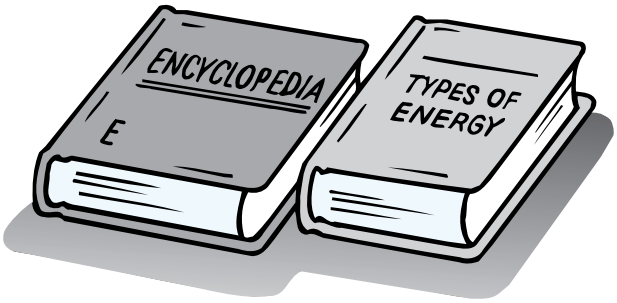
Chapter Science Investigation Name _____

Using Solar Energy

What You Need



reference and nonfiction books on energy

coloring pencils

gummed stars, preferably one color

metric ruler

Find Out

Do this activity to see how we identify forms of energy and transfer them to other forms of energy.

Process Skills

Classifying
Using Numbers
Interpreting Data

Time

- 30 minutes the first day
- 30 minutes each day for three weeks

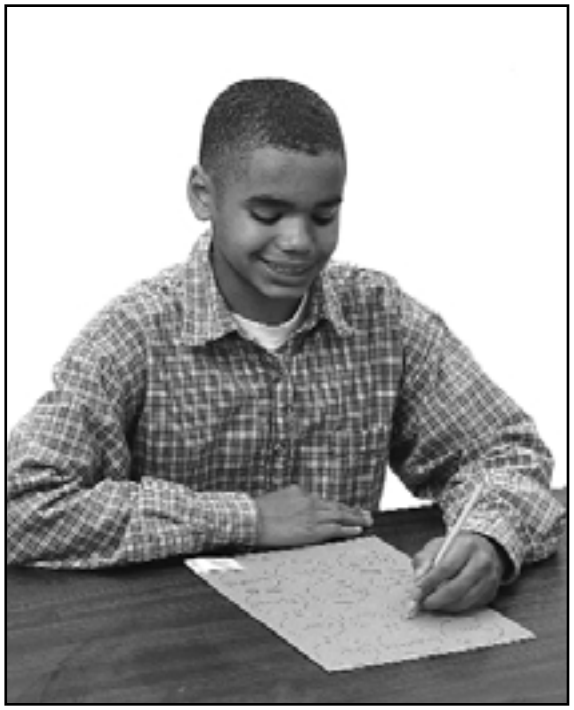
What to Do

1. Complete the Flow of Energy chart. Inside each circle label the following: "Sun," "Moving Air," "River," "Tree," "Plants for Food," "Animals," "Fossil Fuels," "Hydroelectric," "Water Heater," "Furnace," "Radio," and "Automobile."

2. Fill in the key in the lower right corner of the chart to include the following color code.

Heat Energy	red
Light Energy	yellow
Sound Energy	orange
Chemical Energy	green
Electrical Energy	blue
Mechanical Energy	brown

(You may instead choose to make the key on a computer, print it, cut it out, and paste it to the lower right corner of the chart.)

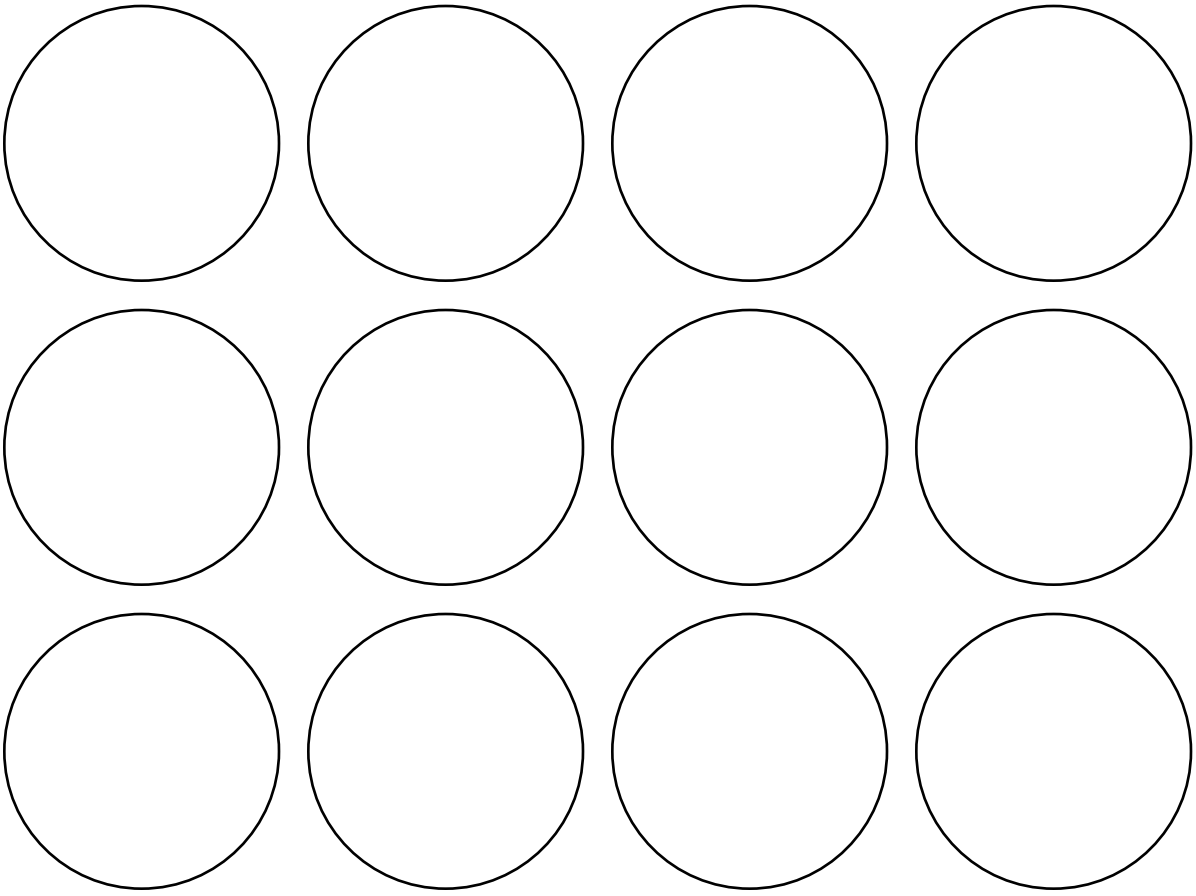


3. **Investigate** and **chart** the flow of energy from the sun to the various ways that we use energy every day. Draw a line from circle to circle, using your color key to identify the various energy forms.

4. Place a star wherever energy is converted into another form. Example sequence: sun (light energy—yellow) to tree (chemical energy—green) to fossil fuels (chemical energy—green) to furnace (heat energy—red) to moving air.

5. If you need to, you may add circles to your chart and label them.

Flow of Energy



Key

Conclusions

1. How do we rely on the flow of energy from the sun?
   All energy used on Earth comes from the sun.

2. Give another example of how energy is used over and over again.
   Answers will vary, but could include the water cycle, the nitrogen cycle, and so on.

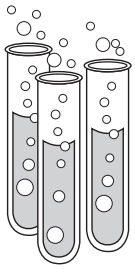
3. Name places in your classroom where energy is converted from one form to another.
   There are many answers, but some may include electrical energy to heat, chemical energy in our bodies to mechanical energy when we sharpen a pencil, energy in an apple to energy in our bodies, chemical energy in a battery to electrical energy to light energy, and so on.

New Questions

1. What are some disadvantages of using conventional energy sources?
   These energy sources are in limited supply and the inefficiency with which we use them may cause pollution.

2. What are some advantages of using solar cells?
   Solar cells are efficient, do not cause pollution, and use an inexhaustible energy source.

3. How can you conserve energy?
   Responses will vary. You may want to make a list with the class.



Name _____

ACTIVITY

Flowing Heat

What do you **predict** will happen to the temperature of water if you fill one bag with hot water and the second bag with cold water?

Students might predict that in time the temperature in the two bags will be equal.

Bag 1 (Hot Water)

Time	**0.5**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**	**4.0**	**4.5**	**5.0**	**5.5**	**6.0**	**6.5**	**7.0**	**7.5**
Temp.															
Time	**8.0**	**8.5**	**9.0**	**9.5**	**10.0**	**10.5**	**11.0**	**11.5**	**12.0**	**12.5**	**13.0**	**13.5**	**14.0**	**14.5**	**15.0**
Temp.															

Bag 2 (Cold Water)

Time	**0.5**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**	**4.0**	**4.5**	**5.0**	**5.5**	**6.0**	**6.5**	**7.0**	**7.5**
Temp.															
Time	**8.0**	**8.5**	**9.0**	**9.5**	**10.0**	**10.5**	**11.0**	**11.5**	**12.0**	**12.5**	**13.0**	**13.5**	**14.0**	**14.5**	**15.0**
Temp.															

Data will vary depending on the starting temperatures of the hot and cold water.

Graph your data on a sheet of graph paper. Use a red line for your hot-water data and a blue line for your cold-water data.

Students' graphs should show that the red line decreases and the blue line increases until they are equal and coincident.

Name _____

Conclusions

1. What happened to the temperature in the bag of hot water? In the bag of cold water?
The temperature in the bag of hot water decreased as the temperature in the bag of cold water increased.

2. Which bag of water gained thermal energy? What evidence do you have that this bag of water gained thermal energy?
cold bag; temperature increased

3. Which bag of water lost thermal energy? What evidence do you have that this bag lost thermal energy?
hot bag; temperature decreased

4. How would you **explain** the temperature changes?
Heat was transferred from the hot water to the cold water.

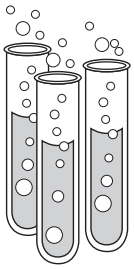
5. **Infer** which way the thermal energy flowed. Explain how you know this.
From the hot water to the cold water; heat always flows from objects with warmer temperatures.

6. How do your results **compare** with your prediction from Step 1?
Answers will vary depending on students' predictions.

Asking New Questions

1. What would happen if you had two bags of hot water and a bag of cold water in the cup?
End temperature would be higher, and the bag of cold water would warm up more quickly.

2. What would happen if you used twice as much cold water?
End temperature would be lower and the bag of hot water would cool down more quickly.



Name _____

ACTIVITY

Insulating for Energy Conservation

Record your data below.

Uninsulated House

Time	Temperature
after 5 min	
after 10 min	Data will vary.
after 15 min	

Insulated House

Time	Temperature
after 5 min	
after 10 min	Data will vary.
after 15 min	

Name _____

Conclusions

1. How much longer than the house *without* insulation did the house *with* insulation stay above 20 °C?
Answers will vary. An insulated house will stay warm longer than an uninsulated house.

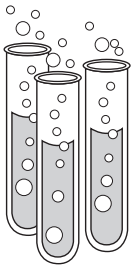
2. How did your results **compare** to those of others in your class?
Depending on how uniform the models are, results should not vary greatly.

3. **Explain** what the crumpled newspaper does.
The newspaper is insulation and keeps the heat from escaping. It keeps the house warm for a longer time.

Asking New Questions

1. Make an **inference** about which house would need the least energy to keep it comfortable on a cold day.
the best-insulated house

2. How could you **test** materials for use in insulating buildings?
repeat the activity with different insulating materials in place of newspaper



Name _____

ACTIVITY

Transferring Energy

Record your data for the solar collector below.

Trial	Beginning Temperature	Ending Temperature	Time Taken
1	Data will vary, but the temperature will increase over time.		
2			
3			

Total time that water spent running through solar energy collector: _____

Record your data for the hot plate below.

Time (min)	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0
Temperature	Data will vary, but the temperature will increase quickly.								

Make sure beginning temperatures in both experiments are the same.

Name _____

Conclusions

1. What was the final water temperature using the solar collector?
Answers will vary. Students may see a 1–5 °C rise in the water temperature.

2. How long did it take the hot plate to heat the water to that temperature?
The electric heat source heated the water in a shorter period of time.

Asking New Questions

1. What are some of the benefits of using solar heating?
The benefits of using solar heating include: it is free except for equipment needed; it does not produce pollution; and there is an infinite supply.

2. What are some of the drawbacks of using solar heating?
Drawbacks include: it can take longer to heat with this method; it is less convenient; and the equipment is expensive.