Hot Penny!

<u>Subject</u>: Magnification and Conduction

<u>Science Fact</u>: Magnifiers can concentrate sunlight to a space. Light energy transforms to heat energy when it is absorbed by matter.

<u>Experiment Question</u>: What effect will focusing light on a penny inside a jar of water have on the temperature of the surrounding water?

MATERIALS

2 small jars with lids (baby food jars will work well)
2 thermometers
1 magnifying lens
2 copper pennies
timer
notebook and pencil
graph paper and ruler

DIRECTIONS

Preparing your Notebook

Write the Experiment Question in your notebook.
Write a hypothesis - an educated guess to the Experiment Question.
Create a table in your notebook like the one below.

	Jar A With Magnifier	Jar B Control Without Magnifier
Starting Temperature		
Temperature after____ min		
Temperature after____ min		
Temperature after____ min		

Conducting the Experiment

Until they are ready to be used, keep your thermometers in the shade so the sun does not strike them.
You may work alone or with a partner.

1. Pour the same amount of water into each small jar. (It is best if you use no more than 1/2 Cup per jar.)

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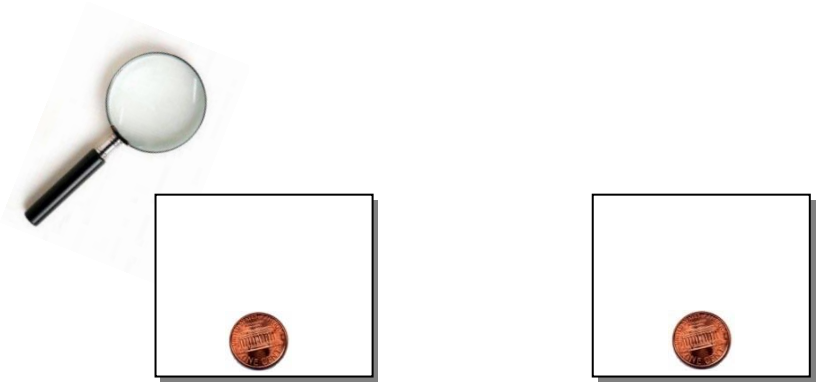
2. Place a thermometer into each jar of water. Record the temperature of the water in each jar on the Starting Temperature line in the chart. Remove thermometer.



Jar A With Magnification (experiment w variable)

Jar B Without Magnification (control)

3. Put lids on jars. Set both jars in the sun. Use the magnifying lens to focus sunlight onto the penny in Jar A. You will record the temperature every five minutes.

4. After five minutes, remove the lids, insert thermometers and record the temperature of the water in Jar A and Jar B.

5. Remove thermometer. Return lid. Continue to focus the sunlight onto the penny in Jar A.

6. Repeat this step every five minutes two more times.

In Your Notebook

Discuss the activity and data with your partner.

1. Compare how the temperature changed in Jar A with how it changed in Jar B.

2. What difference did you notice?

3. Which jar do you think absorbed the most sunlight? Explain your answer.

4. What effect do you think the magnifying lens had on the temperature of the water?

5. Why was a copper penny a good object to use to absorb sunlight?

6. Using the data from your table, create a line graph with time plotted on the x axis and temperature plotted on the y axis.

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Conclusion

This is the answer to the Experiment Question. It is based on your data, diagrams and observations.

Write a Conclusion in your Notebook.

Extension

Create a different experiment to test a new variable such as colored water, adding black color in jar, multiple magnifiers, multiple pennies, a conductor other than a penny, a darkened penny vs regular penny, etc.

Standards Met

PHYSICAL SCIENCE / ENERGY

MS-PS3-3.

- Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.

MS-PS4-2.

- Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.

MS-PS3-4.

- Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.

PHYSICAL SCIENCE / WAVES & ELECTROMAGNETIC RADIATION

MS-PS4-2.

- Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.

EXPRESSIONS & EQUATIONS

CCSS.MATH.CONTENT.6.EE.C.9

- Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation.

SCIENCE & TECHNICAL SUBJECTS

CCSS.ELA-LITERACY.RST.6-8.3

- Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

CCSS.ELA-LITERACY.RST.6-8.7

- Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).