Mr. Ulrich
Regents Biology

Name:……..……...Block:……...

Lab#:……...

Death of a Peanut

A Laboratory Experiment

Problem: How many calories per gram does the average peanut contain?

Background Information:

Would you believe that a single peanut contains enough energy to allow a 65–kg person to bicycle for two minutes? Or that the same peanut will burn two minutes after being ignited by an ordinary match? In this experiment you will determine just how much energy is in a single peanut using a simple calorimeter.

There is energy involved in the bonds holding atoms together into molecules. Often (but not always) when the atoms in a molecule are forced apart, the energy in the bonds is released to do other things such as send the atoms banging into other particles (heat) or released as radiation (light, etc.). Fat and gasoline are examples of molecules that release energy when broken down.

Oxygen is a molecule involved in some chemical reactions that break up these large molecules, releasing energy. We call this combustion or burning if it happens quickly. In your cells, the burning is much slower, and energy is released more slowly, but oxygen is still needed. We call this "slow burning" **cellular respiration.**

Calories are the units we measure energy in just like meters are the units for distance. When we talk about food having 100 calories, we are talking about how much energy is stored in the food. You need a certain number of calories each day to run all the processes in your body. Fats contain the most energy; hence they are highest in calories. **One calorie is the energy needed to raise 1 g of water 1 degree Celsius.** We will use a water to trap the heat of burning food in water.

IMPORTANT FORMULAE

Calculate the number of **calories** using the following formula:

Number of calories = # of degrees the temperature rose X weight of water

Calculate the number of **calories per gram** using the following formula:

Number of calories per gram = # of calories/weight of food burned

Pre-lab Questions: Please, answer the following in complete sentences

1. How many calories would you guess are in a peanut?

2. Why does a candle go out when a jar is placed over it?

3. Why do we breathe oxygen?

Procedure:

What you'll need:

- Nasty, carbonized beaker
- Beaker tongs
- Paper clip
- Mr. Ulrich to provide you with matches
- A peanut
- Celsius thermometer
- Stirring rod

How you'll do it (Use the data table provided to organize your data.):

1. Determine and record the weight of the paper clip (in grams)
2. Bend the paper clip into a "peanut stand".
3. Mercilessly (but carefully) impale the one cotyledon (half) of the sacrificial peanut on the peanut stand so that it is suspended over the lab table.
4. Determine and record the weight of the sacrificial peanut and the paperclip. (Use this data to determine the weight of the sacrificial peanut alone.)
5. Determine and record the mass of the nasty, carbonized beaker. Don't touch the outside. Its nasty!
6. Measure 50 mL of H_2O into the nasty, carbonized beaker using a graduated cylinder.
7. Determine and record the mass of the nasty, carbonized beaker with the 50 mL of H_2O. (Use this data to determine the weight of the H_2O alone.)
8. Determine and record the initial temperature of the water in degrees Celsius. ***Take the thermometer out of the beaker!***
9. **Put on your safety glasses!**
10. Choose one partner to be *The Executioner*. This person's job is to safely ignite the sacrificial peanut. This person may also wish to thank the sacrificial peanut for offering up its body for the furthering of scientific knowledge.
11. The other partner will be the *Grand Collector Of Released Energy* or G-CORE for short. This person's job is to use the beaker tongs to hold the nasty, carbonized beaker of water over the peanut once it has been ignited. The G-CORE's job is not over until the peanut has completely burned and all of the energy available for combustion in the peanut has been released and absorbed by the water (as well as some other things perhaps!) in the form of light and heat.
12. Give the heated water a quick stir with the stirring rod and determine and record the final temperature of the water in degrees Celsius.
13. Use all of your recorded data to determine and report the number of calories in your sacrificial peanut as well as the calories **per gram** of peanut. Use the important formulae from the first page.
14. Get data from two other groups and determine average calories per **half** a peanut as well as calories **per gram** of peanut.

Did *YOU* remember to use the data table and the formulae?

Data:

Peanut #	Weight of paperclip (g)	Weight of paperclip + peanut (g)	Weight of peanut (g)	Weight of empty beaker (g)	Weight of beaker + H_2O (g)	Weight of H_2O (g)	Initial H_2O temp (^oC)	Final H_2O temp (^oC)	Temp change (^oC)	**calories in peanut** (cal)	**Calories per gram of peanut** (cal)
1 group:											
2 group:											
3 group:											

Average calories in a peanut = _____

Average calories per gram of peanut = _____

Analysis: Please, answer the following in complete sentences **on a separate sheet of paper!!**

1. How close was your prediction of the peanut's caloric content to your determined value?

If your determined caloric content was way off, that's OK. What you think of as a calorie and what dieticians at the USDA report on food labels are actually *kilo*calories. Remember, the prefix kilo means 1000. This means:

1 kilocalorie (Kcal or Cal) = 1000 calories (cal)
or
1 dietary Calorie = 1000 chemical calorie

2. Notice how dietary Calories are written with a capitol "C" and chemical calories with a lower-case "c". How many dietary Calories did you determine to be in the average peanut? Now compare this to your initial prediction. Closer?

3. Was *all* of the energy contained in the peanut released? What evidence do you have that combustion was incomplete?

4. Was the G-CORE able to collect *all* of the energy released from the peanut? Identify at least three different things also absorbed the heat released?

5. Write a definition for cellular respiration.

More on the back!

6. Observe someone in your lab group. What can you observe that proves that cellular respiration is occurring in them?

7. Mr. Guggenheim wants to find the best wood to burn to heat his home. Describe how you could use the calorimeter you used in this lab to help him solve his problem.

8. *Optional:* Since you don't need all this energy right away, how does your body store the energy for later use? (Use the book to try to track down the answer.)

Conclusion:

Your conclusion can be written on the same sheet as your analysis answers. It must be written in paragraph form using complete sentences, make sense and, most importantly, represent your own efforts.

In your conclusion, you should briefly summarize the problem and what you did. Then answer the problem referring to the data. Also, include three things you learned from this lab.