Pre-Lab Assignment -20pts

Directions:

- **Read entire lab before you begin Pre-Lab assignment**
- **Create data table for the teacher approval checkpoints. (example below)**

Sample Data Table for Teacher approvals

Teacher Signature Sheet for ...Amazing CheezePuff

Approval Number	Description of Approval & Section	Teacher Signature
---	pre	
3	calorimeter sketch/procedure	

(this is a partial table...you must READ through the lab and determine all the sign-offs)

The second page begins the Pre-lab: Follow the steps below and label each Heading of the pre-lab

Title of lab **and unit (Thermal Energy)**

- **Definitions: "Define" the following terms: energy, thermal energy, specific heat,**
- **Write the equation for specific heat**
- **Read through entire the lab and list the "key points" as related to data collecting**
- **Purpose: In a sentence, write the purpose of the lab.**
- **Procedure: In a numbered list write what you will be doing.**
- **Preliminary Questions: Write and answer all preliminary questions.**
- **Create as data table (in your your lab notebook) based on the data you are collecting .**
- **Have your teacher initial your pre-lab before you begin the lab.**

The Amazing Flaming CheezePuff

INTRODUCTION:

In order to change the temperature of something there must be a transfer of energy. To heat up you must add energy, and to cool down you must remove energy. In this activity we will explore the addition of energy to water, which has a **specific heat capacity of 4.184 J/(g•°C).** The energy source will be an ordinary cheezePuff. Yes, a cheezePuff. Think about it, we eat food to get energy and if we feel we are eating too much food we start counting Calories. Calories are simply a measure of energy contained in food. One food Calorie (Cal) is equal to 1000 calories (cal). The main reason we are using a cheezePuff is the air flow through the cheezePuff structure. This allows the cheezePuff to burn almost completely and quickly. The apparatus used to determine the energy content of food is known as a calorimeter. This device simply burns the food and measures the resulting temperature change of a sample of water. This information is used with the heat equation:

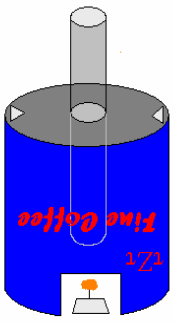
$$\mathbf{Q = m \cdot c_p \cdot \Delta T}$$

Q = Δ (Thermal Energy) ≡ "heat" m = mass c_p = specific heat capacity T = temperature

You will be using a highly simplified and *inefficient* calorimeter so that we can explore the flow of the thermal energy.

Preliminary Questions:

1. How many flaming cheezePuffs do you think it would take to boil 1 cup (255 mL) of water. The water originally is at "room" temperature, 20 °C.
2. What do you think is the source of the input energy?
3. Where do you think the energy from the cheezePuff will go?
4. How efficient (%) do you think the calorimeter is?



Available Materials (***Get only the materials you need as you follow the procedure***):

- *coffee can
- *large test tube
- *food holder (cork and T-pin)
- 1 graduated cylinder
- water ***(D = 1 g/mL)***
- 1 cheezePuff
- triple beam balance
- 1 temperature probe & computer or thermometer
- match(es)

PROCEDURE:

1. Set up a data sheet to **record all data**. (You must read the entire procedure first to do this!)
2. Collect all *materials. Use the example provided by your teacher to set-up your calorimeter.
3. Sketch the calorimeter setup in your lab notebook.

Have your teacher approve your data sheet and calorimeter before continuing.

4. Collect all ✓ materials. Use the graduated cylinder to get about 20 mL of water.

5. Record the actual **volume of the water** to the **nearest 0.1 mL**

6. Pour the water into the test tube.

7. Place the cheezePuff on the food holder.

8. Mass the cheezePuff and holder together using the balance. Record this as the **initial mass of cheezePuff**.

9. Place the thermometer in the water. Measure the temperature of the water to the **nearest 0.1 ^{o}C**. Record this value as the **initial temperature of the water**. **Do not remove the thermometer until step #11.**

Have your teacher approve your data before continuing.

10. Place the cheezePuff/holder about 2 cm directly below the test tube. One group member should lift the coffee can. Another member should ignite the cheezePuff. As soon as the cheezePuff is ablaze on its own, place the can back over the flaming cheezePuff with the test tube directly over the flame. Pay attention to the test tube, the heat may cause it to slip down.

11. After the cheezePuff burns completely, (**Do not remove the can yet)** watch the thermometer and record the highest temperature reached. Record this maximum value as the **final temperature of the water**.

12. Determine the mass of the scorched cheezePuff and food holder together. Record this as the **final mass of cheezePuff.** Be careful not to lose any crumbs.

Have your teacher approve your data before beginning the analysis.

ANALYSIS: Show **K-U-E-S** where "***calculate***" is required.

1. ***Calculate*** the change in temperature of the water.

2. ***Calculate*** the mass of the water. Use the density of water to do this.

3. Identify the specific heat capacity of water?

4. ***Calculate*** the amount of thermal energy (TE) gained by the water. Steps 1-3 provide the **K**nowns

Have your teacher approve your calculations.

5. Describe where you think all of the energy released by the cheezePuff went?

6. Add arrows to your individual sketch of the calorimeter to show the flow of thermal energy during the burning of the cheezePuff.

7. ***Calculate*** the mass of the cheezePuff that was actually burned.

Have your teacher approve.

8. Use the actual value of energy per gram contained in cheezePuffs to ***calculate*** the amount of

energy that was theoretically contained in the cheezePuff mass you burned. *Your teacher should have the actual value for your cheezePuffs.*

Have your teacher approve your calculation.

9. ***Calculate*** the amount of thermal energy that **did not** flow from the cheezePuff into the water.

Have your teacher approve your calculation.

10. ***Calculate*** the efficiency of the coffee can calorimeter.

Have your teacher approve your calculations.

11. What do you think could be done to improve the efficiency of the coffee can calorimeter?

<u>Individual Report</u> (25 pts) to be done on your own time & on a separate sheet of paper!

DUE: Wednesday, November 12 with your lab notebook.

<u>Cover Sheet</u>

Title, your name, lab partners, date, class period

<u>Conclusion</u>

Now that you have completed the lab procedure,

- **Restate** the purpose of the lab.
- **<u>Re-answer</u>** all **four** of the preliminary questions in complete sentences and show K-U-E-S where necessary. Be sure to include your original response and explain why you were right or how you changed your thinking if you were wrong. Include data from lab for support.
- In this lab we used a calorimeter to burn (oxidize) the food, but living things don't use fire to oxidize food. What process do living things use to get the energy out of food? Where does this process occur?
- 50.0g of H_2O initially at 22.4°C was poured into a test tube and placed in the hole of a calorimeter. The initial mass of the marshmallow was 7.2g. The marshmallow was placed under the test tube containing the HO and burnt. The final temperature of the H_2O was 30.5 °C and the final mass of the marshmallow was 6.5g.

  1. Calculate the thermal energy gained by the H_2O from the burning marshmallow. The specific heat of H_2O is 4.184 J / g °C
  2. Find the mass of the marshmallow that was actually burnt.
  3. Using the actual calories per gram in a serving of marshmallows (90 kCal/28g), calculate amount of calories contained in the marshmallow mass that was burned.
  4. Convert your answer in #3 to cal using the conversion factor **1kCal = 1000 cal**
  5. Convert your answer in #4 to J using the conversion factor **1cal = 4.184 J**

- What new skills were introduced in this lab?
- **<u>Identify</u>** possible sources of error or factors influencing the lab, including equipment and student technique.

<u>Group Participation (15 pts)</u>

Group participation (ability to work as a group member Including working & staying on task in group, using lab time wisely, keeping work station clean & proper use & care of equipment

Lab Notebook Scoring (50 pts)
pre-lab---------- -- 20 pts
sketch approval #3 -- 3 pt
initial data approval #9 -- 6 pts
final data approval #14 – 6 pts
A#4 approval -- 7 pts
A#7 approval -- 6 pts
A#8 approval -- 3 pts
A#9 approval -- 3 pts
A#10 approval -- 3 pts
A#11 -- 3 pts