 Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Hour: \_\_\_\_\_\_

**Lab #26: Endo/Exo Reactions**

**Part 1: Pre-Lab**

Practically all chemical reactions either release or absorb energy, often in the form of heat. This is called Thermodynamics. Heat can be measured in a wide variety of units and is based on the equation below.

In science, we most commonly use the unit of heat known as the joule (J) which we have used in the past. A British thermal unit (BTU) is the amount of heat required to raise the temperature of 1lb. of water by 1°F. This is what grills, ovens, and the furnace in your house measure in. Similarly, the calorie is the amount of heat required to raise the temperature of 1g of water by 1°C. This information is used to calculate Calories in food!

One of the important techniques which you will study in this experiment is known as calorimetry. A calorimeter is an insulated device used to measure changes in heat within a system. It must be well insulated from the surroundings so that the heat changes for the reaction occurring within the system may be measured quantitatively. Today we will use the thermal energy equation and our knowledge of moles to find out how much energy a solution will release or absorb when mixed!

**Part 2: Pre-Lab Questions**

1. What are 3 different energy units used in the world today?
2. Which unit of energy impacts your life the most and why?
3. What is a calorimeter and what will you be using today as your calorimeter?
4. You run a reaction and the energy produced raised the temperature of 300.4g of water from 45.3°C to 64.2°C. Using the specific heat of water in the reading above what is the amount of energy the water absorbed from the reaction?

**Part 3: Data Collection**

**Reaction 1:**

1. Measure 25grams of HCl. Record the temperature.

2. Measure 2 grams of NaOH pellets.

3. In the foam calorimeter, mix the HCl and NaOH. Record the highest or lowest temperature the mixture reaches.

|  |  |
| --- | --- |
| Mass of HCl |  |
| Mass of NaOH pellets (grams) |  |
| Temperature of HCl (initial temperature) |  |
| Highest Temperature of Solution (final temperature) |  |
| ΔT for reaction |  |

**Reaction 2:**

1. Measure 25grams of water. Record the temperature.

2. Measure 2 grams of CaCl2 pellets.

3. In the foam calorimeter, mix the Water and CaCl2. Record the highest or lowest temperature the mixture reaches.

|  |  |
| --- | --- |
| Mass of H2O |  |
| Mass of CaCl2 **pellets** used (grams) |  |
| Temperature of H2O (initial temperature) |  |
| Highest Temperature of Solution (final temperature) |  |
| ΔT for reaction |  |

**Reaction 3:**

1. Measure 25grams of HCl. Record the temperature.

2. Measure 2 grams of NaHCO3

3. In the foam calorimeter, mix the Water and NaHCO3. Record the highest or lowest temperature the mixture reaches.

|  |  |
| --- | --- |
| Mass of HCl |  |
| Mass of NaHCO3 used (grams) |  |
| Temperature of HCl (initial temperature) |  |
| Lowest Temperature of Solution (final temperature) |  |
| ΔT for reaction |  |

**Part 4: Calculations**

1. Find the energy in joules for each liquid. You should assume that all of the HCl and water have a specific heat of 4.18J/g°C. Find the heat energy of each reaction below. SHOW ALL WORK

* 1. Reaction 1:
  2. Reaction 2:
  3. Reaction 3:

1. All of your answers for number 2 should be in joules. Knowing that 1000J = 1kJ, convert each of your values to Kilojoules.

SHOW WORK!

* 1. Reaction 1:
  2. Reaction 2:
  3. Reaction 3:

1. Calculate how many **moles** of solid you used in each reaction. SHOW WORK
   1. Reaction 1:
   2. Reaction 2:
   3. Reaction 3:
2. Calculate kJ/mole of solid. Show your work!
   1. Reaction 1:
   2. Reaction 2:
   3. Reaction 3:

**Part 5: Post Lab Questions:**

1. Which of the three reactions had the most energy transferred? Why?
2. Were these reactions endothermic or exothermic and how do you know? Draw an energy graph that represents these reactions.
3. What were the signs that indicated these were chemical reactions?