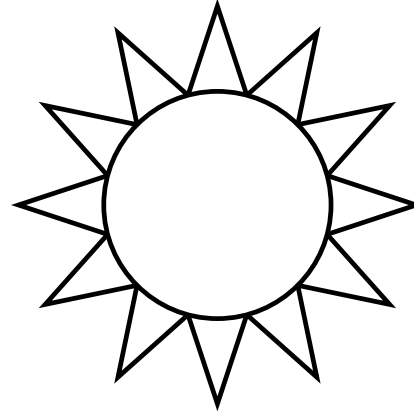


Lesson 5

The Sun Warms



Big Idea

Weather is measurable. The sun plays a role in weather.

A QUICK LOOK

Overview

The children turn their attention to the sun and think about its role in making weather. They focus on how sunlight both illuminates and warms. Children compare shady and sunny locations by measuring each location's temperature and observing how long it takes ice cubes to melt.

Key Note

- Choose a sunny, calm day for this lesson.
- Locate an outdoor area where the class has easy access to large sunny and shady spots on the same type of surface. Suggestions include a sidewalk on the sunny and shady sides of a building, or a field with a sunny center and edges shaded by trees.
- For more information about the science content of this lesson, see the "Sun and Weather" section of the Teacher Background Information.

Materials

Item	Quantity	Notes
ExploraGear Items		
Thermometers	2 per group	To measure the temperatures of shady and sunny spots.
Classroom Supplies		
Construction paper, black	2 sheets per group	To put under the bags of ice cubes.
Ice chest and ice pack	1	To keep ice cubes cold.
Ice cubes	2-3 dozen	To melt in sunny and shady locations.
Pencils	1 per child	To record observations.
Resealable plastic bags, large (gallon size)	2 per group	To hold melting ice cubes.
Curriculum Items		
<i>Weather Science Notebook, pages 7-9</i>		
Teacher Master "Note Recording Tool" (optional)		

NOTES

Preparation

- Assemble the items you need to bring outside for the activity:
 - Cooler and ice pack
 - Sheets of black construction paper (on a clipboard if you don't want them to blow away)
 - Pencils
 - Thermometers
- Pack the ice cubes, plastic bags, and an ice pack in the cooler. Make sure all of the ice comes from the same source, or has had enough time to reach the same temperature.

Vocabulary

shade A place protected from sunlight.

sunlight Light coming from the sun.

Teaching the Lesson

Engage

Introductory Discussion

1. Explain that the class will be going outdoors to explore the sunshine and weather.
2. Ask the children to think about what the sun or sunlight does for the earth. Write some words or ideas on the blackboard. (*Examples include: the sun shines in the sky, makes people hot in the summer, dries wet clothes, helps plants grow, makes daytime.*)

- Pose some of the following questions about the sun and weather.
 - What is the sun doing as part of today's weather? (*It makes the day bright, warm.*)
 - Where is the sun on a rainy day? (*Above the clouds.*)
 - What is different about rainy days besides the rain? (*Rainy days are darker because the clouds block some of the sunlight, and they are often cooler because less sunlight strikes the ground and warms it.*)
 - How does the weather change after sunset? (*Nighttime is dark and usually cooler because no sunlight strikes the ground to warm it.*)

Sensory Observation

+ SAFETY NOTE: Before you go outside, remind the children to never look directly at the sun. Looking at the sun can cause permanent eye damage.

- Take the children to the sunny and shady spots you selected and have them:
 - Explore the two different chosen spots.
 - Compare how the two places feel to the touch, what they look like, and how bright each one is. Can they feel the sunlight on their arms in both places? Can they make shadows in both places?
 - Answer the questions on page 7 of their science notebooks.
- Facilitate a brief discussion about what they've experienced.
 - What are the major differences between the two spots? (*The shade is less bright and generally cooler. It is harder to feel the heat of the sunlight on your arms or to make shadows in the shady spot.*)
 - What causes the differences? (*Less sunshine in the shade.*)
 - What causes the shade? (*An object is blocking the sunshine.*)
- Explore the children's ideas about which spot they would prefer on a warm day. Which would they prefer on a cold day? Why?


TEACHER NOTE: While unusual, it can feel warmer in the shade if the object making the shade is also blocking a refreshing breeze.

NOTES

Date: _____


Sunny and Shady

1. How does the sunny spot feel?





hot warm cool cold
(circle one answer)

2. How does the shady spot feel?



hot warm cool cold
(circle one answer)

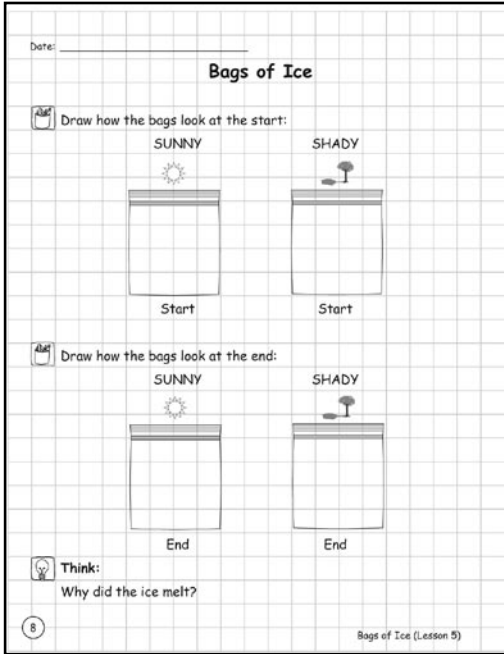
3. Which spot is brighter?

sunny shady
(circle one answer)

Sunny and Shady (Lesson 5) 7

Science Notebook page 7



Science Notebook page 8

 Explore

Melting Ice

Investigate the effect of direct sunshine on ice cubes.

1. Divide the class into groups. Give each group two thermometers, and two sheets of black construction paper.
2. Put two ice cubes in each of the resealable bags and pass out two bags to each group.
3. Instruct each group to do the following. Remind them that both locations should be on the same type of surface.
 - Place a piece of black construction paper in the middle of a nearby sunny spot and put one of the bags of ice on it.
 - Quickly place the other piece in the middle of a nearby shaded spot and put the other bag of ice on it.
 - Draw a picture of how the ice in each bag looks on science notebook page 8.

TEACHER NOTE: The black construction paper absorbs the sunlight and partially insulates the bags from any heat radiated by the surface under the bags. The sunlight, not the radiated heat, should be the main factor in melting the ice.

Measuring Temperature

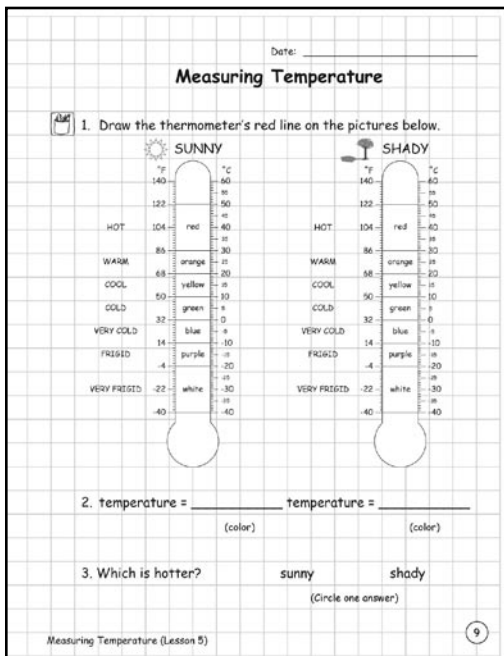
1. Direct the groups to measure the temperatures of the sunny and shady locations by placing one thermometer on top of each sheet of black construction paper.
2. Have the children answer the questions on page 9 of their science notebooks.

TEACHER NOTE: To get accurate readings, the thermometers should remain on the ground for at least a minute and should stay there while the children take readings.

Returning to the Ice

When the ice in the sunny location has melted, instruct the children to draw what the bags in each location look like on science notebook page 8.

MANAGEMENT NOTE: If things went too quickly (if the ice in the shade completely melted), consider repeating the experiment and watching it more closely to catch the time when the sunny bags are different from the shady bags. If things went too slowly (if all the ice in the sun is still un-melted), consider doing one of the Further Science Explorations while the experiment continues. Bring the children back later to check the ice and record the results.



Science Notebook page 9

Reflect and Discuss

Sharing

Use this discussion to consolidate the children's understanding of how the sun provides heat and light to Earth.

1. Based on what the children saw and measured during the exploration, ask them to conclude the following:
 - Whether it was warmer in the sun or in the shade
 - Whether it was brighter in the sun or in the shade
2. Have the class compare how quickly the ice melted in the sun, with how quickly it melted in the shade. Ask why they think the ice melted faster in the sunshine. (*The air and the ground were warmer in the sunshine.*)

TEACHER NOTE: There are three main reasons why the ice melted faster in the sunshine: (1) The surface in the sunny area absorbed more sunlight and is warmer than the surface in the shady area. One of the purposes of the black construction paper is to partially insulate the bags of ice from this effect. (2) The ground warms the air above the sunny spot, so it is warmer than the air above the shady spot. (3) The sunlight warms the ice cubes directly. Another purpose of the black construction paper is to enhance this effect.

3. Discuss how things are different in the shade by asking some of the following:
 - What happened to the ice in the shade? (*It melted more slowly.*)
 - How does it feel on a sunny day to have a cloud shadow move over and then away again? (*It feels cooler and seems darker while the cloud is overhead.*)
 - How do clouds make shadows? (*They block the sunlight.*)
 - What does a cardboard shade in a car's windshield do? (*It blocks the sun and makes the car cooler.*)
 - What is shade? (*It is where the sun's light can't reach or is blocked.*)
4. Ask the children how sunlight affects the weather. (*It affects how hot or cold a day is; it explains why days are hotter than nights, why summers are hotter than winters, and why some sunny days are warmer than some cloudy days.*)

NOTES

Materials: Two or three lamps with focused beams, or flashlights.

Ongoing Learning

Science Center

Set up two or three lamps with focused beams or flashlights to illuminate an area from slightly different directions at the same time. Let the children place an object in the illuminated area to create multiple shadows. Most of the shadows will be faint, but overlapping shadows will be darker. (The best results happen when the lamps are shining at a low angle, or almost horizontally, toward the area being illuminated, and are less than 45 degrees apart.) If the children have mastered the skill of reading temperatures using the Celsius scale or the Fahrenheit scale, or both, have them place the bulb of the thermometer in the different shadows to see if they can find the coolest one.

Extending the Lesson

Further Science Explorations

Air Temperature versus Surface Temperature

After the children measure the temperature on the surface in a sunny and a shady spot, have them measure the temperature of the air in the sunny and shady spots. Have the children determine whether:

- The temperature of the air and the surface are the same in each spot (*No, the surface in the sunny spot will be hotter than the air. It is the surface that absorbs the sunlight and heats up. Once it is hot, it then transfers some of its heat to the air.*)
- The temperature of the air is the same in both spots (*Maybe. If there is a breeze, the wind mixes the air and produces a mostly uniform temperature. If conditions are calm, the air above the sunny spot should be warmer, especially if measured close to the surface.*)

Shadow Gaze

Bring the class together in a circle in the large sunny area. Explore these concepts about shadows:

- Where are their shadows? Who has their shadow in front of them and who has their shadow behind them? (*Within the circle, some shadows will be to the children's sides, some behind, and others in front of the children that cast them.*)
- Why are some children's shadows in front, some behind, and some beside them.
- What determines the direction of the shadows? (*The shadows always point away from the sun.*)

Art Extension

Tracing Silhouettes

Let pairs of children make shadow silhouettes with these directions:

1. Lie down on a piece of butcher paper.
2. Have a partner trace your body's outline.
3. Let the partner trace the outline of their shadow around the outside of your body's outline.
4. Paint the space between your silhouette and the shadow silhouette.

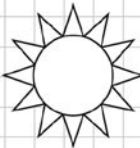


Science Notebook page 7

Date: _____


Sunny and Shady

1. How does the sunny spot feel?





hot warm cool cold
(circle one answer)

2. How does the shady spot feel?



hot warm cool cold
(circle one answer)

3. Which spot is brighter?

sunny shady
(circle one answer)

Sunny and Shady (Lesson 5) 7

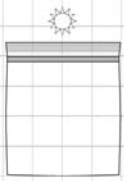
Science Notebook page 8

Date: _____

Bags of Ice

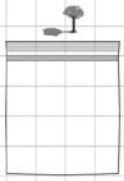
Draw how the bags look at the start:

SUNNY



Start

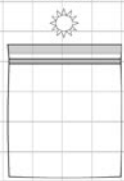
SHADY



Start

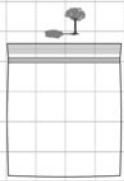
Draw how the bags look at the end:

SUNNY



End

SHADY



End

Think:
Why did the ice melt?

8 Bags of Ice (Lesson 5)

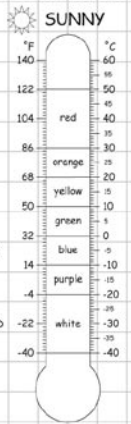
Science Notebook page 9

Date: _____


Measuring Temperature

1. Draw the thermometer's red line on the pictures below.

SUNNY



SHADY



2. temperature = _____ temperature = _____
(color) (color)

3. Which is hotter? sunny shady
(Circle one answer)

Measuring Temperature (Lesson 5) 9

