Chemistry:
Notes: Thermochemistry- Heat and Chemical Change

Energy and Heat:

- Thermochemistry: involves heat changes that occur during a chemical reaction
- Energy is the capacity for doing work or supplying heat. Energy is weightless, odorless and tasteless. Energy is stored stored within the structural units of chemical substances is called *chemical potential energy*.
- *Heat* is energy that transfers from one object to another. This transfer takes place because of the difference in temperature of the two objects. Heat is represented as *q*.
  -heat flows from warmer objects to cooler objects until the temperature of both are equal.

Exothermic and Endothermic Processes

- Both a system and its surroundings make up the *universe*.
- A *system* is the part of the universe on which you focus your attention
- A *surrounding* makes up everything else in the universe
- ***law of conservation of energy:*** in any chemical or physical process, energy is neither created nor destroyed. All of the energy involved in a process can be accounted for as work, stored energy, or heat.
- *Endothermic Processes* take place when a process absorbs heat from its surroundings. *q* has a positive value
- *Exothermic Processes* take place when a process loses heat to its surroundings. *q* has a negative value

Heat Change Sign Convention		
Direction of heat flow	Sign	Reaction type
Heat flows out of the system	Heat change < 0 (negative)	Exothermic
Heat flows into the system	Heat change > 0 (positive)	Endothermic

Heat Capacity and Specific Heat:

- The quantity of heat needed to raise the temperature of 1 g of pure water 1° Celsius is known as a ***c****alorie*
- One dietary **C**alorie is actually equal to one kilocalorie, or 1000 **c**alories
- *Heat Capacity* is the amount of heat needed to increase the temperature of an object 1° Celsius. This is dependent upon mass and chemical composition of an object.
- *Specific heat (specific heat capacity)* of a substance refers to the amount of heat that it takes to raise the temperature of one gram of the substance 1° Celsius
- In order to calculate the specific heat of a substance you divide the heat input by the temperature change times the mass of the substance. See page 297 in your book for the equation.
- Specific heat can be expressed in joules or calories.

Calorimetry:

- *Calorimetry* is the accurate and precise measurement of heat change for chemical and physical processes. Heat released by the system is equal to the heat absorbed by its surroundings
- A *calorimeter* is an insulated device used to measure the absorption or release of heat in chemical or physical processes
- *Enthalpy (H)* is a property of systems at a constant pressure with the same heat content.
- Heat changes for reactions carried out at constant pressure are the same as changes in enthalpy, symbolized as *"delta H"*
- The relationship for the heat change in a chemical reaction carried out in aqueous solutions can be expressed as:

$$q = \text{delta } H = m \times C \times \text{delta } T$$

Enthalpy Sign Convention	
Exothermic Reaction	delta H is negative
Endothermic Reaction	delta H is positive

Thermochemical Equations:

- A *thermochemical equation* includes a heat change
- *Heat of Reaction* is the heat change for the equation exactly as it is written. Heat of reaction is written as Delta H.
- *Heat of Combustion* is the heat of reaction for the complete burning of one mole of a substance.

Heats of Fusion and Solidification:

- *Molar heat of fusion* is the heat absorbed by one mole of a substance in melting from a solid to a liquid at a constant temperature.
- *Molar heat of solidification* is the heat lost when one mole of a liquid solidifies at a constant temperature.
- *Molar heat of vaporization* is the amount of heat necessary to vaporize one mole of given liquid.
- *Molar Heat of Condensation* is the amount of heat released when 1 mol of vapor condenses.

Heat of Solution:

- *Molar heat of solution* is the heat change caused by dissolution of one mole of a substance.