Peanut Energy

Student Worksheet

Name_____

Overview: Here's another chance to burn something in order to discover something about chemistry! Today you'll burn a peanut to find how much energy is stored in one of those little, tasty morsels.

What to Learn: You will need to know that by burning the peanut you are releasing energy, which can be measured in Calories.

Materials

- raw peanuts (not roasted or salted)
- chemistry stand with glass test tube and holder (watch video)
- flameproof surface (large ceramic tile or cookie sheet)
- paper clip
- alcohol burner or candle with adult help
- fire extinguisher

Lab Time

1. Set up a chemistry stand as directed by your teacher. It should include the following:
    a. Glass test tube with water in it and tilted 30-40° (This is important to allow the gas to escape while keeping the liquid in the test tube). If you are calculating the energy released by the peanut, make sure to measure the mass of the water in the test tube, and find the temperature of the water before the peanut is burned.
    b. Underneath test tube, attach peanut. It may be skewered with a paper clip and the paper clip taped to a test tube clamp, which is then clamped onto the stand (The peanut needs to be free to burn 1-2 cm below the tilted test tube).
2. Use a burner to light peanut on fire. Observe flame. The water in the test tube should begin to boil. If the flame is too large, it may need to be moved in order to prevent the test tube from cracking. You should notice black soot forming on the test tube.
3. When peanut is done burning, let it cool for 5 minutes. Measure the mass of water remaining in the test tube. To dispose, throw away peanut and dump water down the sink. The black material on the test tube is soot, so wash your hands thoroughly if you touch it.

Peanut Energy Data Table

	Before Burning Peanut	After Burning Peanut
Mass of water in test tube		
Temperature of water		

Exercises Answer the questions below:

1. What happened to the energy of the peanut when it burned?

2. What happens in our bodies when we eat a peanut?

3. Not all of the energy from the peanut went into the water. Some escaped as light, and some out of the bottom and sides. What could you do in order to increase the efficiency of this experiment?

4. Use the following equation to calculate the heat flow due to the temperature increase of the water: Q = m c T, where Q is the heat flow (in calories), m is the mass of the water you started with (in grams,) c is the specific heat of water (which is 1 degree per calorie per gram), and T is the temperature change (in degrees Celsius).

5. Use the following equation to calculate the heat energy that was boiled off as water vapor, or steam: Q = L m, where Q is the heat flow (in calories), L is the latent heat of vaporization of water (L= 540 calories per gram), and m is the mass of the water (in grams).

6. Combine the results of the two heat equations to determine the total energy burned by your peanut.

Exercises

1. What happened to the energy of the peanut when it burned? (The energy of the peanut was released.)
2. What happens in our bodies when we eat a peanut? (The same thing…the energy of the peanut gets released into our body.)
3. Not all of the energy from the peanut went into the water. Some escaped as light, and some out of the bottom and sides. What could you do in order to increase the efficiency of this experiment? (Answers will vary but could include doing the experiment in a very closed container or shielding the test tube and peanut so more of the energy is directed straight into the test tube.)
4. Use the following equation to calculate the heat flow due to the temperature increase of the water: Q = m c T, where Q is the heat flow (in calories), m is the mass of the water you started with (in grams,) c is the specific heat of water (which is 1 degree per calorie per gram), and T is the temperature change (in degrees Celsius). (Answers will vary.)
5. Use the following equation to calculate the heat energy that was boiled off as water vapor, or steam: Q = L m, where Q is the heat flow (in calories), L is the latent heat of vaporization of water (L= 540 calories per gram), and m is the mass of the water (in grams). (Answers will vary.)
6. Combine the results of the two heat equations to determine the total energy burned by your peanut. (Answers will vary.)

Closure: Before moving on, ask your students if they have any recommendations or unanswered questions that they can work out on their own. Brainstorming extension ideas is a great way to add more science studies to your class time.