Name _____ Date _____ Period _____

Specific Heat Activity
How many calories are in your favorite snack food?

Purpose: To build a calorimeter and to determine the amount of energy contained within a kernel of popcorn and a single peanut.

Materials:
- aluminum beverage can (calorimeter)
- thermometer
- 100 mL graduated cylinder
- aluminum foil squares
- paper clips
- matches
- ring stand
- ring clamp
- popcorn, peanuts, etc.

Background Information:
1. What is the unit of measurement for heat energy?

2. Which unit do we use to measure the amount of energy in food?

3. The density of pure water is 1 g/mL. Determine the mass of 50 mL of pure water.

4. What does Δ mean?

5. What does the prefix kilo- mean?

Scientists can determine the calorie content of food by burning a measured quantity of food in a container surrounded by water and then by measuring the temperature increase in the water. The container in which the calorie determination is done is called a calorimeter. The amount of heat required to raise the temperature of 1 gram of water by 1 °C is a calorie.

Measuring Heat Energy
$Q = m \times c_p \times \Delta T$

for water,
1.0 calorie
1 gram x 1 °C

Procedure:

1. Build your calorimeter. Draw a picture of what your calorimeter looks like.

2. Measure 50 mL of water using a graduated cylinder. Carefully pour this water into your calorimeter.
3. Remember, the density of water is 1 g/mL. Record the mass of the water in the data table.
4. Carefully measure the temperature of the water in the can (oops, calorimeter) by suspending the thermometer in the water. Record this as the initial water temperature in the data table.
5. Place a square of aluminum foil underneath the calorimeter to catch any burning particles.
6. Select a piece of popcorn and spear it securely on a straightened paper clip. Be careful not to break the popcorn apart.
7. Using a match, carefully light the popcorn piece and place it directly under the calorimeter immediately and hold it there until it is completely burned.
8. Watch the temperature carefully. Record the highest temperature as the final temperature of the water.
9. Calculate the # of calories in your piece of popcorn. Record this value in the data table.
10. Repeat steps 6-9 with a second piece of popcorn. Record your information in the data table.
11. Repeat steps 6-10 with a peanut.

Data Table:

Substance	**Mass of H_2O (g)**	**Initial H_2O temperature (°C)**	**Final H_2O temperature (°C)**	**Δ T**	**Calories**

Questions:

1. What is a calorie?

2. Since the number of calories in food is quite large, nutrition labels report the number of kilocalories in food. How many calories are in a kilocalorie?

3. What is the your average number of calories emitted from one piece of popcorn? Show your work below.

4. What is your average number of calories emitted from a (whole) peanut? Show your work below.

5. According to your data, how many calories are contained in 35 pieces of popcorn?

6. According to your data, how many calories are contained in 35 peanuts?

7. How many kilocalories are in 2,800 calories?

8. Suppose that a slice of bread, when burned raised the temperature of 1000 g of water from 20 °C to 80 °C. How many calories of heat are in the slice of bread? Show your work below.

9. Suppose that we have a thimble and a bucket, both of which are filled with boiling water at 100 °C. Which one is the hottest? Explain your answer.

10. Which of the two objects described in #9 has the most heat energy? Justify your answer.