

Hot and Cold Colors

Written by GEF Staff



Grades: 3-5

Subjects: Science

Time: Two sessions of 30-40 minutes each

***Standards:** Students will...

Science Standard 9: Understand the sources and properties of energy.

Benchmark # 1: Know that heat is often produced as a byproduct when one form of energy is converted to another form.

Benchmark # 3: Know that light can be reflected, refracted or absorbed.

Science Standard 12: Understand the nature of scientific inquiry.

Benchmark # 3: Plan and conduct simple investigations.

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Benchmark # 4: Use appropriate tools and simple equipment (e.g., thermometer) to gather scientific data and extend the senses.

Benchmark # 5: Know that scientists' explanations about what happens in the world come partly from what they observe and partly from how they interpret their observations.

Technology Standard 6: Understand the nature and uses of different forms of technology.

Benchmark # 3: Know that different types of energy (solar, fossil fuels) have different advantages and disadvantages (e.g., solar energy is a cleaner source of energy than fossil fuels, but currently is more expensive).

Objectives: Students will be able to...

- Explain the relationship between color and solar energy absorption and identify ways to use color to harness or repel the sun's energy.
- Collect, organize and record data.
- Construct a graph organizer (e.g., tables, bar graphs, pictographs, line graphs, line plots) to compare multiple sets of data.

[Please click here to view both the creative artwork for this great lesson and the downloadable PDF.](#)

Materials:

- Thermometer
- Empty soup cans
- Poster paints of various colors (including black and white)
- Paintbrushes
- Clock
- "Hot and Cold Colors Hypothesis and Conclusions" worksheet included below

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Overview:

The color of an object depends on the wavelengths of colors reflected by that object. When a black object is illuminated by white light all wavelengths are absorbed. Dark objects appear dark because they absorb light instead of reflecting it. The light absorbed by dark objects does not disappear. The absorbed light energy is transformed into heat energy. Since darker colors absorb light better they also emit heat better. Wearing a white T-shirt rather than wearing a black T-shirt on a hot day keeps you cooler. A white t-shirt reflects more sunlight and so absorbs less heat.

Green building programs recommend the use of cool roofing. Light colored roofs reflect sunlight minimizing temperature rise and reducing smog formation. This is important in urban areas with asphalt parking lots, paved roads, black roofs, and little vegetation. Solar energy is a renewable resource that can be converted into electricity and heat. Solar energy is free and produces no air or water pollution.

Kid's Speak: Solar energy is a renewable resource that can be converted into electricity and heat. Dark colors absorb sunlight, gain the most energy, and heat up more than light colors.

Eco-Fact: In one hour more sunlight falls on the earth than what is used by the entire population in one year. This is one of many reasons why solar Energy is becoming more and more popular.

Procedure:

First Session:

- To introduce solar energy ask students what color t-shirt they would wear on a hot day to keep cool.
- Discuss the concept and uses of solar energy with the class.
- Divide the class into groups of two. Each group will choose or be assigned a color to paint their soup can.
- Paint the outside of the soup cans and let dry overnight.

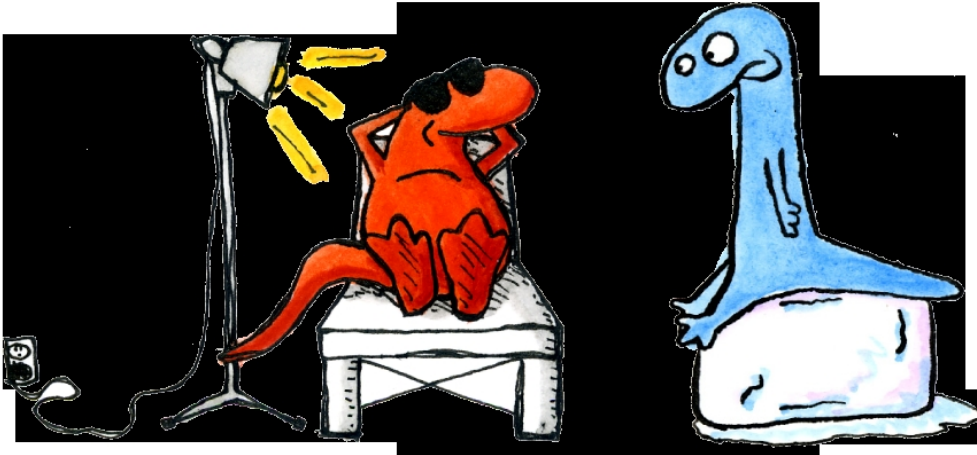
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Second Session:

Instructions for Hot and Cold Colors:

- Have each group complete the attached “Hot and Cold Colors” worksheet.
- Write a hypothesis. Students will first write a hypothesis predicting which color gets warmest fastest or which color will absorb the most heat. (I think _____ because _____.)



Instructions:

1. Place your thermometer inside of the can.
2. Place your can in a sunny spot where there is no wind or draft.
3. Record the temperature using the thermometer. What is the starting temperature? _____ °F
Write it in the first line of the attached chart. Also write the time of your temperature measurement.
4. Predict what you think the temperature will be at the end of the activity. What do you think the temperature will be at the end of the activity? _____ °F
5. Monitor and record the time and temperature on your observation chart every minute. Be sure to record the temperature every minute for ten minutes.

After Conducting the Lesson:

- **Data/Results:** Complete the two questions on the attached worksheet.
- **Conclusion:** My hypothesis was _____ because _____.
- **Complete on the attached worksheet.**
- **Compare:** Compare the temperatures changes of the different color soup cans of each group to discover which colors best absorbed the solar heat.
- **Graph:** The class could create a line graph with lines corresponding to the soup can colors to compare temperature differences over time. Students could construct a color coded bar graph to show overall temperature change of each can.

Questions for Discussion:

1. Which colors would be best for painting homes, schools, and other buildings to help keep them cool? Why?
2. Which colors of clothes would be cooler? Why?
3. Which colors of cars would be hotter? Why?
4. How can choosing the best color save energy?
5. "Color can affect the absorption of heat energy." Explain what this means or how you know it is true.

Adaptations:

- Students can record other conditions when they measure the temperature of their container. These conditions could include the time of day and the time of year. In doing so, students can test for variations in temperature change.
- Students can cover their empty soup cans with tin foil, clear wrap, or colored paper instead of using poster paints. To do this, students will need to cut a slit in the top of the can for the thermometer. By doing this, students can observe how these materials absorb and reflect solar energy.

Extensions:

- Visit this GEF website for more solar energy lessons, click on Green Energy Challenge then Solar.
- Students can take a field trip to a solar energy power plant to learn more about solar energy.

GEF Community: Join the GEF Community online. It only takes a minute. Students can share pictures of their containers along with their thoughts and ideas regarding solar energy with the GEF Community.

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Name: _____

HOT & COLD colors

Hypothesis:

Time	Temperature (°F)

Data/Results:
1) What color did you select?
2) How much did the temperature change?

Conclusion:

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