

HOT COLORS

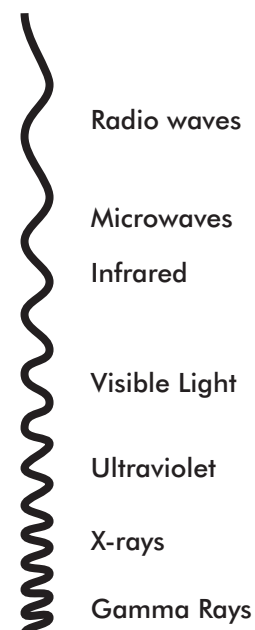
Background Information for Activity Leaders

Overview

Children will use different colors of felt to explore the absorption and reflection of radiant energy from the Sun.

Key Concepts

- The Sun’s energy reaches the Earth as radiant energy. **Radiant energy** includes all the energy of the electromagnetic spectrum, including visible light.
- When visible light waves strike an object they can be absorbed or reflected.
- When light is absorbed it turns into heat. When light is reflected it is not absorbed and does not turn into heat.
- An object’s color can determine how much radiant energy is reflected or absorbed.
 - White objects reflect all light in the visible portion of the electromagnetic spectrum.
 - Lighter colors reflect more light than darker objects.
 - Black objects absorb all light in the visible portion of the electromagnetic spectrum.
- Heat and light are two different forms of energy. When light energy is absorbed by a substance it transforms into heat energy. The material that absorbs the most light gains the most energy and heats up more. The object then emits the heat it has collected.
- When a black object is illuminated by white light, all wavelengths are absorbed and none are reflected—that’s why the object appears black. Black objects absorb more light energy than white objects.



The Electromagnetic Spectrum

What to Expect

- Children may mistakenly hold the thermometer at the bulb end. By holding the thermometer at the bulb their body’s heat will raise temperature on the thermometer. Remind them to read the thermometer as soon as the ten minutes are up, without touching the bulb.

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Common Misconceptions

- *Children may think: "Certain colors are 'warm' colors, such as red and orange."*

It's true that red and orange are regarded as warmer colors than blue and violet, but this describes the way people feel when they look at colors, and has nothing to do with the abilities of different colors to warm things up.

- *Children may think: "Heat and temperature are the same thing."*

Heat is a form of energy caused by both the amount and internal motion of molecules of matter. Temperature is a measurement of the motion of the molecules. For example, a bucket of water at 40°C has more heat than a cup of water at 40°C even though they are both at the same temperature, because there are more molecules in the bucket than in the cup.

HOT COLORS

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Data Collection Sheet

Name: _____

Date: _____

WONDER Why do dark-colored clothes make you feel warmer than light-colored clothes on sunny days?

.....

RECORD

Data Table

color	start temperature (°C)	end temperature (°C)	temperature change (+/-)	rate in order of which absorbed the most heat
1. Black				
2. White				
3. _____				
4. _____				

CONCLUDE What did you discover about how colors determines how much heat an object absorbs?

Set Up the Expedition

Materials

For the activity leader:

- (1) poster size piece of butcher paper
- (1) 6 cm x 24 cm piece of dark blue felt
- (1) 6 cm x 24 cm piece of light blue felt
- (1) 6 cm x 24 cm piece of red felt
- (1) 6 cm x 24 cm piece of pink felt
- (1) 6 cm x 24 cm piece of dark yellow felt
- (1) 6 cm x 24 cm piece of light yellow felt

For each group:

- **Hot Colors** Learning Cards
- (1) 6 cm x 24 cm piece of white felt
- (1) 6 cm x 24 cm piece of black felt
- (1) 6 cm x 24 cm piece of colored felt
- (3) thermometers per group
- (1) timer or watch per group
- (1) meter stick

For each child:

- (1) **Hot Colors** Data Collection Sheet
- (1) pencil or pen

Prepare the demonstration:

1. Reproduce the data table (found on the Data Collection Sheet) on a poster-size piece of paper. Place it where all the children can see it.
2. Gather different colors of markers to use to record each group's data.

Prepare the exploration:

1. Find an outdoor area that is flat and sunny.
2. For each group, prepare a set of materials to take outside:
 - one piece of white felt
 - one piece of black felt
 - a third color (each group should get a different third color)
 - timer or watch
 - 3 thermometers

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Activity Leader's Guide

Group Size: 4-6 children

Time: 45 minutes

Engage

- 1 Gather the children together.

Say:

“Have you ever worn a dark shirt out on the playground on a warm, sunny day? How did it make you feel?” Most children have experienced how hot they feel when they wear a dark colored-shirt out on a sunny day.

Ask:

“Why do you think a dark-colored shirt feels so much warmer than a light-colored shirt?” Give the children an opportunity to suggest reasons.

- 2

Say:

“How can we use different colors of felt and thermometers to explore how different colors absorb solar energy?” Show children the various colored felt squares and the thermometers. Give children opportunities to explain how they would conduct the experiment. Once children have shared their ideas, suggest that they place the thermometer under different colors of felt to see if the temperature under the different colors changes during a period of time.

Ask:

“What must be done to make sure that each piece of felt is treated in the same manner?” They should all receive the same amount of sunlight for the same amount of time. The only difference should be the color.

Say:

“When you are finished we will place everyone's data on this large data table.” Point to the table drawn on the poster paper. Distribute the Data Collection Sheets and the Learning Cards.

Explore/Expand

- 3** If working with more than 4-6 children, divide children into groups.

Say:

“Follow the instructions on your Learning Card. Try to notice everything you can about how solar energy is absorbed by different colored materials.”

- 4** Allow children enough time to complete the WONDER, EXPLORE, RECORD, EXPAND and CONCLUDE sections of their Learning Card.

Conclude

- 5** Gather the children together. Ask one child per group to come forward to add their data for each color to the large data table you created.

Ask:

“What did you do to explore how sunlight affects colors?” Most children will describe how they covered the thermometer with felt, and then compared the effects that each color had on the temperature.

“Was it important to expose the felt to sunlight for the same amount of time? Why or why not?”

Encourage children to discuss what would happen with different variables, such as exposing different colors for different periods of time.

“What did you discover about the connection between the colors of the felt and the temperature changes?”

Encourage children to refer to the data table. Dark colors of felt experience a more significant rise in temperature, while lighter colors will have a less significant change. The light energy from the sun transforms into heat energy when the felt absorbs it.

“What else can we learn from the data table?”

Allow children to make suggestions.

“In what creative ways can you apply what you have learned?”

Encourage children to share their ideas about how to apply what they learned. They may start with ideas such as wearing light colors in the summer to keep cool and dark colors on cool days. Encourage them to think creatively.

- 6** **Say:**

“Congratulations! You have earned your ‘Ask Me About the Sun’ stamp. You are ready to tell people about solar energy.”

HOT COLORS

Expedition Learning Card



How does color determine the amount of heat absorbed by materials?



**absorb
reflect
heat**



Explore what happens when different colors absorb light.

1

WONDER Why do dark-colored clothes make you feel warmer than light-colored clothes on sunny days?

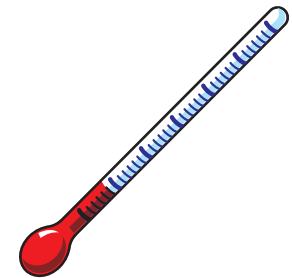


Record your ideas on your Data Collection Sheet.

2

EXPLORE

1. Gather your three different colors of felt: black, white, and any other color available.
2. Go outside with your felt, three thermometers, Data Collection Sheets, a watch or timer, meter stick, and pencils or pens.
3. Place your group's three thermometers 30 cm apart, under direct sunlight.
4. After 5 minutes, record the starting temperature of each thermometer on your Data Collection Sheet.
5. Cover each thermometer with one of the three different colors of felt.
6. After 5 minutes, record the temperature of each thermometer.



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Expedition Learning Card

3 RECORD What starting temperature did you read on each thermometer before you covered them?

What was the temperature reading of each thermometer after being covered for 5 minutes?

Subtract the difference between each starting temperature and final temperature. How much did the temperature of each piece of felt change?

If you have time, experiment with other colors.

 Record on your Data Collection Sheet the temperature reading of each thermometer before and after you placed each piece of felt on top of them. Next, record any temperature changes. Last, rank each color in order of which color absorbed more heat by noticing which had the greatest increase in temperature change.

4 EXPAND How can the information you discovered be useful to people?

 Describe creative ways you can apply what you have learned. Draw your ideas on the back of your Data Collection Sheet.

5 CONCLUDE What did you discover about how color determines how much heat an object absorbs?

Discovery

Why did we do that?

- Solar energy can be absorbed or reflected.
- When solar energy is absorbed it becomes heat energy.
- Certain colors absorb light better than others

Congratulations!

You have earned your "Ask Me About the Sun" stamp! Now you are ready to tell people about solar energy!

