Outline for Today
Monday, Oct. 8

- Chapter 5: Thermochemistry
  - State Functions
  - Calculating work from pressure and volume changes
  - Enthalpy of Reactions
  - Calorimetry

Example Problem: Calculating Potential Energy

- Calculate the change in **total energy** of Ginny, my dog (**mass = 27 kg**), if she starts at a **stand-still** at an initial altitude of **100 m**, hikes up Speckled Mountain to an altitude of **880 m**, and **stops** (stands still).

- Assume no change in mass and no change in the gravitational constant.

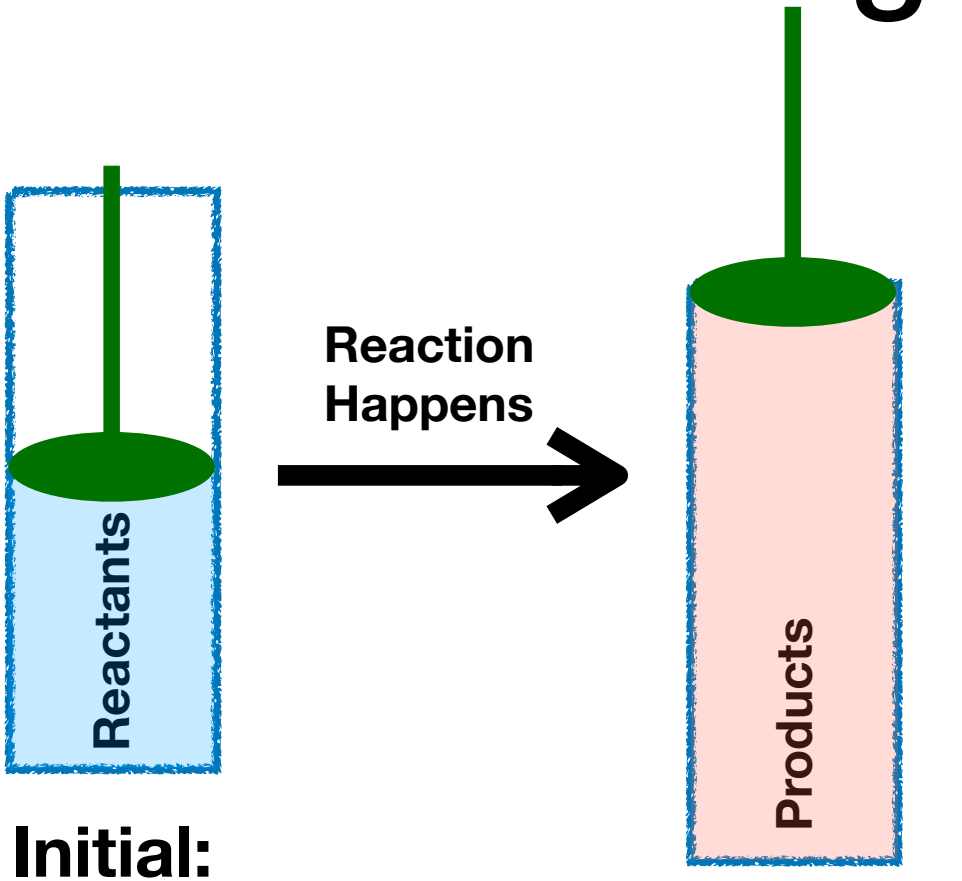
Example Problem: Calculating Potential Energy

- Calculate the change in **total energy** of Ginny, my dog (**mass = 27 kg**), if she takes a *different* trail up Speckled Mountain.

- Path 2: The hike **starts** at an altitude of **100 m**. We hike up to the top of Blueberry Mountain (**altitude= 540 m**), down to a ridge (**altitude= 440 m**), and back up to the top of Speckled Mountain (**final altitude = 880 m**).

- Assume we start and stop our hike at a stand still (no velocity).

Example Problem: Calculating PV Work



Initial:
P=1 atm
V_i=60.0 L

Final:
P=1 atm
V_i=110.0 L

1. How much work was done?

2. What does the sign (positive or negative) tell us about the work performed?

Helpful Conversion Factor:
1 L atm= 101.3 J

Example: Enthalpy of Reactions

- NH_4NO_3 (s) → NH_4NO_3 (aq) ΔH_{rxn}= +25.69 kJ/mol
- If 50.0 g of ammonium nitrate is dissolved in water, is heat released or absorbed? How much?
- If 100. g of ammonium nitrate is dissolved in water, how much head is absorbed?

Example: Combustion of Glucose

- The combustion of glucose ($C_6H_{12}O_6$ (s)) has a ΔH_{rxn} of -2800 kJ/mol. What is the heat of reaction for the following reaction?

- $6CO_2$ (g) + 6 H_2O (l) → $C_6H_{12}O_6$ (s) + 6 O_2 (g)

Example: Why should we specify the states of matter?

- Why are the ΔH_{rxn} different?
- $CH_4\,(g) + 2O_2\,(g) \rightarrow CO_2\,(g) + 2H_2O\,(l)$ ΔH_{rxn}=**-890** kJ/mol
- $CH_4\,(g) + 2O_2\,(g) \rightarrow CO_2\,(g) + 2H_2O\,(g)$ ΔH_{rxn}=**-802** kJ/mol

Example: Constant Pressure Calorimetry

- 0.20 mol of HCl (g) is dissolved into 500. g of water. Assuming no heat is lost to the surroundings, what is the temperature change (C_s=4.184 J/(g K))?

$$HCl(g) \rightarrow HCl(aq) \qquad \Delta H_{rxn} = -17.88 \text{ kJ/mol}$$

Example: Constant Pressure Calorimetry

- How many grams of ammonium nitrate did I dissolve into solution based on the fact that my calorimeter has a mass of **500 g** of water and the change in temperature is **5 K.**

- Assume that the heat capacity of water is approximately equal to the heat capacity of a dilute ammonium nitrate solution.