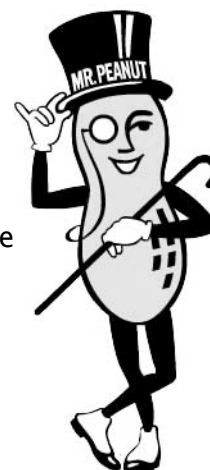


How Much Energy is in a Nut?

Introduction

We can use a lab technique called “calorimetry” to test the amount of chemical energy contained in food samples by burning them underneath a sample of water. Since one Calorie of energy will raise the temperature of one Liter of water by one degree Celsius, we can easily measure both the mass of the food sample and the temperature change of the water to calculate how much energy has been released.



Materials

cashews
matches
paper clips

tap water
wooden splints

Equipment

beaker (400-mL)
Erlenmeyer flask (125-mL)
graduated cylinder (100-mL)
ring stand

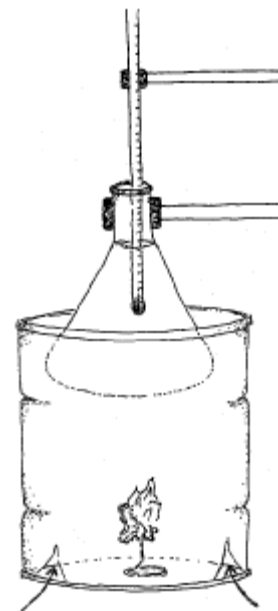
rubber stopper, 1-hole
thermometer
tin can
utility clamp

Safety Considerations

- Be careful not to burn yourself with the open flame, hot water, or any hot equipment.
- Sometimes chemicals from previous labs still remain in glassware and on other lab equipment; wash all lab equipment before and after performing this lab.
- Wash your hands thoroughly after completing this lab.

Procedure

1. Prepare a waste beaker by filling a 400-mL beaker halfway full of tap water.
2. Connect a utility clamp to a ring stand, and connect the ring stand to the lab station.
3. Place the Erlenmeyer flask in the utility clamp on a ring stand.
4. Place an empty tin can on the lab station under the flask. Leave some space between the can and the flask so you don't accidentally heat the water with the wooden splint.
5. Using a graduated cylinder, fill a 125-mL Erlenmeyer flask with exactly 100.0 mL of tap water. Place a 1-hole rubber stopper in the opening of the flask - make sure you use a stopper number that matches the number on your flask!
6. Place the thermometer in the flask through the hole in the rubber stopper. Record the temperature of the water to the nearest 0.1 °C in the data table.
7. Obtain a cashew piece. Determine and record its mass in the data table.
8. Create a food stand out of a paper clip by bending it into shape. Spear the cashew onto the paper clip and carefully place it at the bottom of the can.



9. Use a match to light a wooden splint. Then, use the lit wooden splint to light the cashew. Once the cashew is burning on its own, quickly move the flask down to completely cover the opening of the tin can.
10. Allow the cashew to heat the water until it stops burning. Record the maximum temperature of the water in your data table.
11. Once your cashew has completely burned out, carefully place it in the waste beaker to soak it before placing it in the trash.
12. Place your used wooden splint in the waste beaker.
13. Dump the water in the flask and repeat Procedure steps #5-12 for at least two additional cashew pieces.

Clean-up

1. Empty the solids from your waste beaker in the trash and dump the tap water in the sink.
2. Return all used equipment and materials to the supplies table.
3. Wipe down your lab area.
4. Dispose of any weigh paper, paper towels or matches in the trash can.
5. Wash your hands before leaving the lab.

Data Table

	Trial 1	Trial 2	Trial 3
Mass of cashew piece			
Starting temperature (°C)			
Final temperature (°C)			
Temperature difference (°C)			
Calories in cashew piece (multiply previous row by 10)			
Calories per gram of cashew (divide previous row by mass)			

Questions

1. What difference is there between the Calories per gram you measured in your cashew and the Calories per gram listed on the label? Why do you think this is?

2. Fats produce nine Calories per gram when burned, while carbohydrates and proteins only produce four Calories per gram. What results would you expect if we performed this lab with a marshmallow, which is mostly made of sugars? Explain.

3. List four other types of food you could test using this method.

4. What are two sources of error in this lab?

5. List one way you could change this lab and describe how your results might be different.
