

How Do Shadows Move in Space?

Objectives

Students name objects found in this solar system, explain how the objects move, and describe the force that moves them.

Students model and assemble a mobile composed of solar system components.

Grades 3-6 students create oil pastel shadow-motion drawings generated from the moving shadows of the mobile forms.

Multiple Intelligences

Interpersonal

Naturalist

Spatial

What Does It Mean?

Mobile: type of sculpture consisting of carefully equilibrated parts that move in response to air currents

Stabile: abstract sculpture, resembling a mobile but with no moving parts

National Standards

Visual Arts Standard #2

Using knowledge of structures and functions

Visual Arts Standard #5

Reflecting upon and assessing the characteristics and merits of their work and the work of others

Visual Arts Standard #6

Making connections between visual arts and other disciplines

Science Standards

Unifying Concept and Process

Form and function

Science as Inquiry

Abilities to do scientific inquiry

Physical Science

Grades K-4

Positions and motion of objects

Grades 5-6

Motions and forces

Background Information

Our solar system consists of the sun, eight planets, and various other celestial bodies. The sun is the center of our solar system and the planets orbit around it due to gravitational forces. Celestial bodies have unique characteristics. For example, from outer space the Earth looks like a marble in motion. Its surface is covered with various hues of blues, browns, and greens as well as white.

Sometimes one celestial body blocks the light of the sun from another. This creates a shadow called an eclipse. A lunar eclipse occurs when the Earth casts its shadow on the moon. Occasionally the moon blocks the light of the sun from the Earth. When this happens we experience a solar eclipse.

Resources

Alexander Calder and His Magical Mobiles by Jean Lipman with Margaret Aspinwall

Text and illustrations bring to life the works of this 20th-century inventor of mobile and stabile sculptures. Includes 40 full-color illustrations. A series of flip photos shows one of the artist's mobiles in action. All ages.

Destination: Jupiter by Seymour Simon

An exploration of the largest planet and its four moons. Close-up illustrations appeal to all ages.

Hand Shadows and More Hand Shadows by Henry Bursill

Illustrations show how to create 34 moving figures with the shadows cast by hands and fingers. All ages.

Our Solar System by Seymour Simon

An elementary introduction to the solar system for ages 4 through 8. Includes full-color photographs of planets, moons, asteroids, meteoroids, comets, and the sun.

Vocabulary List

Use this list to explore new vocabulary, create idea webs, or brainstorm related subjects.

- Science
 - Astronaut
 - Axis
 - Celestial
 - Eclipse
 - Force
 - Gravity
 - Lunar
 - Moon
 - Motion
 - Orbit
 - Visual arts
 - Armature
 - Balance
 - Form
 - Hue
 - Light
 - Mobiles
 - Model
- | | |
|----------------|--------------|
| Phases of moon | Revolve |
| Planets | Rotate |
| Saturn | Shadow |
| Uranus | Solar system |
| Neptune | Space |
| Jupiter | Stars |
| Mars | Suns |
| Earth | Waning |
| Venus | Waxing |
| Mercury | |
- | | |
|----------|-------------------|
| Movement | Suspend |
| Sphere | Three-dimensional |
| Stables | Weight |



Artwork by students from College Oaks Elementary School, Lake Charles, Louisiana. Teacher: Bobbi Yancey



Artwork by students from College Oaks Elementary School, Lake Charles, Louisiana. Teacher: Bobbi Yancey



Artwork by students from Mount Prospect Elementary School, Basking Ridge, New Jersey. Teacher: Susan Bivona



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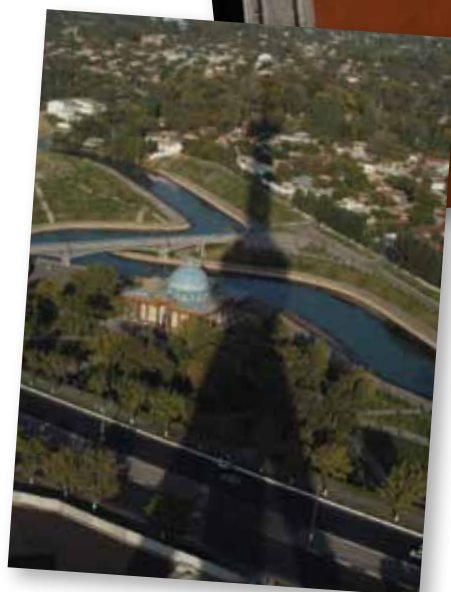
	K-2	3-4	5-6
Suggested Preparation and Discussion	<p>Display a map or model of the solar system. Identify the sun as the center of our universe. Explain how everything else is in motion around it.</p> <p>Point out and name the eight planets. Explain how the planets, their moons, comets, asteroids, and other space objects revolve around the sun. Identify gravity as the force that keeps planets in orbit around the sun, and the moon in orbit around the Earth.</p> <p>Demonstrate how the Earth rotates on its axis.</p>		<p>Post a map of the solar system. Ask students to name the planets and review how the solar system works. Identify gravity as the force that keeps planets in orbit around the sun, and the moon in orbit around the Earth.</p>
	<p>Collect and display NASA photos of celestial bodies with shadows cast upon them. Include photos of solar and lunar eclipses such as those shown here. Explain how an eclipse occurs. Ask students if they think that astronauts can observe moving shadows in space.</p> <p>Discuss shadows and how they are made. Experiment with shapes and shadows using a projector and assorted objects. Demonstrate sample figures shown in <i>Hand Shadows and More Hand Shadows</i>.</p> <p>Demonstrate how to create a balanced solar system mobile.</p>		
Crayola® Supplies	<ul style="list-style-type: none"> • Glitter Glue • Model Magic® • Paint Brushes • School Glue • Tempera Paint 		
		<ul style="list-style-type: none"> • Oil Pastels 	
Other Materials	<ul style="list-style-type: none"> • Brown rolled craft paper • Overhead projector (use with adult supervision) 		
	<ul style="list-style-type: none"> • Paper clips • Paper towels • Recycled newspaper • Sticks, twigs, or dowels • String, yarn, or ribbon • Water containers 		
Set-up/Tips	<ul style="list-style-type: none"> • Ask families to help collect sticks for mobiles. • Recruit parent volunteers to assist groups of younger students with mobile construction. • Demonstrate how to model simple celestial forms that reflect the colors, lines, patterns, and shapes observed in the NASA photos. • Cover painting surface with recycled newspaper. • Set up a workstation where students can hold each other's mobiles to cast shadows on craft paper. 		




Grille Shadows
 Ismael Samani
 Mausoleum
 Early 10th Century
 Bukhara, Uzbekistan
 Photo by J. McCracken



Lantern Shadows
 Mexico
 Photo by Erica Simon-Brown



TV Tower Shadow
 Tashkent, Uzbekistan
 Photo by J. McCracken

	K-2	3-4	5-6
Process: Session 1 20-30 min.	Create the mobile 1. Working cooperatively in small groups, students model solar system components. Include stars, asteroids, comets, and meteoroids as well as planets. Embed glue-covered paper clips deeply into the forms for hanging. Air-dry 24 hours.		
Process: Session 2 10-15 min.	2. Paint the forms. Air-dry the paint.		
Process: Session 3 20-30 min.	3. Thread and then loosely tie the forms together on stick armatures. 4. Work collaboratively to assemble mobiles. Experiment with weight and adjust string lengths to balance pieces. 5. Decorate forms with glitter glue. Air-dry the glue.		
Process: Session 4 30-45 min.		Draw colorful shadow designs 6. Suspend mobiles so forms cast shadows on paper in the workstation. 7. Quickly trace shapes of moving shadows with oil pastels to create action-like drawings. Fill shapes with color. 8. Brush a thin tempera paint wash over the entire drawing. Air-dry the paint.	
Assessment	<ul style="list-style-type: none"> Children correctly identify objects on their mobiles as planets, the sun, stars, comets, asteroids, and/or meteoroids. Children act out the terms <i>rotation</i> and <i>revolution</i>. 	<ul style="list-style-type: none"> Students name the eight planets and other objects in our solar system. Students describe rotation and revolution of celestial bodies. Students name and explain the force that keeps planets and moons in orbit. Randomly display the mobiles and action-shadow drawings. Ask students to analyze and match mobiles to the correct action-shadow drawings. 	
	<ul style="list-style-type: none"> Are mobiles balanced and do they accurately represent celestial bodies found in our solar system? Ask students to reflect on this lesson and write a DREAM statement to summarize the most important things they learned about shadows, celestial bodies, and mobiles. 		
Extensions	<p>Invite younger children and those with disabilities to outline the shapes of their own shadows with markers on large paper or outdoors with sidewalk chalk.</p> <p>Challenge students to invent shadow games, such as Follow the Leader, Shadow Tag, and Simple Simon. Make an illustrated book of shadow game suggestions.</p> <p>Invite students who benefit from kinesthetic learning experiences to demonstrate how the planets orbit the sun while the Earth rotates on its axis.</p>	<p>Build and use a sundial. Compare the time indicated on the sundial to the time indicated on the classroom clock. Adjust sundial to more closely match actual time.</p> <p>Have students imagine that they are on the moon, looking back at Earth. Draw a picture of how the Earth and the sun would look if viewed from the moon.</p>	<p>Invite students skilled in research and technology to prepare and present an audio-visual presentation about solar and lunar eclipses for younger students.</p> <p>Challenge students to research a specific planet. Identify what they would need to pack to survive there and explain the purpose of each item.</p>
		<p>Lunar eclipse Photo by permission Jon Sullivan, San Diego, California.</p>	

