



Shadow Time Lesson Plan

Overview: In this lesson, students learn about and experiment with shadows.

Grades: Preschool and K-2

Length of Lesson: Approximately 45 minutes

Related Video: "Sick Day" episode

Learning Goals:

After completing this lesson, students will be able to:

- Describe what a shadow is.
- Understand that larger objects make larger shadows and smaller objects make smaller shadows when the objects are placed the same distance away from a light source.
- Explain that if an object moves closer to a light source, its shadow becomes larger.
- Make predictions about what will happen in an experiment.
- Discuss how shadows are formed.
- Discuss observations about shadows cast by objects indoors, as well as outside.
- Compare and contrast different results.

Related Goals from the Space Racers™ Curriculum:

Scientific Inquiry -

Exploration and Investigation: We obtain information and learn about the world through exploring objects and investigating how things work. Conducting scientific investigations, engaging in hands-on experiences, and asking open-ended questions can foster greater conceptual understanding of our world.

- Explore new things as a way to broaden one's understanding of the world.
- Form theories/hypotheses/predictions to explain how and why things happen.
- Design and carry out simple cooperative investigations that apply learning from past experiences and support new discoveries.
- Discuss the findings of investigations.

Observation: Looking carefully is one way to learn about things around us.

- Take note of a variety of properties and describe as accurately as possible (e.g., number, shape, size, length, color, texture, weight, motion, temperature, other physical characteristics, etc.).
- Scan/analyze an object or event from multiple positions in order to capture different perspectives.
- Make comparisons to identify similarities and/or differences.
- Inspect/investigate in detail in order to sort, group, classify, or sequence according to size or other characteristics.
- Develop questions and predictions based on observations.
- Communicate findings verbally or by using pictures, graphs, charts, and/or representations.

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Related Goals from the Space Racers™ Curriculum (continued):

Experimentation: Sometimes more can be learned by actually doing something to things and taking note of what happened. We use scientific testing and experimentation to seek reasons and evidence in an attempt to prove or disprove our ideas and hypotheses, to discover new information, and to draw conclusions.

- Form hypotheses/make predictions using prior knowledge and past experiences.
- Perform tests and observe any new findings.
- Collect data: e.g., ask questions, make observations, perform simple measurements using standard and/or non-standard units of measure, make estimations, etc.
- Describe things as accurately as possible in terms of their number, shape, texture, size, weight, color, motion, etc.
- Draw conclusions/discover new information; compare conclusions to original hypotheses.
- Communicate findings using pictures, graphs, charts, representations, and/or words.
- Model safe behaviors while experimenting.

Materials:

- one or more flashlights (or flashlight app on a phone or mobile device), overhead projectors or other bright light sources
- ruler
- masking tape
- large sheets of paper (to tape on the wall and draw the outline of someone's shadow)
- markers or crayons
- props to represent the sun, Mercury, and an obstacle course (for activity 4). Suggestions: a flashlight or other light source for the sun, a ball for Mercury and a rectangular block for the obstacle course
- computer with internet for the "Sun, Light and Shadows" interactive (www.sciencekids.co.nz/gamesactivities/lightshadows.html) in the wrap-up activity (optional)

Prep:

- Gather all the materials in the materials list.
- Review the "Sun, Light and Shadows" interactive (www.sciencekids.co.nz/gamesactivities/lightshadows.html) for use in the wrap-up activity if desired.

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Lesson Activities:

Activity 1: Introducing Shadows

1. Explain that today you will be exploring shadows and conducting different experiments with shadows. Ask students what a shadow is. (*A dark shape that appears when something moves between the surface and a source of light.*)
2. Ask students to discuss where and when they have seen shadows before.
3. Ask students what they think might cause a shadow to form. (*When there is a bright light source and something or someone moves in front of it.*)
4. Explain that today you will be conducting shadow experiments.
5. Ask for two students, who are not the same height, to come to the front of the class. Ask students to predict who will have the taller shadow. Ask students to explain their predictions.
6. Place a long strip of masking tape on the floor a few feet from a blank wall or screen. (The masking tape should be parallel to the wall.) Have the students stand on the masking tape. Shine a light on the two students, so that they are between the light source and the wall (and the light source is the same distance from each). Ask the class whose shadow is taller.
7. Pick another student and have the class to predict how the height of his/her shadow will compare with the first two. Once students have made their predictions, have the third student stand next to the other two on the masking tape line. Have the rest of the class observe and compare the three shadows.
8. Ask students what they notice about the size of the shadows. (*The taller the person, the taller the shadow.*)
9. Have more students line up between the light source and the wall/screen (so that they are all standing next to each other on the masking tape) and ask them to line up in the order of smallest shadow to tallest shadow. Once they have arranged themselves in order of shadow size, ask students to make an observation about the sizes of shadows. (*Taller people have taller shadows.*)
10. Repeat step 9 with so that all students in the class get a chance to observe and discuss their shadows.

Activity 2: Experimenting with Shadows

1. Have one student stand in front of the class between the light source and the wall/screen. Ask the class how the student could increase the size of his/her shadow. Test that idea. If the first attempt at increasing the size of the shadow doesn't work, have students brainstorm another approach. Have students experiment with different ideas until they come up with the solution. (*Decreasing the distance between the student and the light source.*)
2. Ask students to hypothesize how they could make someone's shadow get smaller. Have them test their hypothesis. If they do not succeed, have them try again until they come up with the solution. (*Increasing the distance between the student and the light source.*)
3. Discuss what makes the shadow get bigger and smaller. (*The closer the person is to the light source, the bigger the shadow. The further the person moves away from the light source, the smaller the shadow.*)
4. Have students experiment with making their shadows larger and smaller by moving the light source closer to them and moving it away from them. If you can't move the light source, have the children move closer to and further away from the light source.

Note: When conducting these experiments, make sure students don't look directly into the light.

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Activity 3: Drawing Shadows

1. Divide your students into groups of three students each. Tape large sheets of paper onto the wall. Select one group and assign the group members to the following roles: “model,” “artist” and “light provider.”
2. Hand the light provider a flashlight or other bright light source. Have the model stand between the light provider and a wall/screen. Have the light provider shine the light on the model.
3. To start, have the model stand very close to the wall, where a large sheet of paper is hanging. Place a piece of masking tape down on the floor next to that spot and label it “1.” Have the model hold up his/her hand so that the shadow of the hand is projected on the paper.
4. Give the artist a marker, crayon, or pencil and instruct him/her to draw the outline of the shadow of the model’s hand onto the paper. Have the artist put a “1” next to that outline. Then instruct the model to take a few steps closer to the light source (and away from the wall) and then place a piece of masking tape on the ground next to where he/she is standing and label it “2”). Have the model hold his/her hand up again and have the artist draw the outline of the shadow on the paper and put a #2 next to it. Then have the model step a few feet closer to the light source and away from the wall and place another piece of masking tape on the ground and label it “3. Then have the artist draw the outline of the shadow and put a #3 next to it. (Note: To make the different outlines stand out more, the artist could do each one in a different color.)
5. Have the group members observe the different hand outlines and discuss how the size of the shadow changed as the hand got closer to the light source.
6. Have the students switch roles so that everyone gets a turn at being a light provider, model and artist.
7. Depending on how many flashlights, students, and space you have in your classroom, you could either have one group do this at a time, with the rest of the class observing or have all the groups conduct their drawings simultaneously, each one drawing on a separate piece of paper for each model.
8. *Fun Option:* Have each group use a separate sheet of paper for each distance (distance 1, 2, and 3), rather than a separate sheet of paper for each model. For example, for distance “2” have the three members of a group, take turns being their model and having their hand shadow drawn onto the same large sheet of paper. Each group should use a different color crayon or marker for each model. This way, students can compare the shadows of each model on the same sheet of paper.

Activity 4: Sick Day

1. Let your students know that in the Space Racers™ episode “Sick Day,” one of the Space Racers helps his friend and teachers by making an important discovery that involves a shadow.
2. View the Space Racers “Sick Day” episode to find out what discovery the Space Racer makes.
3. After watching the episode, ask your students to describe what Eagle discovered. (*Mercury was going to cast a shadow on the obstacle course where the Space Racers were testing their solar engines.*)
4. Using props to represent the sun, Mercury and the obstacle course, place “Mercury” between the sun and the obstacle course, very close to the “sun.” Ask students to observe and discuss what they see. Ask students to describe what happens when Mercury goes between the sun and the obstacle course. (*It creates a shadow on the obstacle course.*)
5. Ask students why it was important for Eagle to send his message about the shadow. (*Because Mercury was going to cast a shadow on the obstacle course and prevent the sun from shining on the Space Racers and powering their solar engines.*)

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Activity 5: Outdoor Shadows

1. Go outside and observe the shadows that you and your students make.
2. Compare the shadows of different-sized objects (trees, animals, people, houses, fire hydrants, light poles, etc.) Observe what objects make the biggest shadows and what make the smallest shadows.
3. Repeat these observations at different times of the day.
4. Observe and discuss how the shadows are different at different times of the day.
5. Encourage students to observe their shadows outside at night with their families.

Wrap-up:

1. Discuss some facts you learned about shadows.
2. Optional: Explore the “Sun, Light and Shadows” interactive (www.sciencekids.co.nz/gamesactivities/lightshadows.html) on the Science Kids website with your students and do the following:
 - Try to make the shadow of the featured object bigger. (*Move the light source closer to the object.*)
Note: The interactive requires you to complete this step before you can continue to experiment with different objects and settings.
 - Experiment with moving the light source closer and further away from the featured object.
 - Click on one of the red arrows to select a new object and drag it up onto the image. Compare the different shadows cast by different objects.
 - Experiment with the “Outside” setting and drag the sun from east to west and observe how the shadows change. Select a new object by clicking on one of the red arrows and dragging the object up onto the image. Compare the different shadows cast by the different outdoor objects.
 - Click on the moon and drag it from east to west and observe the changing shadows.
3. End the lesson by having your students conduct their own shadow show. Project a bright light onto a wall or screen in your classroom and have students make shapes, patterns, animals, “shadow monsters,” etc. with their fingers. Encourage them to move their hands closer to and away from the light source to see how their creations change in size. Encourage them to make voices for their shadow monsters, animals, etc.