Chemistry Guided Notes
Unit 5: Thermodynamics and Kinetics

Name: _____
Date: _____ Period: _____

Energy

- ❖ What is Energy?
  - Energy- _____
  - Chemical Potential Energy- _____
    - _____ of atoms
    - _____ of atoms
    - _____ of bonds

- ❖ What is Heat?
  - Heat (q)- _____
  - Heat always flows from a _____ object to a _____ object
    - Warmer object losses energy in the form of heat and its temperature _____
    - Cooler object gains energy in the form of heat and its temperature _____
  - NOT THE SAME AS TEMPERATURE
  - Temperature (T)- _____
  - Measuring Heat: Two Units
    - Calorie (cal)- _____
    - Joule (J)- _____

Thermochemistry and Enthalpy

- ❖ Thermochemistry
  - Thermochemistry- _____
  - Universe= System + Surroundings
    - System- _____
    - Surroundings- _____

- ❖ Enthalpy (H)
  - Enthalpy (H)- _____
  - Enthalpy of a Reaction (ΔH_{rxn})= _____
  - Thermochemical equation are balanced equations that include values for ΔH_{rxn}
    - Endothermic Reactions
      - _____
      - _____
      - _____
    - Exothermic Reactions

- _____
- _____
- _____

❖ Hess's Law

- Hess's Law- states that if you can add two or more thermochemical reaction equations to produce a final equation for the reaction then the sum of the enthalpy changes for the individual reactions is the enthalpy change for the final reaction

- Three Rules:
  - If the reaction must be doubled, _____
  - If the reaction must be reversed, _____
  - Anything on both sides of the final equation can be _____

- Example: Calculate the ΔH for the reaction $2S\ (s) + 3\ O_2 \rightarrow 2SO_3\ (g)$ using the information below.
  a. $2SO_3\ (g) \rightarrow 2SO_2\ (g) + O_2\ (g)$ ΔH= 198 kJ
  b. $S\ (s) + O_2 \rightarrow SO_2\ (g)$ ΔH= -297kJ

  - SO_3 is on the product side of the desired equation so reverse reaction a.

  - The coefficient of the 1st reactant, S (s) is 2 in the desired equation. Therefore, reaction b must be doubled.

  - Add the equations together and cancel anything that occurs on both the reactant and product side.

  - Write the final equation for the reaction including the ΔH value. Box or Circle.

- ❖ Spontaneity
  - Spontaneous Processes- _____
  - Nonspontaneous Processes- _____
- ❖ Entropy (S)
  - Entropy (S)- _____
  - 2nd Law of thermodynamics- _____
- ❖ Gibb's Free Energy (G)
  - Gibb's Free Energy (G)- _____
  - Relates _____ and _____ and can be used to predict reaction spontaneity
  - Formula for Gibb's Free Energy:

    - If ΔG value is negative, _____
    - If ΔG value is positive, _____
  - Spontaneity, Enthalpy, and Entropy

	Exothermic Reaction (-ΔH)	**Endothermic Reaction (+ΔH)**
Increased Entropy (+ΔS)		
Decreased Entropy (-ΔS)		

<u>Specific Heat</u>

- ❖ Specific Heat (c)
  - Specific Heat (c)- _____
  - _____
  - Substances with high specific heat
    - _____
    - _____
    - _____
  - Substances with low specific heat
    - _____
    - _____
    - _____

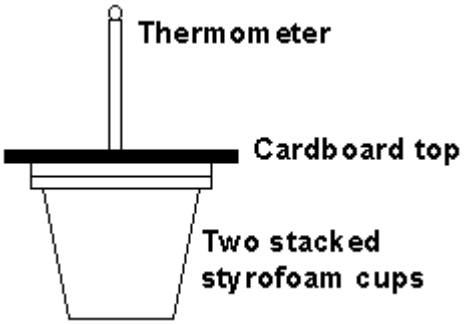
- Formula for Calculating Heat Released or Absorbed:

  - q-_____
    - if the value for q is negative, _____
    - if the value for q is positive, _____
  - m- _____
  - c-_____
  - ΔT- _____

❖ Law of Conservation of Energy

- Law of Conservation of Energy- _____
- 1st Law of Thermodynamics
- Heat lost by the _____ must be absorbed by the _____

- Heat transfer is measured using a device called a calorimeter



❖ Specific Heat Example Problems

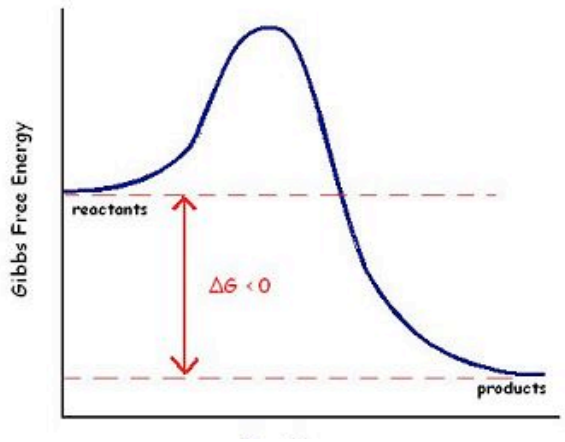
- Example 1: Calculating Heat- If the temperature of 34.4g of ethanol increases from 25.0°C to 78.8°C, how much heat has been absorbed by the ethanol? (The specific heat of ethanol is 2.44J/g°C)

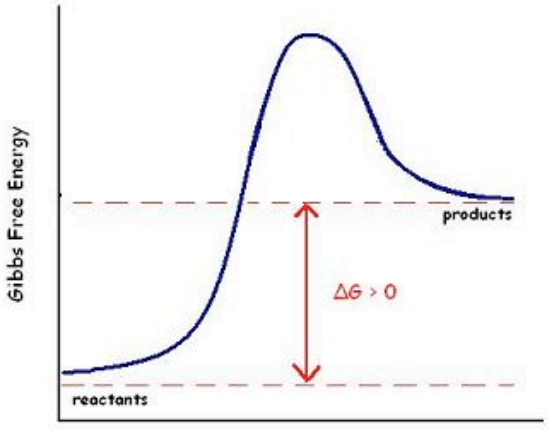
- Example 2: Calculating Temperature- A 4.50g nugget of pure gold absorbed 267J of heat. What was the final temperature of the gold if the initial temperature was 25°C? (The specific heat of gold is 0.129J/g°C.)

- Example 3: Calculating Specific Heat- A 155g sample of an unknown substance was heated from 25.0°C to 40.0°C. In the process, the substance absorbed 5696 J of energy. What is the specific heat of the substance?

Activation Energy and Reaction Rates

❖ Reaction Energy Diagrams





❖ Activation Energy

- Activation Energy (E_A)- _____

_____

- Reaching the activated complex requires _____
- High activation energy correlates to a _____
- Low activation energy correlates to a _____

❖ Factors that Affect Reaction Rates

- Nature of Reactants- _____
- Concentration- _____
- Surface Area- _____
- Temperature- _____

_____

- Catalyst- _____

_____