



Beavertail Geology



Deformation

Deformation means to change shape. Geologists separate deformation into two forms. Breaking a brick is an example of *Brittle Deformation*. At first, nothing appears to happen as pressure is applied to the brick. Then suddenly, the brick snaps in two. Folding is an example of *Ductile Deformation*. As pressure is applied, the rock smoothly bends. Clearly, something special is required to make rock behave like that.

Activity Overview

In this activity, you will bend birthday cake candles to discover the special conditions that allow solid rock to bend into complex shapes.

Materials

Newspaper
Container of warm water
Container of ice water
10 birthday cake candles
Force measuring device or system

Instructions

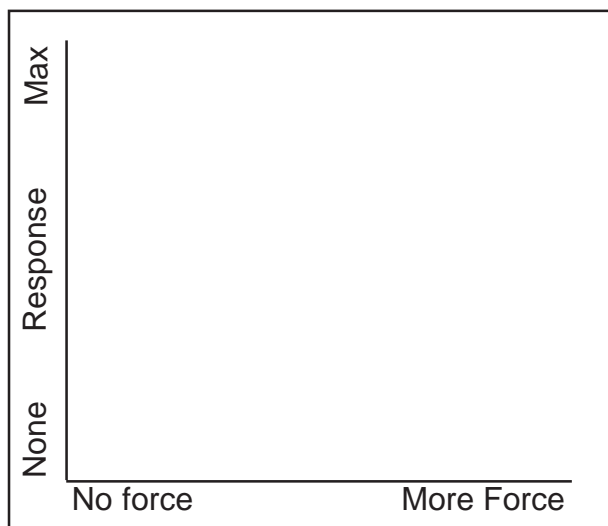
First read all of the steps and think through what you are going to do. Now you are ready to begin.

1. Gather all of the materials that you'll need.
2. Spread newspaper over your work area. When you clean up, all you'll have to do is roll it up.
3. Your instructor will tell you how to measure the force that you use to bend the candles. Make sure that you understand this and ask any questions that you may have.

4. Place three of the candles in the warm water bath and three more in the ice water bath.
5. Leave the remaining candles on your work space at room temperature.
6. While you wait for the candles in the baths to adjust to their new temperatures, re-read Step 8 so that you will be familiar with the procedure.
7. Make a test run of the procedure by placing the base of one of the room temperature candles on the edge of a desk or counter with a book over the end. The idea is to have a good grip on the base of the candle with most of the wick-end sticking out in mid-air. You should be able to hold the candle well enough with only three-quarters of an inch of candle base between the counter and book.
8. Using the force measuring device supplied by your instructor, apply force to the end of the candle. Continue to apply force until the candle either breaks, or has bent so that the wick-end is pointing down.
9. You are now ready to make actual measurements. You will use the same procedure to test first a cold candle, then a room-temperature candle, and finally a warm candle. You have nine candles left, enough to run this three-candle comparison, three separate times.
10. Keep careful records of the force used and the amount of bending of each candle.
11. Prepare your data for plotting by combining all of the cold candle results. In the same way, combine all of

your room-temperature candle results and all of your warm candle results.

11. Plot the results for each candle group as a separate line on the same graph. Use a different color pencil or a different line style for each candle temperature group. Some lines may be straight and others may be curved or kinked.



Candle Bending and Temperature

Conclusions

Complete the following sentences to form a conclusion about this activity.

1. As force was applied to cold candles, they (describe their response):

2. As force was applied to warm candles, they (describe their response):

3. The special condition that allows solid rock to bend is (describe the condition).

Words to Know and Understand

Brittle Deformation - As force is applied, little happens at first. Then, all of the shape change that will take place, happens suddenly.

Ductile Deformation - The shape of an object changes smoothly as force is applied. The first change in shape begins soon after force is applied.