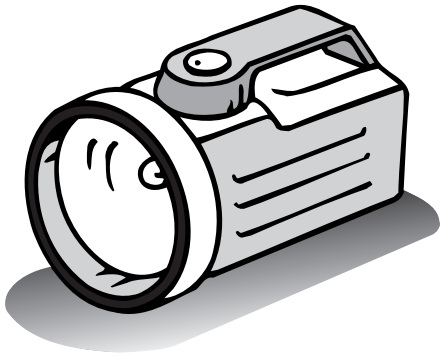
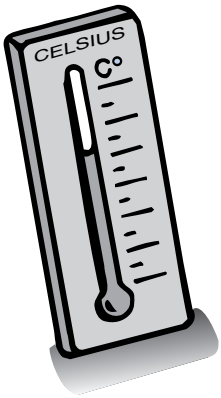
Chapter Science Investigation Name _____

Absorbing Heat

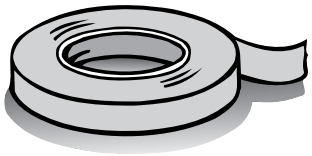
What You Need



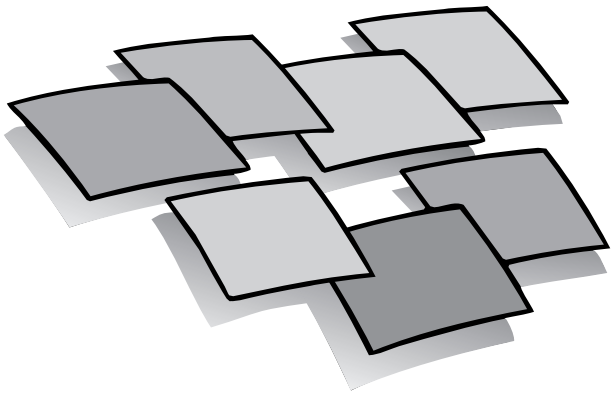
beam flashlight with 6-volt dry cell



thermometer (Celsius)



masking tape



pieces of construction paper (14 cm × 14 cm), red, orange, yellow, green, blue, indigo, violet, white, and black

Find Out

Do this activity to see which colors absorb the most heat.

Process Skills

- Measuring
- Communicating
- Experimenting
- Controlling Variables
- Using Numbers

Time

- 20 minutes each day for two weeks

What to Do

1. Fold a piece of construction paper in half and fold the two side edges. Using the masking tape, seal the sides to make a pouch. Also, seal the top of the pouch, except for a 1.5-cm opening. Place the thermometer inside the pouch through the opening in the top.

2. **Measure** and **record** the starting temperature. Shine the flashlight on the pouch for 10 minutes. **Measure** and **record** the ending temperature.

3. The next day, repeat Step 2. **Calculate** and **record** the **average** of the two trials. Also, repeat Step 2 for a different-colored piece of construction paper.

4. Every day, repeat Steps 2 and 3 until you have **tested** each color of construction paper twice. Be sure that the only **variable** that changes is the color of the construction paper.

Observing Temperature and Color				
Color	Day	Beginning Temperature	Ending Temperature	Average Temperature
Red	1			
	2			
Orange	1			
	2			
Yellow	1			
	2			
Green	1			
	2			
Blue	1			
	2			
Indigo	1			
	2			
Violet	1			
	2			
White	1			
	2			
Black	1			
	2			

Conclusions

1. Which color of pouch had the greatest average change in temperature?
black
Which color of pouch had the least average change in temperature?
white

2. What can you conclude about the amount of heat absorbed by the different colors of the visible light spectrum?
Darker colors absorb more heat.

3. What color of clothing would you wear on a hot day in Florida?
light or white clothing

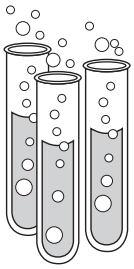
What color of clothing would you wear on a cold day in the mountains?
dark clothing

New Questions

1. Will snow on the ground melt equally in all places, or will it melt faster in certain areas? Explain.
It will melt faster in some areas than others because of the angle of the sun, the amount of sun the snow receives, and dark objects nearby that may absorb light and heat at higher levels, thus melting the nearby snow. Student explanations may include: Snow around trees melts faster than the snow in the middle of a field. Snow on the south side of a house melts faster than snow on the north side of the house if you live in the northern hemisphere.

2. What are some reasons that support your answer?
Accept all reasons that demonstrate a basic understanding of heat absorption.

3. In what other situations is color a factor in helping to cool or heat something?
Responses will vary but may include houses made of white stucco in tropical climates, tinted car windows, and people of the desert wearing light-colored clothing.



Name _____

ACTIVITY

Making Waves

What happens when you move the end of the rope up and down?
The rope undulates; looks a little bit like a wave.

What do you **predict** will happen if you increase the speed of your movement?
Answers will vary. Students might think that the rope will move faster.

What do you **observe** when you increase the speed of your movement?
More wavelike movement and shape along the rope appear.

What do you **predict** will happen if you increase the height of your movement?
Students may correctly predict that the waves will get bigger.

What do you **observe** when you increase the height of your movement?
Fewer but higher waves move along the rope.

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Conclusions

1. What happened to the frequency and wavelength when you increased the speed of movement?
At constant speeds, frequency increased when wavelengths decreased.

2. What happened to the wave when the rope hit the stationary object?
The wave reflected back.

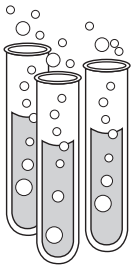
3. What type of wave was modeled?
transverse

4. Describe the relationship between the source and the wave.
The amount of energy released by the source determines the characteristics of the wave. The frequency of the wave depends on the frequency at which the source is vibrating.

Asking New Questions

1. How many ropes would you need to demonstrate electromagnetic waves?
two: one for the electric part of the wave and another for the magnetic field at a 90° angle.

2. What would you need to demonstrate sound waves?
a soft spring so that parts of each wave could compress



Name _____

ACTIVITY

Making Colors from Light

What do you **see** when white light passes through the prism?
Students should observe colors.

What colors do you **predict** you will see if you place a second prism between the first one and the paper?
Answers will vary. Students might think that they'll see two sets of the rainbow colors.

What happens when you use two prisms?
The light refracted into colors by the first prism is spread out further by the second prism.

Illustrate the effects of using one or two prisms with colored pencils.

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Conclusions

1. How does the prism change the white light?
The prism separates the white light into the colors of the spectrum.

2. What colors do you see?
Red, orange, yellow, green, blue, indigo, violet; students may not be able to distinguish indigo.

3. What happens when two prisms are used?
When a second prism is used, the separated colors are further spread out.

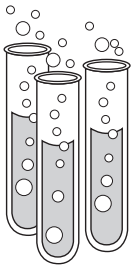
Asking New Questions

1. When you look at the visible light spectrum, what is the order in which the bands of color appear?
red, orange, yellow, green, blue, indigo, violet

2. Make a **hypothesis** about what would happen if only one color of light was shown through the prism.
Students may suggest that the same color will refract out of the prism; that the color will change to white light; or that the color will refract into other colors of the visible light spectrum.

3. **Design an investigation** to test your **hypothesis.**
The setup will be similar to the activity. Students may want to use a strong flashlight and different colors of transparent cellophane.

4. Write a report to include the steps and results of your investigation. Present your findings to your class.
Reports will vary. Students should be encouraged to critically think of the importance of the order of the steps.



Name _____

ACTIVITY

Making Wind Work

Draw a plan for a device that can use wind to pick up paper clips.

How My Wind Device Performed

Answers will vary depending on students' designs.

Wind Speed	Prediction: How Many Paper Clips Will It Pick Up?	How Many Paper Clips Did It Pick Up?

Name _____

Conclusions

1. How many paper clips did your device pick up when you first built it?
Accept all responses.

2. How well did it work at different wind speeds?
Answers will vary depending on the type of structure built. Most will think it should pick up more at higher speeds, but this isn't necessarily true. A strong wind could destroy or damage the structure.

3. Did your design changes result in more paper clips being picked up?
Answers should come from students' data.

4. Why was it important to design the windmill before it was built?
A design first allows improvements to be made before the actual windmill is built, saving time and money.

Asking New Questions

1. Wind speed can vary a lot. How could you control the work your windmill does at different speeds?
Answers will vary, but students might mention designing a system in which automatic pivoting controls kick in when the wind speed is too slow or too fast.

2. How could your machine be useful?
Answers will vary but may include recognition of wind as an alternative energy resource.