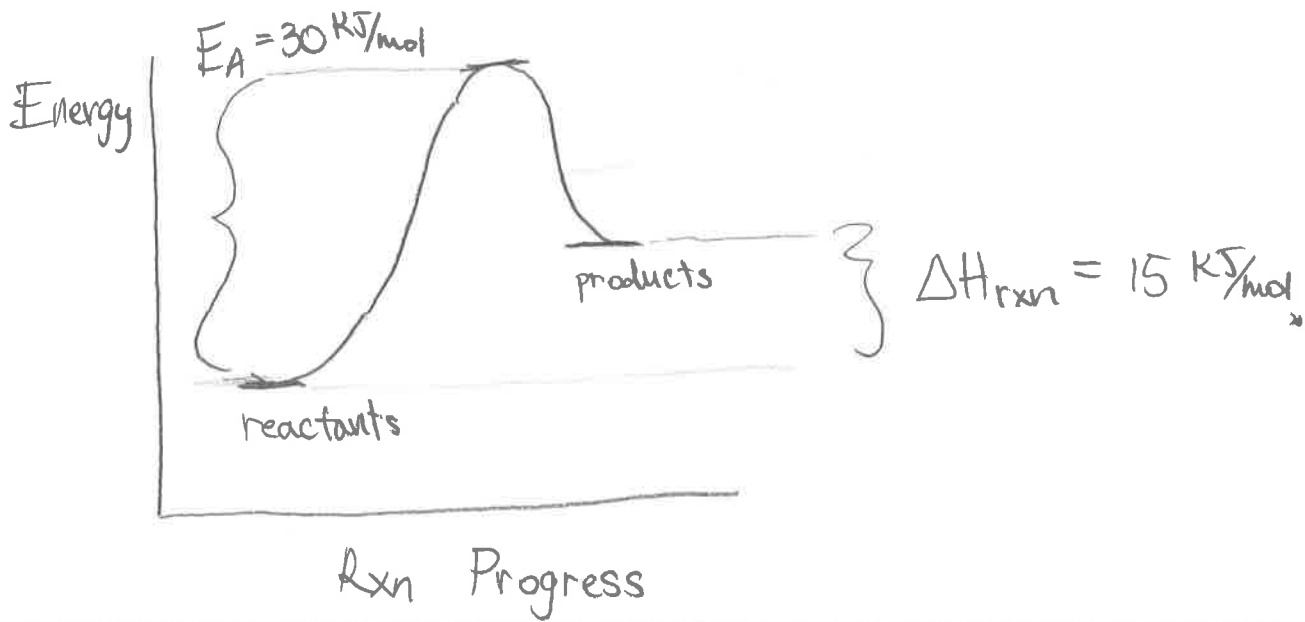


2.) Given the following reaction coordinate below (fancy name for reaction diagram, aka the energy profile for a given reaction as it proceeds), solve for the heat of reaction (ΔH_{rxn}) as well as the activation energy (E_a). You got this!



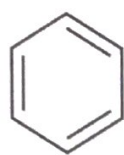
3.) Now for some role reversal: Based on the following thermodynamic information, I want you guys to construct the reaction coordinate.

- $E_a = 30 \text{ kJ/mol}$, $\Delta H_{rxn} = 15 \text{ kJ/mol}$

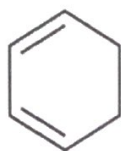


4.) Okay, gang, just to **really** hammer the concept home, remember that nature loves stability. That means that a molecule having LOWER energy means more stability and lower reactivity. On the other hand, a molecule having higher energy means it is more unstable and reactive.

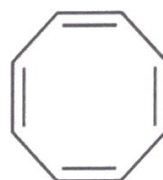
So take a gander below: I've given you three molecules labeled 1-3. Molecule 3 is the most unstable and 1 is the most stable. Sketch a rough E diagram and position the molecules relative to one another based on their stabilities (like we did in the [jOeCHEM video](#)).



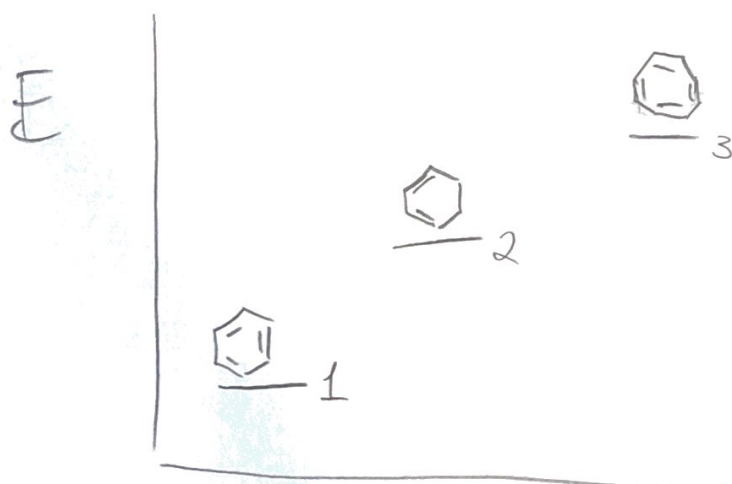
1



2



3



5.) Alright, gang, this one is a bit of a challenge. So, if you don't get this one, do **not** sweat it, but I wanted to give you a harder energy diagram question since they always pop up on exams and should be easy points we snatch up.

On the next page, draw an energy diagram that exhibits the following characteristics:

- The E diagram illustrates an exothermic reaction
- The overall reaction occurs over THREE distinct steps (hint: 3 transition states)
 - The rxn intermediate produced in the 2nd step of the rxn is more unstable than the intermediate produced in the 1st rxn step.
- Please indicate/label (no numbers needed) the overall ΔH_{rxn} , the E_a of the 1st step, the E_a of the 2nd step, and the E_a of the 3rd step.

