

Peanut Power

Use the energy in a peanut to heat water!

SOURCE: http://www.all-science-fair-projects.com/science_fair_projects/39/475/cbe45aef86bab20c2fc93bb286708cee.html

Just about everything has potential energy stored in it. The problem is releasing that energy to be able to do some work.

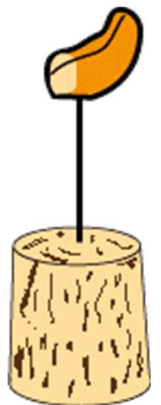
A tiny peanut contains stored chemical energy. When we eat them, the stored energy is converted by our bodies so we can do work. We can also use the energy in a peanut to heat a container of water.

What do you need?

1. A small bag/can of unsalted, shelled peanuts
2. A cork
3. A needle
4. A large metal juice or coffee can
5. A small metal can (like a soup can) with paper label removed
6. A can opener
7. A hammer
8. A large nail
9. A metal BBQ skewer (like the kind for kebobs)
10. About a cup of water
11. A thermometer
12. Some matches or a lighter (ask an adult for help here)
13. A piece of paper and pencil to record your observations

What to do?

1. Carefully push the eye of the needle into the smaller end of the cork. Then gently push the pointed end of the needle into a peanut. If you push too hard the peanut will break. If it does, use another peanut. It's also better to have the peanut at a slight angle.
2. Remove the two ends of the large juice can with the can opener. Be careful as the top's and bottom's edge can be sharp!
3. Using the hammer and nail, have an adult punch holes around the bottom of the large can. These are air holes that will make the can act like a chimney and will contain the heat energy focusing it on the smaller can.
4. Remove the top end of the small can (if it is not already removed). Using the hammer and nail, punch two holes near the top of the small can exactly opposite each other.



Slide the BBQ skewer through the holes of the small can.

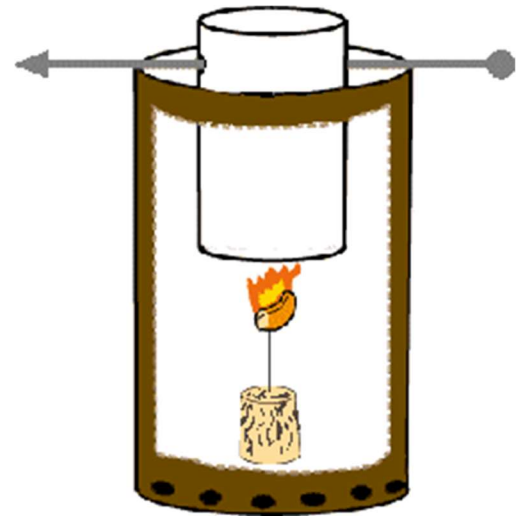
5. Pour 1/2 cup of water into the small can and let it sit for an hour. This will allow the water to be heated or cooled to room temperature. (Munch on some peanuts while you're waiting.)

Put the thermometer into the water and record the temperature on your paper.

6. Place the cork and peanut on a nonflammable surface. Light the peanut with a match or lighter. Have an adult help you! Sometimes the peanut can be difficult to light, so the lighter may be easier to use.
7. As soon as the peanut has caught fire, immediately place the large can around the nut. Balance the skewer holding the small can on the top of the large can.

Allow the nut to burn for several minutes or until it goes out.

Stir the water with the thermometer and record the temperature again.



What you'll discover?

The chemical energy stored in the peanut was released and converted into heat energy. The heat energy raised the temperature of the water in the small can.

Try a couple of other experiments using different kinds of peanuts or other kinds of nuts. Try:

- Raw peanuts
- Dry roasted peanuts
- Vacuum-packed peanuts
- Freeze-dried peanuts
- Try cashew nuts, Brazil nuts, pecans, walnuts or other kinds of nuts. (Do they contain more energy than the peanut? Why or why not?)

You might want to try more than one peanut. You'll need extra needles. Use four or five peanuts to heat the water. Is the temperature four or five times higher?

Energy is measured in a unit called the Btu, which stands for British thermal unit. A Btu is the amount of heat required to raise the temperature of one pound of water by one degree Fahrenheit. Using math, you can figure out how many Btu are in the one peanut. (The plural for Btu is still Btu, not Btus.)

First you'll need to find out how heavy 1/2 cup of water is. Use a small scale and weigh the small can with nothing in it. Then weigh the can with 1/2 cup of water in it. That will tell you how much the water weighs.

Then, knowing how hot the water was, how many degrees its temperature was raised, you can

figure out roughly how many Btu are in the peanut. (**PLEASE NOTE:** This will be an *approximate* figure because the entire peanut will not be completely burned...there is still some chemical energy left inside the partially burned peanut. In order to measure the heat energy exactly, you would need to use a sophisticated piece of machinery called a "calorimeter".)

For example: If the water weighed four ounces ($1/4$ of a pound), one Btu would raise the water temperature 4 degrees Fahrenheit. So, **if** your water temperature increased by 10 degrees (70 degrees at room temperature to 80 degrees), 10 divided by 4 would mean the peanut contained approximately 2.5 Btu. *This is only an example of the math and will not be the same as your calculations.*

One Btu equals approximately:

- One blue-tip kitchen match
- 0.252 kilogram Calories (food calories)

1000 Btu equal approximately:

- One average candy bar (252 kilogram Calories)
- One hour of bicycling
- $4/5$ of a peanut butter and jelly sandwich

NOTE: You may see Btu defined as 252 calories. These are *International Table* calories which are equal to 1000 of the "Calories" or "kilocalories" we use for measuring food energy.