

Sunshine and Shadows

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About **Sunshine and Shadows**

DeltaScienceModules, THIRD EDITION

Students explore shadows from every possible angle. They begin with a simple definition of *shadow* and end with a full-fledged original performance in a shadow theater. Once students identify what is needed to make a shadow—a light source, a solid object, and a surface—they are off and running. In both indoor and outdoor activities, students make predictions about how shadows change position, size, and length, and even become multiples or disappear. From their experiments they draw conclusions about the variables, such as the sun’s movement, that affect shadow shapes. They create silhouettes to explore shadow properties. And they build sundials to put shadows to work telling time.

In the Delta Science Reader *Sunshine and Shadows*, students read about the world of light and shadows. They learn about how shadows are formed and why shadows change size and shape. They find out about different sources of light and identify kinds of objects that block light to make a shadow. They also read about the job of a meteorologist, a scientist who studies and forecasts weather—sunny and otherwise. Finally, students learn how sundials use sunlight and shadows to tell the time.

Overview Chart for Hands-on Activities

Hands-on Activity	Student Objectives
1 What Is a Shadow? <i>page 13</i>	<ul style="list-style-type: none"> • observe and describe a shadow • define a shadow • identify the three things needed to produce a shadow
2 Shadow Drawings <i>page 19</i>	<ul style="list-style-type: none"> • learn the correct order of the three things necessary to produce a shadow • identify a silhouette • make silhouettes of their hands • compare their hand-silhouettes with their actual hands and note their similar shapes
3 What Makes a Shadow? <i>page 27</i>	<ul style="list-style-type: none"> • note that light passes through some objects and not others • predict whether certain objects will produce shadows or not • observe that objects produce light shadows, dark shadows, or no shadows, depending on how much light they allow to pass through them
4 Shadows Change Places <i>page 33</i>	<ul style="list-style-type: none"> • record the changes in the position of a shadow from morning to midday to afternoon • note changes in the sun's position in the sky during the course of a day • infer that shadow changes are caused by changes in the sun's position in the sky
5 Shadow Opposite Light <i>page 43</i>	<ul style="list-style-type: none"> • observe outdoor shadows and note which side of the object the shadows fall on in relation to the sun • observe indoor shadows and note the change in their position when a light source is moved • conclude that a shadow always falls opposite the light source that creates it
6 A Shadow Clock <i>page 49</i>	<ul style="list-style-type: none"> • recall that shadows change as the sun's position in the sky changes • learn that changes in shadows can indicate the time of day • make a simple sundial • use the sundial to tell time
7 A Separate Shadow <i>page 57</i>	<ul style="list-style-type: none"> • predict the movement of a discrete shadow at different times of the day • observe and record the movement of that shadow at different times of the day • conclude that the shadow moves as the sun's position in the sky changes
8 Shadows Big and Small <i>page 65</i>	<ul style="list-style-type: none"> • create and describe shadows of different shapes and sizes • explore ways to increase the size of a shadow • explore ways to decrease the size of a shadow • infer that shadow size depends on the distance between an object and its light source
9 Shadows Long and Short <i>page 71</i>	<ul style="list-style-type: none"> • create shadows of different lengths by changing the position of a light source • tell how shadows are made longer or shorter • infer that shadow length depends on the angle at which light shines on an object
10 Disappearing Shadows <i>page 77</i>	<ul style="list-style-type: none"> • experiment with a flashlight to see if it is possible to make a shadow disappear • predict at what time of day there will be almost no shadows outdoors • observe that when the sun is high in the sky, there are almost no shadows outdoors • discover that their own shadows disappear when they stand within a larger shadow
11 Shadows from Two Lights <i>page 83</i>	<ul style="list-style-type: none"> • observe that two light sources can be used to make shadows disappear • discover that two light sources can also create two shadows for an object • create multiple shadow arrangements using two light sources
12 Shadow Plays <i>page 89</i>	<ul style="list-style-type: none"> • use their hands to create shadows that look like animals and other objects • create shadow puppets by gluing cutouts to a stick • create a shadow play featuring their puppets and hand characters
Assessment <i>page 97</i>	<ul style="list-style-type: none"> • See page 97.

Sunshine and Shadows

Process Skills	Vocabulary	Delta Science Reader
observe, define based on observations	shade, shadow	pages 2–5, 12–13
communicate, compare	silhouette	pages 4–5, 10, 11
compare, predict, observe, classify		pages 4–7
collect, record, display, or interpret data, infer	sun	pages 8–9, 12–13
observe, collect, record, display, or interpret data	opposite	pages 6–7
communicate, make and use models, use variables	sundial	pages 14–15
predict, observe, infer		pages 8–9, 15
communicate, experiment, use variables, infer		pages 8–9, 15
observe, communicate, infer	length	pages 8–9, 15
experiment, predict, observe		
observe, experiment, use variables		page 10
make and use models, communicate	shadow play	page 11

See the following page for the Delta Science Reader Overview Chart.

Overview Chart for Delta Science Reader

Sunshine and Shadows

Selections	Vocabulary	Related Activity
Think About . . .		
What Is Sunshine? <i>page 2</i>	light, object, sun, sunshine	Activity 1
What Is a Shadow? <i>page 4</i>	block, shadow <i>optional: surface</i>	Activities 2, 3, 5
How Do Shadows Change? <i>page 8</i>	<i>optional: opposite</i>	Activities 4, 7, 8, 9
Other Kinds of Light <i>page 10</i>		Activities 2, 11
What Object Made the Shadow? <i>page 11</i>		Activities 2, 12
People in Science		
• A Meteorologist <i>page 12</i>		Activities 1, 4
Did You Know?		
• About Time and the Sun <i>page 14</i>		Activity 6

See pages 105–112 for teaching suggestions for the Delta Science Reader.

MATERIALS LIST

Sunshine and Shadows

Quantity	Description	Quantity	Description
32	batteries, C-cell*	TEACHER-PROVIDED ITEMS	
1	cards, index, blank, p/100*	8	bags, clear, plastic, reclosable
1	chalk, assorted, p/12*	8	books
16	chalk, blue, large*	1	box, cardboard
16	chalk, red, large*	32	crayons or markers
16	chalk, yellow, large*	-	extension cords (optional)
2	clay, modeling, 0.25 lb	-	objects, assorted, for casting shadows
16	cones, foam	8	paper, chart
16	disks, foam	2	paper, construction, black
8	dowels, wooden, thick	4	pennies
64	dowels, wooden, thin	-	poem, "My Shadow," Robert Louis Stevenson
16	flashlights	32	scissors
1	glue, white, 4 oz*	64	stickers, small
8	light bulbs, frosted, 60-watt	32	stones, medium
8	light sources	-	string
1	Lincoln Profile Silhouette	-	watch (optional)
2	paper, construction, white, p/50*	-	water, tap
1	plastic wrap*		
1	ring, foam		
1	tape, masking*		
8	tumblers, plastic		
1	waxed paper*		
1	Teacher's Guide		
8	Delta Science Readers		
1	Delta Science Reader Big Book		

* = consumable item

† = in separate box

ACTIVITY SUMMARY

In this Delta Science Module, students are introduced to the world of shadows.

ACTIVITY 1 Students go outdoors on a sunny day and explore their shadows. They identify three things needed to produce a shadow: sunshine, an object to block the light, and a surface on which the shadow is cast.

ACTIVITY 2 Students work indoors with an artificial light source. They make silhouettes of their hands and then compare them to their actual hands, noting the similarity in the shapes. They discuss the correct order of the three things needed to produce a shadow.

ACTIVITY 3 Students discover that not all objects cast shadows. They observe that light passes through some objects and not others and that some objects produce dark shadows while others produce light shadows. They discover that if light passes through an object, the object will produce no shadow or only a light shadow, whereas if light cannot pass through an object, the object will produce a dark shadow.

ACTIVITY 4 Students go outside and observe that shadows change over time. They record the changes in a shadow from morning to midday to afternoon and infer that some shadow changes are caused by changes in the position of the sun.

ACTIVITY 5 Students survey outdoor shadows and note which side of objects the shadows fall on, relative to the sun. They then create indoor shadows and conclude that a shadow always falls opposite the light source that creates it.

ACTIVITY 6 Students construct a simple shadow clock, or sundial. They position an upright stick in the center of a sheet of chart paper and trace the position of the shadow it casts at several times throughout the day.

ACTIVITY 7 Students observe and record the movement of a discrete shadow at different times of the day. After the second observation, they predict the direction of movement of the shadow. They discover that a shadow moves as the sun's position changes.

ACTIVITY 8 Students observe shadows of different sizes. Then, working with just one shadow, they experiment with ways to change the size of the shadow. In this way, they learn the relationship between shadow size and distance between the object and light source.

ACTIVITY 9 Students experiment with the length of shadows. This time they hold a flashlight in different positions all around an object, thus varying the angle at which the light source shines on the object. By doing so, they discover the relationship between shadow length and incoming light angle.

ACTIVITY 10 Students investigate the circumstances under which a light source does not produce a shadow. Students use a flashlight to make an indoor shadow disappear, and observe the location of the sun when there are almost no shadows outdoors. Students also show that their own shadows disappear when covered by a larger shadow.

ACTIVITY 11 Students investigate shadows with two light sources and explore ways to create multiple shadows. They observe that two light sources can also be used to make shadows disappear.

ACTIVITY 12 Students use their knowledge of shadows to create shadow characters and shadow puppets. Using the puppets and hand shadows, they create an original shadow play.