MoSH

THE SUN & THE MOON:
Suitcase Program [3-5]

TEACHER'S MANUAL

This Suitcase Program provides the materials and lesson plans for teachers of grades 3-5 with content and activities increasing in difficulty by grade level. Activities in this Suitcase Exhibit may assist in meeting the Tennessee State Standards.

ACTIVITIES

TENNESSEE STATE STANDARDS FOR 3-5

3.ETS2.1	Identify and demonstrate how technology can be used for different purposes.
4.ESS1.2	Use a model to explain how the orbit of the Earth and sun cause observable patterns: a) day and night; b) changes in length and direction of shadows over a day.
4.ESS3.1	Obtain and combine information to describe that energy and fuels are derived from natural resources and that some energy and fuel sources are renewable (sunlight, wind, water) and some are not (fossil fuels, minerals).
5.ESS1.1	Explain that differences in apparent brightness of the sun compared to other stars are due to their relative distances from the Earth.
5.ESS1.3	Use data to categorize different bodies in our solar system including moons, asteroids, comets, and meteoroids according to their physical properties and motion.
5.ESS1.4	Explain the cause and effect relationship between the positions of the sun, earth, and moon and resulting eclipses, position of constellations, and appearance of the moon.
5.ESS1.5	Relate the tilt of the Earth's axis, as it revolves around the sun, to the varying intensities of sunlight at different latitudes. Evaluate how this causes changes in day-length and seasons.
5.ETS2.2	Describe how human beings have made tools and machines (X-ray cameras, microscopes, satellites, computers) to observe and do things that they could not otherwise sense or do at all, or as quickly or efficiently.
5.ETS2.3	Identify how scientific discoveries lead to new and improved technologies.

For the entire activity and materials and to reserve a Suitcase Exhibit, please call 901.636.2362.

MoSH

THE SUN & THE MOON:
Suitcase Program [3-5]

ACTIVITY I: The Shadow Knows…

DURATION OF ACTIVITY: 15 minutes per day for 1-2 months

LESSON OBJECTIVES

To demonstrate how the length of a shadow is affected by the apparent path of the Sun, shorter in winter, longer in summer, students will measure the shadow cast by a constant object (a meter stick). They will record and collect the data over at least 1-2 months.

GUIDING QUESTIONS

What causes your shadow to change in size at different times of the day?
Will the shadow be the same at all times of the year? Why?
Are shadows the same in every part of the world? Why?
How can shadows help you tell time?

TENNESSEE STATE STANDARDS

4.ESS1.2	Use a model to explain how the orbit of the Earth and sun cause observable patterns: a. day and night; b. changes in length and direction of shadows over a day
4.ETS2.1	Use appropriate tools and measurements to build a model.
5.ESS1.5	Relate the tilt of the Earth's axis, as it revolves around the sun, to the varying intensities of sunlight at different latitudes. Evaluate how this causes changes in day-lengths and seasons.

MATERIALS INCLUDED

Book: *MoonBear's Shadow*
60 watt bulb, in fixture, no shade
Extension cord
Compass

MATERIALS PROVIDED BY TEACHER

Meter stick
Markers or crayons
Tape
Butcher paper (about 6' x 4')
Book: **Peter Pan** (optional)

For the entire activity and materials and to reserve a Suitcase Exhibit, please call 901.636.2362.

ACTIVITY II: The Shadow Knows… (Grades 4-5)

DURATION OF ACTIVITY: 15 minutes per day for 2 months

LESSON OBJECTIVES

Students will design and build a sundial to observe shadows as an indication that the Sun's rays hit the Earth at different angles during a day and over time. Students will be able to identify and predict the pattern the Sun takes as it travels across the horizon. Students will observe and log information about the sunrise and sunset. They will use the metric system to measure shadows. Students will chart and compare observed data by creating graphs and tables. They will analyze data to infer solar/seasonal patterns. Students will telecommunicate with other students at different latitude locations to relate and compare the shadow's pattern as the Sun's rays hit the Earth over time.

GUIDING QUESTIONS

Can you find a pattern in the Sun's path of travel across the sky over time?
What can be discovered when a shadow is marked and studied daily?

TENNESSEE STATE STANDARDS

4.ESS1.2	Use a model to explain how the orbit of the Earth and sun cause observable patterns: a. day and night; b. changes in length and direction of shadows over a day.
4.ETS2.1	Use appropriate tools and measurements to build a model.
5.ESS1.4	Explain the cause and effect relationship between the positions of the sun, earth, and moon and resulting eclipses, position of constellations, and appearance of the moon.
5.ESS1.5	Relate the tilt of the Earth's axis, as it revolves around the sun, to the varying intensities of sunlight at different latitudes. Evaluate how this causes changes in day-lengths and seasons.

MATERIALS INCLUDED

Compass
Protractor

MATERIALS PROVIDED BY TEACHER

Meter stick
Craft supplies for building gnomons
Chalk or patio paint
Butcher paper
Blank science journals for each student
Graph paper

For the entire activity and materials and to reserve a Suitcase Exhibit, please call 901.636.2362.

ACTIVITY III: What Causes the Seasons?

DURATION OF ACTIVITY: 50 minutes

LESSON OBJECTIVES

Students will use models of the Earth and the Sun to demonstrate how the tilt of the Earth causes variations in the amount of light intensity received by the two hemispheres during different seasons.

GUIDING QUESTION

What causes the seasons?

TENNESSEE STATE STANDARDS

4.ESS1.2	Use a model to explain how the orbit of the Earth and sun cause observable patterns: a. day and night; b. changes in length and direction of shadows over a day.
4.ETS2.1	Use appropriate tools and measurements to build a model.
5.ESS1.1	Explain that differences in the apparent brightness of the sun compared to other stars is due to their relative distances from the Earth.
5.ESS1.4	Explain the cause and effect relationship between the positions of the sun, earth, and moon and resulting eclipses, position of constellations, and appearance of the moon.
5.ESS1.5	Relate the tilt of the Earth's axis, as it revolves around the sun, to the varying intensities of sunlight at different latitudes. Evaluate how this causes changes in day-lengths and seasons.
5.ESS1.6	Use tools to describe how stars and constellations appear to move from the Earth's perspective throughout the seasons.

MATERIALS INCLUDED

For each team of four students:

- 2 thermometers
- 2 flashlights
- Protractor (optional)

MATERIALS PROVIDED BY TEACHER

2 globes mounted so that the axis is tilted 23.5 degrees
Black construction paper
Chalk (optional)
Bright light source (a lamp with a 75-watt bulb)

For the entire activity and materials and to reserve a Suitcase Exhibit, please call 901.636.2362.

ACTIVITY IV: A New Slant on the Seasons

DURATION OF ACTIVITY: 2-3 class periods

LESSON OBJECTIVES

This lesson examines the role of the Earth's tilted axis in causing the seasons we experience on Earth. Students explore this phenomenon by modeling the seasons using globes positioned in a circle around an overhead projector (representing the Sun). Students will model the positions and orientations of the Earth with respect to the Sun in the different seasons. They will observe how the Earth's tilt affects the amount of sunlight energy an area receives. Students will draw conclusions about the relationship between the tilt of the Earth and the seasons. They will dispel a common misconception that Earth's distance from the Sun causes seasons.

GUIDING QUESTION

How does the Earth's tilt cause the seasons?

TENNESSEE STATE STANDARDS

4.ESS1.2	Use a model to explain how the orbit of the Earth and sun cause observable patterns: a. day and night; b. changes in length and direction of shadows over a day.
5.ESS1.1	Explain that differences in the apparent brightness of the sun compared to other stars is due to their relative distances from the Earth.
5.ESS1.4	Explain the cause and effect relationship between the positions of the sun, earth, and moon and resulting eclipses, position of constellations, and appearance of the moon.
5.ESS1.5	Relate the tilt of the Earth's axis, as it revolves around the sun, to the varying intensities of sunlight at different latitudes. Evaluate how this causes changes in day-lengths and seasons.
5.ESS1.6	Use tools to describe how stars and constellations appear to move from the Earth's perspective throughout the seasons.

MATERIALS INCLUDED

4 stickers or adhesive circles
Extension cords
Square of aluminum foil
40-foot length of rope or twine
In the Teachers Manual, Supplementary Materials Section:
- A New Slant on the Seasons Worksheet, 2 pages (copy 1 per student)
- "What Causes the Seasons" Fact Sheet 3 pages (copy 1 per student)
- Answers to Slant on the Seasons Worksheet
- 2 transparent grids for overhead projector
- KWL chart with instructions

MATERIALS PROVIDED BY TEACHER

2 globes
2 overhead projectors
Masking tape labels marked December, March, June and September
one 12 cm (approx.. 5-inch) diameter cut out of yellow construction paper labeled "Sun"

For the entire activity and materials and to reserve a Suitcase Exhibit, please call 901.636.2362.

ACTIVITY V: Predicting Phases & Features of the Moon

DURATION OF ACTIVITY: 45 minutes

LESSON OBJECTIVES

This activity investigates students existing knowledge of the Moon's appearance, making their observations in the following activities more meaningful. Students will draw their mental image of the Moon, and they will infer the sequence of the Moon's phases based on observations of lunar photos.

GUIDING QUESTION

Why does the moon look different over time?

TENNESSEE STATE STANDARDS

5.ESS1.4	Use data to categorize different bodies in our solar system including moons, asteroids, comets, and meteoroids according to their physical properties and motion.
5.ESS1.3	Explain the cause and effect relationship between the positions of the sun, earth, and moon and resulting eclipses, position of constellations, and appearance of the moon.

MATERIALS INCLUDED

Lunar photographs

MATERIALS PROVIDED BY TEACHER

Scissors
Pencil
Tape or glue
Sheets of blank paper

For the entire activity and materials and to reserve a Suitcase Exhibit, please call 901.636.2362.

ACTIVITY VI: Modeling Moon Phases

DURATION OF ACTIVITY: 45 minutes

LESSON OBJECTIVES

This activity allows students to use models of the Sun, Earth and moon to discover why the moon phases occur. Students will be able to state the order of the Moon's phases from one full Moon to the next and also to demonstrate how the Moon's position relative to the Earth creates the phases.

GUIDING QUESTION

Why does the moon look different over time?

TENNESSEE STATE STANDARDS

5.PS2.2	Make observations and measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.
5.ESS1.4	Explain the cause and effect relationship between the positions of the sun, earth, and moon and resulting eclipses, position of constellations, and appearance of the moon.

MATERIALS INCLUDED

Light bulb on a stand or clamp
Extension cord
Ping pong balls: one for each student to use as a model Moon
Poster: Phases of the Moon
Foam Moon cross section
Skewer sticks (may be used in place of pencils)

MATERIALS PROVIDED BY TEACHER

Pencil and paper
Materials to block light from window, if necessary
Overhead projector as a light source (optional)

For the entire activity and materials and to reserve a Suitcase Exhibit, please call 901.636.2362.

ACTIVITY VII: Modeling Eclipses

DURATION OF ACTIVITY: 45 minutes

LESSON OBJECTIVES

This activity explores why, when, and how often solar and lunar eclipses occur, using the Earth, Moon and Sun models of the previous activity. Students will distinguish between lunar and solar eclipses, model how lunar and solar eclipses occur, predict when an eclipse is most likely to occur and consider whether more people will be likely to see a lunar or solar eclipse.

GUIDING QUESTIONS

How can we predict when an eclipse is most likely to occur? How do we know when people will be more likely to see a lunar or solar eclipse?

TENNESSEE STATE STANDARDS

5.PS2.2	Make observations and measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.
5.ESS1.4	Explain the cause and effect relationship between the positions of the sun, earth, and moon and resulting eclipses, position of constellations, and appearance of the moon.

MATERIALS INCLUDED

Light bulb on a stand or clamp
Extension cord
Ping pong balls, one for each student
Foam Sun and Moon cross sections
Skewer sticks (may be used in place of pencils)
Segmented hoops (10 segments)

MATERIALS PROVIDED BY TEACHER

Pencils and paper

For the entire activity and materials and to reserve a Suitcase Exhibit, please call 901.636.2362.

ACTIVITY VIII: Sensing Energy

DURATION OF ACTIVITY: 60 minutes

LESSON OBJECTIVES

Students will explore the unseen energy produced by the Sun, using a variety of materials, such as UV detection beads and sunblock. Students will understand that light has components that are both visible and invisible to our eyes. They will understand that exposure to light can be measured and controlled and that exposure to light can change the properties of an object.

GUIDING QUESTIONS

What types of energy does the Sun produce?
How can we sense different types of solar radiation?

TENNESSEE STATE STANDARDS

4.PS4.2	Describe how the colors of available light sources and the bending of light waves determine what we see.
5.ESS1.5	Relate the tilt of the Earth's axis, as it revolves around the sun, to the varying intensities of sunlight at different latitudes. Evaluate how this causes changes in day-lengths and seasons
5.ETS2.2	Describe how human beings have made tools and machines (X-ray cameras, microscopes, satellites, computers) to observe and do things that they could not otherwise sense or do at all, or as quickly or efficiently.

MATERIALS INCLUDED

5 or 6 Ultraviolet Detection Beads per child
9 empty, opaque film canisters per group
Colored filters
A white piece of cloth
A black piece of cloth
A baseball cap
Paper clips
Plastic wrap
A paintbrush or sponge
Sunglasses
Sunscreen (spf 5 or 8, and 30)
Flashlight
UV filter kits
UV beads detector tubes

MATERIALS PROVIDED BY TEACHER

Water
UV eyeglasses (not included, but may be purchased. Must be extremely careful using.)
Sunblock
Drawing materials

For the entire activity and materials and to reserve a Suitcase Exhibit, please call 901.636.2362.

ACTIVITY IX: Sunspotter Activities

DURATION OF ACTIVITY: 40 minutes each

LESSON OBJECTIVES

Students will use the Sunspotter to view sunspots on the Sun and view how the Sun appears to move in the sky due to Earth's rotation.

GUIDING QUESTIONS?

How is the Sun different than other stars in the sky? How does the tilt of the Earth's axis relate to the varying intensities of sunlight at different latitudes?

TENNESSEE STATE STANDARDS

4.ESS1.2	Use a model to explain how the orbit of the Earth and sun cause observable patterns: a. day and night; b. changes in length and direction of shadows over a day.
4.ETS2.3	Explain how engineers have improved existing technologies to increase their benefits, to decrease known risks, and to meet societal demands (artificial limbs, seatbelts, cell phones).
5.ESS1.1	Explain that differences in the apparent brightness of the sun compared to other stars is due to their relative distances from the Earth.
5.ESS1.4	Explain the cause and effect relationship between the positions of the sun, earth, and moon and resulting eclipses, position of constellations, and appearance of the moon.
5.ESS1.5	Relate the tilt of the Earth's axis, as it revolves around the sun, to the varying intensities of sunlight at different latitudes. Evaluate how this causes changes in day-lengths and seasons.

MATERIALS INCLUDED

Sunspotter telescope and manual
Sun layer puzzle

MATERIALS PROVIDED BY TEACHER

White paper
Pencils
Drawing materials

For the entire activity and materials and to reserve a Suitcase Exhibit, please call 901.636.2362.

SUITCASE EXHIBIT INVENTORY CHECKLIST

School: _____
Check Out: _____
Return Date: _____

MoSH Check In:	Teacher Check In:	Item	Books/Videos/Posters	Teacher Return:
		A	Teacher's Guide	
		B	Book: The Moon	
		C	Book: A Look at The Sun	
		D	Book: The Sun	
		E	Book: The Moon	
		F	Book: Moonbear's Shadow	
		G	Poster: The Moon (Poster)	
		H	2 Posters: Moon Phases H.1: 9 illustrations H.2 8 illustrations	
		I	Lunar Photographs -8	
		J	Poster: The Sun	

MoSH

THE SUN & THE MOON:
Suitcase Program [3-5]

SUITCASE EXHIBIT INVENTORY CHECKLIST

MoSH Check In:	Teacher Check In:	Item	Materials	Teacher Return:
		1	Segmented Hoops – 10 ©Encyclopedia Brittanica, Inc.	
		2	Ping-Pong Balls – 31	
		3	Sun Layer Puzzle (7 pieces)	
		4	Sunspotter	
		5	Sun/Moon Cross Sections 2 items	
		6	Classroom Thermometers - 5	
		7	Solar Motion Model	
		8	Ball Caps -2	
		9	Kite String	
		10	Compass	
		11	35 pennies, in canister	
		12	Skewer sticks	
		13	Aluminum foil	
		14	Plastic wrap	
		15	Stick	
		16	Flower pot	
		17	Rope	
		18	60-watt light bulb and stand	
		19	Sun block - 2 (SPF 15 & SPF 30)	
		20	Sunglasses - 2	
		21	Touch N See Squares - 5	
		22	Film canisters - 36	
		23	UV Filter Kit - 2 filters (transparent & opaque)	
		24	UV beads	
		25	Stickers	
		26	Flashlights - 2 with batteries	
		27	5 Protractor sets - 5 protractors/5 drawing compasses	
		28	Tape measure in meters	
		29	Sun Clock & Solar Motion Demonstrator	
		30	Solar bag	
		31	Compasses – 5	
		32	Extension cord	
		33	Thermometers - 9	
		34	6 Styrofoam balls/6 pencils	
		35	Color filters - 8	
		36	Paper clips (box)	
		37	Toothpicks - 2 containers	
		38	Black & white cloth squares	
		39	UV Beads Detector Tubes - 9	
		40	Sponges - 4	
		41	Tennis Balls - 5	

MoSH

THE SUN & THE MOON:

Suitcase Program [3-5]