Solar Heating - Elementary

Teacher Instructions

Theory

When objects are placed in the sun, they get warmed by the sunlight. Different objects absorb heat differently, and attain higher or lower temperatures as a result. This experiment will look at solar heating in a fun and hands-on way.

Purpose

Learn more about graphing while comparing the heating rates for different objects.

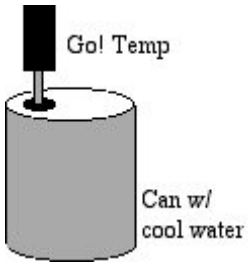
Materials

Go! Temp probe, Macintosh or PC Computer, soda cans, water

Procedure

1. Plug the Go! Temp probe into your computer then launch *Logger Lite* software. When the software launches, it will set up a graph of Temperature versus Time.

2. Under **Experiment** in the menu bar select **Data Collection.** Set the time for data collection to 600 seconds. A rate of 1 sample per every 5 seconds should be a good rate. Click [Done] to set this new time.



3. Pour room temperature water into the can, filling it close to overflowing. Place the can in the direct sunlight. Place a Go! Temp probe so the tip is as close to the center as possible and hold it there. (You could use a ring stand to hold the probe if necessary, or use a cork with a slit in it that can hold the probe steady as it passes into the can.) Wait approximately a minute for the probe to adjust to the temperature of the water then press the green Collect button to begin data collection.

4. While the data collection proceeds, discuss what is happening with the thermometer in the center of the screen and what that means. Also discuss what the graph line is doing and what it means.

5. After discussing the shape of the graph and what it means, have the students do a short writing assignment that helps them put the ideas into their own words. Using "correct" scientific vocabulary isn't the key ingredient; rather, getting the key idea is what we hope to gain.

6. Now the class is ready for the question of the day. "Gang, we're going to repeat this experiment tomorrow. The only thing is, I want the water to get hotter than it did today. Get into your groups and come up with some ideas of what we could do to get the water to end up hotter than it did today."

7. After you've given the class enough time to come up with ideas, put one or two per group on the board. Select several of them to do and then follow up by doing them in the coming days. You've just put your students into the role of scientist, and without knowing what the results are going to be in advance, they are setting out on a quest to learn more about how the world works and waiting until the results are in before drawing conclusions.

Analysis Questions

1. Did the can heat at a steady rate? Did it heat fastest at the beginning or at the end? How did you determine your answer?

2. Compare the graphs from different cans. Which heated the fastest? Which heated slowest? How did you determine this from your graph?

3. Formulate a reason why you think one heated faster than the other. How would you test to see if your reason will be true in other situations? For example, if you say a darker color heats faster, then try several colors ranging from light to dark.

Extensions

Reverse the process. Put hot water into the cans and watch them cool off. Before you start, predict which one will cool fastest. Does it? How do the rates for heating and cooling compare?

If access to direct sunlight is difficult or impossible, consider using a heat lamp instead This is actually easier to control than the sun which may hide behind a cloud and there may also be differences on windy or calm days.

Possibilities

Some possible changes you could make: different colors, different sizes of cans, different materials that the cans are made of, change the profile of the can by crushing it, using different liquid besides water. Other changes are possible, too. Try to change only one variable at a time, however, so you can see the effect of the change by itself and not get lost in changing too many things at once.

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