B6.2 Harnessing solar energy as heat (2)

When you come home from school, your father complains, "The sun has now been shining a long time, and the water in our pool is still too cold to swim because the nights are so cold. The pool cover over the water simply isn't adequate by itself. Today I must talk with your mother to see if there isn't something we can do."

How could the water in the pool warm up even faster?
How could you use solar energy?

Write down your ideas and guesses:

_____

_____

_____

You need the following for the experiment:

- ☐ Aluminum foil
- ☐ 1 burning mirror
- ☐ Some modeling clay
- ☐ 2 plastic bottles with caps
- ☐ 1 pair of sunglasses
- ☐ Direct sunlight
- ☐ 2 sheets of cardboard or thick paper
- ☐ 1 thermometer
- ☐ (Stop) watch
- ☐ Water (lukewarm)

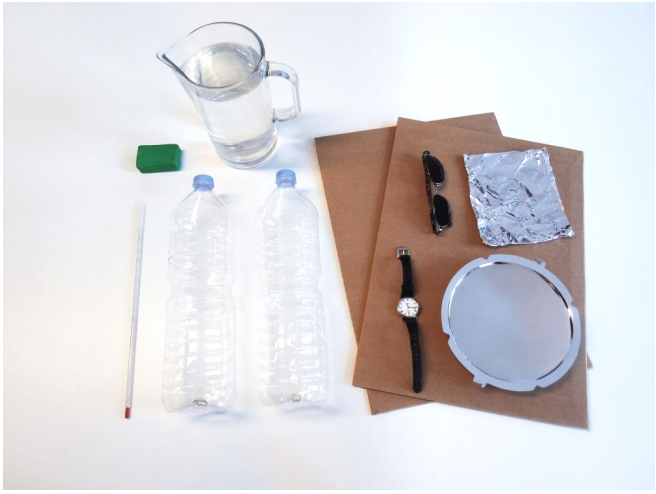

Figure 1: Required materials.

SAFETY INSTRUCTIONS:

- Protect your eyes! Be careful not to be blinded by the sunlight. Wear sunglasses.
- Do not burn yourself. Objects that have sunlight aimed at them can become very hot. Make sure that nothing catches fire!
- After the experiment, do not forget to disassemble everything so that fires cannot start.

How to set up the experiment:

Lay out all the materials as shown in the photo.

1. Wrap a small piece of cardboard about the size of your palm with aluminum foil – and now you have a mirror! Tip: Make sure that the shiny side of the aluminum foil is on the outside and try to keep it from getting wrinkled.
2. Stick a piece of modeling clay on the back of your homemade mirror. The clay serves as a base that "holds" the mirror at an angle so that it points toward the bottle and doesn't fall over. You can position your mirror this way.
3. Build a total of four to five mirrors.
4. Arrange your homemade mirrors and the burning mirror around one of the bottles. All the mirrors should be angled so that they aim the sun's rays directly at the bottle.
5. Place the other bottle in the sun without mirrors for comparison. The light from the mirrors should not hit this bottle.

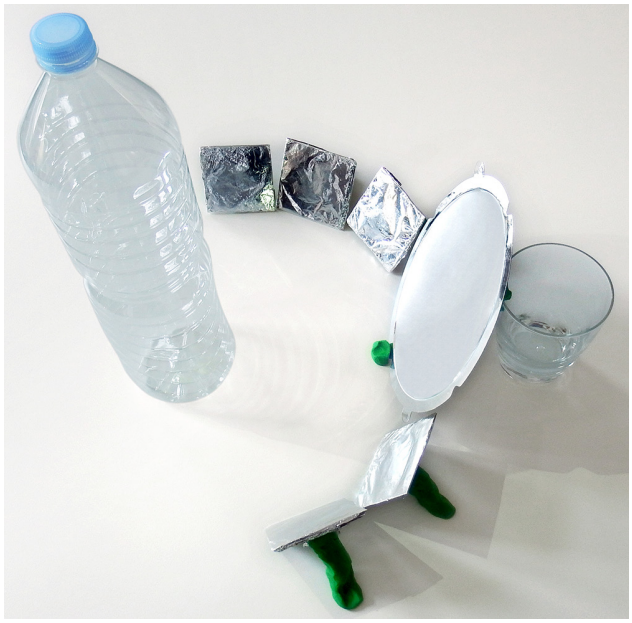

Figure 2: What your experiment setup could look like.

How to conduct the experiment:

1. Measure the water temperature ("starting temperature") and write down the value.
2. Then fill each of the two bottles almost halfway with water.
3. Measure the water temperature in both bottles again after three minutes and write the values in the table.
4. Repeat the measurement two more times after waiting three minutes each time.

Write your observations in the table:

Starting temperature of the water: _____ degrees Celsius.

Time	Temperature in degrees Celsius	
	Bottle without mirrors	Bottle with mirrors
3 minutes		
6 minutes		
9 minutes		

Evaluate your measurements:

1. Compare the measured temperatures with each other. What do you notice?

2. What purpose do the mirrors serve? Tip: Have you ever used a burning mirror to light a candle or set a piece of paper on fire?

3. Formulate the energy conversion chain.
   Use the following terms: solar energy and heat.

The _____ is converted to _____ in the wall of the plastic bottle and in the water.

Doing further research:

The big power plants that provide us with electricity use steam to generate current with a turbine and a generator.
Think about how you could use the design from the experiment to produce electric current in a solar power plant.