

Heat from FRICTION

Topic
Friction

Key Question
What happens when you rub two objects together?

Learning Goal
Students will realize that rubbing two surfaces together produces heat.

Guiding Documents
Project 2061 Benchmark

- *People can often learn about things around them by just observing those things carefully, but sometimes they can learn more by doing something to the things and noting what happens.*

NRC Standards

- *Objects have many observable properties, including size, weight, shape, color, temperature, and the ability to react with other substances. Those properties can be measured using tools, such as rulers, balances, and thermometers.*
- *Heat can be produced in many ways, such as burning, rubbing, or mixing one substance with another. Heat can move from one object to another by conduction.*

Science
Physical science
heat
friction

Integrated Processes
Observing
Communicating
Comparing and contrasting

Background Information

Heat can be produced by friction. Two objects when rubbed together cause friction, a speeding up of the molecules in the objects. Friction is the force that opposes motion. Friction always changes work to heat. If you rub your palms together, you can feel heat caused by friction.

Materials with rough surfaces can create more friction and resulting heat than those with smooth surfaces. However, friction can be produced on smooth surfaces by rubbing them rapidly for a long time, but it will take longer than with rough surfaces and the resulting heat will be less.

Procedure

1. Write the word *friction* on the board and discuss that friction occurs when two objects are rubbed together. Tell students that heat is produced by friction.
2. Direct students to put their hands on their faces. Have them discuss how their hands feel.
3. Tell them to press the palms of their hands together and rub them fast and hard while they count to 30. Have them put their hands on their faces again. Ask them how their hands feel now. Why? [They are warmer because the friction created heat.]
4. Let the students' hands cool off and then repeat. Ask them if they got the same results.
5. Have the students rub their hands over their desks, on top of their jeans, over the surface of a book, etc. Each time, have them place their hands on their faces and describe what they feel.

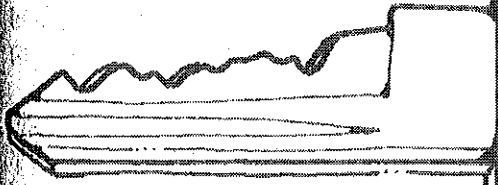
Connecting Learning

1. What is friction?
2. Name some ways that you can create friction.
3. Does it make a difference in the amount of heat produced if you rub your hands fast or slow? Explain.
4. Do we need friction? Explain. [Yes. It is friction that makes the brakes stop our bikes and cars. It is friction that keeps our shoes from slipping on the floor.]
5. How is friction used to stop motion?
6. What are you wondering now?

Extensions

1. Rubbing two inflated balloons together will create friction and heat. One balloon will eventually pop. Ask the students why rubbing the balloons together made one pop. [Because the friction between the two balloons made one balloon so hot that part of it melted.]
2. Try rubbing two sheets of fine sandpaper together. There will be enough heat produced that you will not want to put your hands on them.
3. Friction is often unwanted heat energy. Explain that machines with moving parts encounter friction when parts touch. Oil is added to reduce friction. Have the students repeat the *Heat from Friction* activity with lotion on their hands. How do the results differ?

Heat from FRICTION



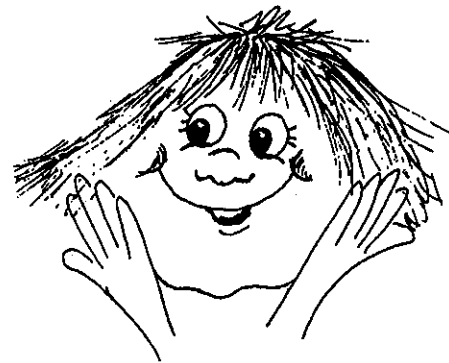
Key Question

What happens when you rub two objects together?

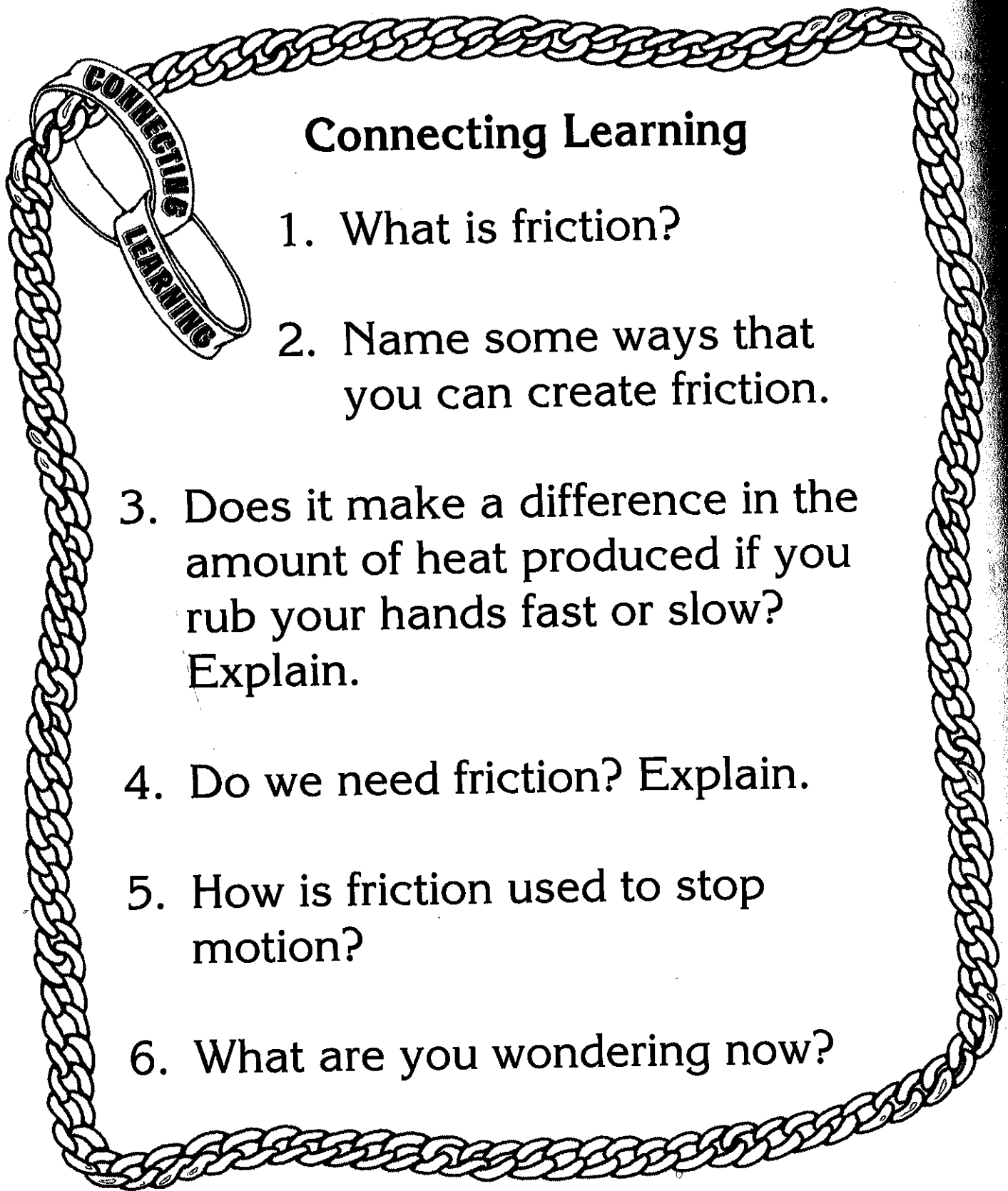
Learning Goal

Students will:

realize that rubbing two surfaces together produces heat energy.



Heat from FRICTION



Connecting Learning

1. What is friction?
2. Name some ways that you can create friction.
3. Does it make a difference in the amount of heat produced if you rub your hands fast or slow? Explain.
4. Do we need friction? Explain.
5. How is friction used to stop motion?
6. What are you wondering now?

Hot or Cold?

Topic

Skin's sensitivity to heat

Key Question

Is it possible for the skin to sense heat and cold temperatures reliably?

Learning Goal

Students will observe that the skin is not always a reliable sensor of temperature.

Guiding Document

Project 2061 Benchmarks

- *People can often learn about things around them by just observing those things carefully, but sometimes they can learn more by doing something to the things and noting what happens.*
- *Change is something that happens to many things.*
- *Describing things as accurately as possible is important in science because it enables people to compare their observations with those of others.*

Math

Measuring
time
temperature

Science

Physical science
heat energy
Life science
skin sensors

Integrated Processes

Observing
Comparing and contrasting
Communicating
Predicting
Drawing conclusions
Interpreting data

Materials

Hot and cold water
Three bowls
Paper towels

Background Information

The skin is one of the five main sense organs. The skin has five special skin senses; they are touch, pressure, heat, cold, and pain. The sense of touch informs us if things are rough, smooth, hard, or soft, etc. Messages are carried from the skin through nerves to the brain.

The skin senses heat and cold and reacts to it. When it becomes cold, the blood vessels in the skin will become smaller. Thus, less blood is able to enter the blood passages in the skin. More heat energy is kept inside the body.

When the skin becomes warm, tiny passages in the skin get larger. More blood is able to flow. More heat energy from the blood passes from the blood into the air and the body is cooled.

The skin adapts to many sensations.

Management

1. Be sure to have water at three distinct temperatures, cold, warm (room temperature), and hot. **CAUTION:** Don't make the hot water too hot to touch.
2. Discuss the sense of touch with the students.

Procedure

1. Discuss what sense organ is involved in feeling hot or cold temperatures.
2. Ask the students to describe what hot and cold means to them. Encourage them to use descriptive adjectives to explain the differences in temperatures.
3. Ask the students if water can be hot and cold at the same time?
4. Set out the three bowls.
5. Pour cold water into one bowl, hot water into another, and lukewarm water into the third.
6. Have a student put one hand in the hot water and one hand in the cold water. Leave them there for one minute.
7. Put the hand that is in the hot water into the lukewarm water. How does it feel—hot, cold, or lukewarm?
8. Put the hand from the cold water into the lukewarm water. Does the water feel the same as it did with the other hand?



by Barbara Aston and Myrna Mitchell
AIMS Research Fellows

Topic
Floating and Sinking

Key Questions

Which objects float in water? Which objects sink?

Learning Goals

Students will:

1. determine whether objects float or sink by placing them in water, and
2. discover whether vegetables float or sink before and after being cooked.

Guiding Documents

Project 2061 Benchmarks

- *People can often learn about things around them by just observing those things carefully, but sometimes they can learn more by doing something to those things and noting what happens.*
- *Describing things as accurately as possible is important in science because it enables people to compare their observations with those of others.*

NRC Standard

- *Classify materials that float/sink in water.*

*NCTM Standards 2000**

- *Pose questions and gather data about themselves and their surroundings*
- *Sort and classify objects according to their attributes and organize data about the objects*
- *Represent data using concrete objects, pictures, and graphs*

Math

Data analysis

Venn diagram

Science

Physical science

floating and sinking
matter

Integrated Processes

Observing

Predicting

Classifying

Collecting and recording data

Comparing and contrasting

Materials

Part One

- clear plastic cups
- ice cubes
- small rocks
- selection of items to sink/float
- Soup-er Journal*

Part Two

- assorted vegetables for soup
- additional ingredients for soup
(see *Management 3*)
- utensils to cut vegetables and cook soup
- paper/plastic bowls and spoons for eating soup
- AIMS Grouping Circles (see *Management 6*)
- Soup-er Journal*

Background Information

For primary students, simply observing objects floating or sinking is an important prerequisite to studies in upper grades about density, water displacement, and buoyancy. Observation encourages, and usually results in, new questions and extending the activities.

Management

1. Clear plastic cups are needed for *Part One* so that students can observe what happens when items are dropped into the water.
2. Use a variety of objects from your classroom for the float/sink trials.
3. Select vegetables for the soup depending on class allergies and preferences. Here is a suggested recipe:
12 cups of water
4 cups tomato juice
6 beef bouillon cubes
1 cup chopped onions
3 tablespoons salt
2 tablespoons Worcestershire sauce
3 teaspoons chili powder
6 bay leaves
Add chopped vegetables and simmer for 3 hours.
4. In addition to what is being used in the soup, bring one extra vegetable for each group of students to do the *Part Two* Venn activity. To reduce costs, set this up as a station and bring only one of each type of vegetable.
5. Although there is a single circle for the Venn activity on page three of the *Soup-er Journal*, space has been allocated to draw an overlapping circle for advanced students.

6. AIMS Grouping Circles are suggested for Venn diagram activities; however yarn pieces formed into circles will also work.

Procedure

Part One

1. Set out two clear plastic cups, each half-filled with water. Ask students to observe the cups. "What do you think will happen when we add ice cubes to one of the cups? Predict if they will sink or float."
2. Have one student come up and add some ice cubes to the first cup. "What happened?" [The ice floated.]
3. Direct students to look at the second cup of water. "What will happen if you drop some rocks into this water?" Have them predict if they will sink or float. "What happened?" [The rocks sank.]
4. Ask students to return to their groups. Give each group a clear cup half filled with water and have them select some small items from the classroom to put into the water.
5. Direct students to complete the first page of the *Soup-er Journal* by recording what happened when the ice and rocks were dropped into the water. Have them select two of the classroom items that they used and draw the objects either floating or sinking in the cups of water.

Part Two

1. Read or retell the story of *Stone Soup* (see *Curriculum Correlation*).
2. With help from adults, allow students to cut up the different vegetables. Before they add each one to the pot ask, "Do you think it will float or sink?"
3. Once the vegetables are in the pot, allow students to look and see if they float or sink. Ask students to record which vegetables sink or float on page two of the *Soup-er Journal*.
4. While the soup is cooking, have groups of students use raw vegetables, such as those placed in the soup pot, to sort and classify using a one- or two-circle Venn diagram. For example: "I have put some vegetables in the circle and some out of the circle. Can you guess how these are sorted and add more into the circle?" (Green vegetables in the circle, others out of the circle; tubers in the circle, non-tubers out of the circle; vegetables that float in the circle, others out.) Direct students to decide how they will sort their vegetables within their groups. For advanced students, use a two-circle Venn.
5. Direct students to record a Venn example on page three of the *Soup-er Journal*.
6. After the soup is cooked, have students predict which vegetables will float and which will sink.

7. With an adult supervising, allow each student to look in the pot and see which vegetables are floating and which have sunk to the bottom.
8. Give each student a small serving of the soup and a cracker to eat (see *Discussion 6*).

Discussion

1. What happened to the ice when you put it in the water? [It floated.]
2. What happened to the rocks? [They sank.]
3. What other objects did you put in the water? Which ones floated? Which ones sank?
4. Which vegetables floated before being cooked?
5. Were there any vegetables floating after the soup had cooked? If so, which ones?
6. If you put a cracker in your soup, will it sink or float? (Give each student a cracker with their soup and allow them to discover the answer.)
7. What are you wondering now?

Extension

Have students bring a piece of fruit from home to see if it sinks or floats. Test both the fruit and the peel (if it has one). Cut up the fruit to make a fruit salad for the class.

Curriculum Correlation

Literature

Gordon, Maria. *Float and Sink*. Thomson Learning. New York. 1995.

Heiligman, Deborah. *Mike Swan, Sink or Float*. First Choice Chapter Books. New York. 1998.

Kovacs, Susan and Rita Golden Gelman. *Splash! All About Baths*. Little Brown. Boston. 1987

McGovern, Ann. *Stone Soup*. Scholastic, Inc. New York. 1968.

Rowe, Julian and Molly Perham. *Keep it Afloat!* Children's Press. Chicago, IL. 1993.

Music



Using a familiar tune, such as *Row Row, Row Your Boat*, have the class create a float and sink song, possibly including the objects they tested. For example:

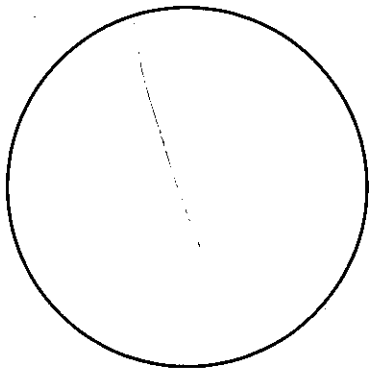
Take a few ice cubes,
Put them in a cup.
Add some water, slowly now.
They will float right up.

What about the rocks?
Tell me what you think.
Will they pop up like the ice?
No, they're going to sink!

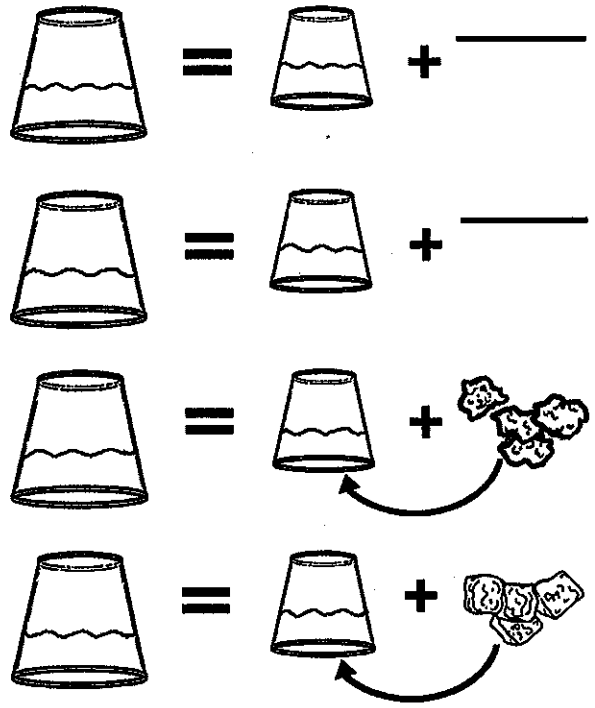
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Draw  and color  the vegetables in the soup that:



How did you sort your vegetables?



What sinks and what floats?

Soup-er Journal



Chef _____

Dress for the Weather

Topic

Weather changes

Key Question

How does the weather affect what we wear?

Learning Goals

Students will:

- observe and describe seasonal changes in weather, and
- decide how they should dress based on the weather.

Guiding Documents

Project 2061 Benchmarks

- *Change is something that happens to many things.*
- *Simple graphs can help to tell about observations.*
- *Some events in nature have a repeating pattern. The weather changes some from day to day, but things such as temperature and rain (or snow) tend to be high, low, or medium in the same months every year.*

NRC Standard

- *Weather changes from day to day and over the seasons. Weather can be described by measurable quantities, such as temperature, wind direction and speed, and precipitation.*

Science

Earth science
weather

Integrated Processes

Observing
Collecting and recording data
Interpreting data
Drawing conclusions
Generalizing

Materials

Set of *Dress for the Weather Cards*
Student *Dress for the Weather* book
Dress for the Weather Calendar
Camera (see *Management 3*)
Stapler
Scissors
Weather wear

Background Information

Most young children are unaware that people wear clothing for protection and adornment. Often students don't realize that what they wear is influenced by the weather. They just know that their parents make them wear something. They are often not aware that they have to wear a coat and long pants because it is winter and are allowed to wear shorts in the summer when it is warm. They usually become aware of what they are wearing when it is uncomfortable for one reason or another. For example, they want to wear shorts and no coat if they are warm. When they get cold, they want to put on a sweater.

In this activity, students will become aware of the influence that weather has on their clothing choices through discussion and charting of the daily weather. They will then be asked to choose an appropriate outfit for the day from their *Dress for the Weather* books.

Management

1. Make multiple copies of the *Dress for the Weather Cards* so that each child can glue down the picture to keep a record of the weather for one month.
2. Make one copy of the student *Dress for the Weather* book and calendar for each child.
3. Prior to teaching this lesson, take pictures of the students in the class wearing different weather gear. For example, shorts and a t-shirt, raincoat and boots, winter coat and long pants, etc. Note—when taking pictures of the children in your class, it is best to get parents' permission.
4. Make a copy of each of the pages from the *Dress for the Weather* book on transparency for procedure 7. Cut each page apart as directed.

Procedure

1. Engage the students in a discussion about the weather. Ask the class to describe the day's weather. If necessary, take the students outside to observe the weather.
2. Discuss how parents decide what the weather is going to be like today. [listen to the weather on television or radio, go outside to check the weather, etc.]
3. Ask the class to help you generate a list of words that are often used to describe the weather. [foggy, rainy, snowy, cloudy, sunny] Record these on the board or chart paper.

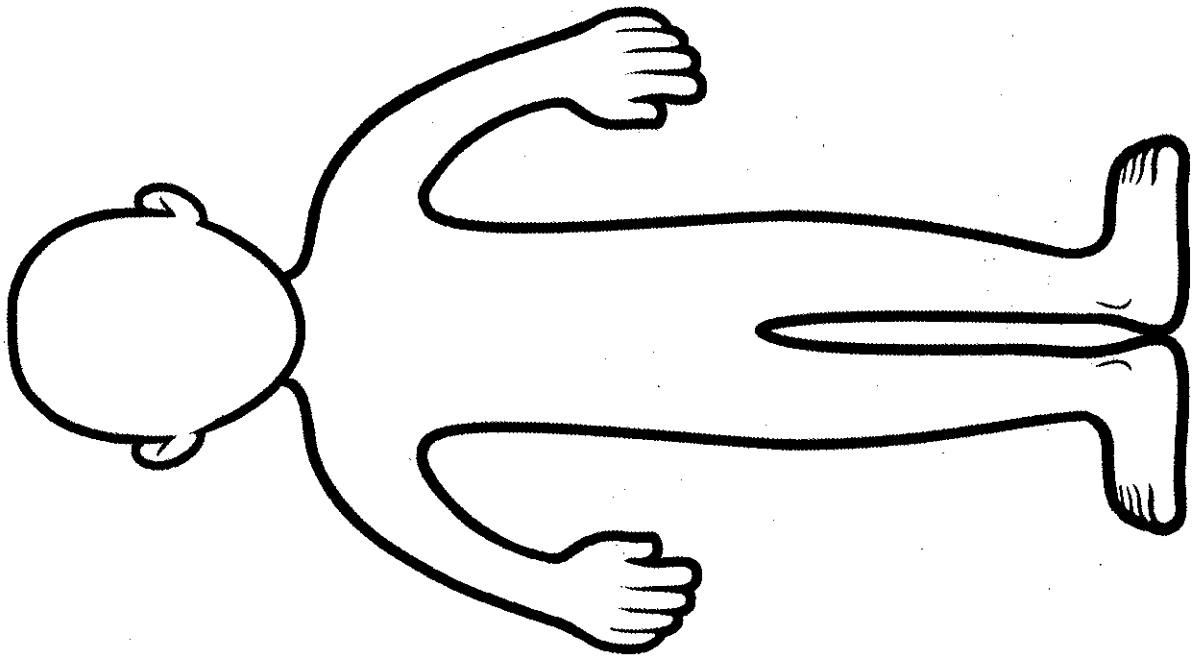
4. Ask the student how today's weather influenced what they are wearing.
5. Display the photos. Discuss the various outfits in the photos. Ask the students what type of weather each of the outfits would be appropriate for.
6. Tell the class that each day for the next several weeks they will be keeping a record of the weather. Explain that each day they will observe the weather, choose the weather card that best illustrates the day's weather, and glue the weather card onto the *Dress for the Weather* calendar.
7. Place a transparency copy of the winter jacket, boots, and long pants from the *Dress for the Weather* book on to the overhead. Ask the class what the weather would most likely be if they wore that outfit to school. Repeat several times using different clothing combinations.
8. When the students are familiar with the various clothing combinations, show them an assembled copy of the student book and demonstrate how you can flip the pages to reveal various combinations appropriate for different kinds of weather. Explain that the students will be making their own copies of the book and that each day as they record on their calendars, they will also show the appropriate clothing to wear in that type of weather using their flip books.
9. Distribute scissors and copies of the student book to each child. Assist the students with the assembly of their books. Ask the students to draw facial features and hair on the character.
10. When books are assembled, practice using the books by asking the class to show you what they should wear on a rainy day. Have the students compare their choice with their neighbors. Continue this procedure each day for a month.

Connecting Learning

1. What is the weather like today? How did you dress?
2. What should you wear when it is very hot outside?
3. What should you wear when it is very cold outside?
4. Why shouldn't you wear shorts in the winter?
5. Other than weather, what influences what we wear?
6. How might our *Dress for the Weather Calendar* be different in the summer? ...winter?
7. What are you wondering now?

Extension

Have the class sort the pictures by season, hot or cold temperature, etc.



by _____



