**Unit 8 Reaction Energy Notes**

**Thermochemistry**

-the branch of chemistry that is the study of the energy changes that accompany chemical reactions and physical changes

**Calorimeter**

-a device used to measure the energy as heat absorbed or released in a chemical or physical change

**Temperature**

-a measure of how hot (or cold) something is; specifically, a measure of the average kinetic energy of the particles in an object

**Heat**

**-**the energy transferred between objects that are at different temperatures; energy always moves from higher to lower to temperatures until equilibrium is reached

**Specific Heat**

-the quantity of heat required to raise a unit of mass by one degree

**Calculating Specific Heat:**

Formula: **Q =mc(tf- ti)**

**Q** = heat in Joules (J)-unit for all forms of energy; make Q negative if the energy is being given off or released

**m** = mass in grams (g)

**c** = specific heat in Joules/grams x degrees (J/g˚C)

**tf** = final temperature in Celsius or Kelvin (C or K)

**ti** = initial temperature in Celsius or Kelvin (C or K)

**Example**: It takes 487.5J to heat 25 grams of copper from 25˚C to 75˚C. What is the specific heat?



**Enthalpy Change**

-the amount of energy absorbed by the system

**Enthalpy of Reaction**

-the energy transferred as heat during a chemical reaction

**Calculating Enthalpy Change (∆H)**

**Steps**:

1. Make sure the equation is balanced.

CH4(g) + 2O2(g) 🡪 CO2(g) + 2H2O(l)

2. Look at chart for enthalpies (given) and determine each enthalpy for each compound. Pay attention to liquid, solid or gas.

3. If there is a coefficient, multiply it to the enthalpy as well.

4. Add up reactants.

5. Add up products.

CH4(g) + 2O2(g) 🡪 CO2(g) + 2H2O(l)

Reactants Products

6. Calculate the ∆H = Hproducts - Hreactants

7. If the answer is negative, call it exothermic.

8. If the answer is positive, call it endothermic.

**Thermochemical Equation**

-an equation that includes the quantity of energy released or absorbed as heat during the reaction

-ex: 2H2(g) + O2(g) 🡪 2H2O(g) + 483.6 kJ

-coefficients equal the number of moles and never molecules, that’s why you can have fractions

-physical states are important

**Hess’s Law**

-the overall enthalpy change in a reaction is equal to the sum of the enthalpy changes for the individual steps in the process

**Example #1**

Given: ½ N2(g) + ½ O2(g) 🡪 NO(g) ∆Hf = +90.29 kJ

½ N2(g) + O2(g) 🡪 NO2(g) ∆Hf = +33.2 kJ

Unknown: NO(g) + ½ O2(g) 🡪 NO2(g) ∆H?

**Example #2**

Given:

C(s) + O2(g) 🡪 CO2(g) ∆H = -393.5 kJ

H2(g) + ½ O2(g) 🡪 H2O (l) ∆H = -285.8 kJ

CH4(g) + 2O2(g) 🡪 CO2(g) + 2H2O(l) ∆H = -890.8 kJ

Unknown:

C(s) + 2H2(g) 🡪 CH4(g) ∆H?

**Example #3**

Given:

C(s) + O2(g) 🡪 CO2(g)  ∆H = -393.5 kJ

CO(g) + ½ O2(g) 🡪 CO2(g) ∆H = -283.0 kJ

Unknown:

C(s) +½ O2(g) 🡪 CO(g) ∆H?