MoSH

# THE SUN & THE MOON:
Suitcase Program [6-8]

# TEACHER'S MANUAL

This Suitcase Program provides the materials and lesson plans for teachers of grades 6-8 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 6-8

| | |
|---|---|
| 1.PS3.1 | Make observations to determine how sunlight warms Earth's surfaces (sand, soil, rocks, and water). |
| 1.ESS1.1 | Use observations or models of the sun, moon, and stars to describe patterns that can be predicted. |
| 1.ESS1.2 | Observe natural objects in the sky that can be seen from Earth with the naked eye, and recognize that a telescope, used as a tool, can provide greater detail of objects in the sky. |
| 1.ESS1.3 | Analyze data to predict patterns between sunrise and sunset and the change of seasons. |
| 1.ETS2.1 | Use appropriate tools (magnifying glass, basic balance scale) to make observations and answer testable questions. |

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

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# **ACTIVITY** I: What Causes the Seasons?

**DURATION OF ACTIVITY:** 50 minutes

### LESSON OBJECTIVES
Students will observe the effect on temperature of slanting and vertical light rays. 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 different hemispheres during different seasons.

### GUIDING QUESTION
What causes the seasons?

### TENNESSEE STATE STANDARDS
8.ETS1.2 Research and communicate information to describe how data from technologies (telescopes, spectroscopes, satellites, and space probes) provide information about objects in the solar system and universe.

### 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
- Several pieces of black construction paper
- Pencils and paper
- Chalk
- Lamp with 75-watt bulb

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

# **ACTIVITY** II: 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 observe the areas of the Earth receiving the most sunlight at each season by studying the shape and size of a projected grid. After completing this activity, students will be able to explain the reasons for the seasons. 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

8.ETS1.2 Research and communicate information to describe how data from technologies (telescopes, spectroscopes, satellites, and space probes) provide information about objects in the solar system and universe.

## 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 labeled "December," "June," and "September"
One 12 cm (approx. 5 inch) diameter circle 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** III: When the Sun Turns Dark…

**DURATION OF ACTIVITY:** 45 minutes

**LESSON OBJECTIVES**
To understand the causes of a solar eclipse. Students will model the eclipse using a penny, light bulb and globe. Students will set up the pattern that causes an eclipse. Students will draw, write about and explain the occurrence of a solar eclipse.

**GUIDING QUESTION**
What causes a solar eclipse?

**TENNESSEE STATE STANDARDS**

| | |
|---|---|
| 8.ETS1.2 | Research and communicate information to describe how data from technologies (telescopes, spectroscopes, satellites, and space probes) provide information about objects in the solar system and universe. |

**MATERIALS INCLUDED**
Penny
Tennis ball
Light bulb, with a stand

**MATERIALS PROVIDED BY TEACHER**
Globe

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

# **ACTIVITY** IV: The Reasons for Seasons

**DURATION OF ACTIVITY:** 50 minutes

**LESSON OBJECTIVES**

By the end of the lesson, students should be able to describe the apparent daily path of the Sun during the four seasons, to explain why the Sun's daily path changes during the year, to predict the rising and setting point for the Sun for different seasons of the year and to explain why days are longer in the summer and shorter in the winter.

**GUIDING QUESTION**

What causes the seasons?

**TENNESSEE STATE STANDARDS**

8.ETS1.2 Research and communicate information to describe how data from technologies (telescopes, spectroscopes, satellites, and space probes) provide information about objects in the solar system and universe.

**MATERIALS INCLUDED**

White light (flashlight used to represent the Sun)
Meridian Line Projector for measuring the altitude of the Sun at noon (mark where the meridian line would be on the Styrofoam balls)
Pencils
Styrofoam balls
Toothpicks

**MATERIALS PROVIDED BY TEACHER**

Markers (to indicate the predicted position of sunrise/sunset on the dome)
Clipboard or hard surface
Earth globe that will turn on its axis
Small paper or toy figurine (one with mobile arms will be best)
Data on the length of a day at solstices and equinoxes at your latitude (found in newspapers or observers' handbooks with sunrise and sunset listings)

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

# **ACTIVITY** V: Predicting Phases and 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**

How to predict the Moon Phases?

**TENNESSEE STATE STANDARDS**

8.ETS1.2 Research and communicate information to describe how data from technologies (telescopes, spectroscopes, satellites, and space probes) provide information about objects in the solar system and universe.

**MATERIALS INCLUDED**

Lunar photographs

**MATERIALS PROVIDED BY TEACHER**

Scissors
Pencil
Sheets of blank paper
Tape or glue

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**

How are the phases of the moon created?

**TENNESSEE STATE STANDARDS**

8.ETS1.2 Research and communicate information to describe how data from technologies (telescopes, spectroscopes, satellites, and space probes) provide information about objects in the solar system and universe.

**MATERIALS INCLUDED**

Light bulb on a stand or clamp
Extension cord
1 Styrofoam ball or light colored sphere for each student (as a model Moon)
Ping-pong balls: one for each student to use as a model Moon
Skewer sticks (may be used in place of pencils)

**MATERIALS PROVIDED BY TEACHER**

Pencil and paper
Darkened room

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 QUESTION

How to identify and predict lunar and solar eclipses?

## TENNESSEE STATE STANDARDS

8.ETS1.2 Research and communicate information to describe how data from technologies (telescopes, spectroscopes, satellites, and space probes) provide information about objects in the solar system and universe.

## MATERIALS INCLUDED

Light bulb on a stand or clamp
Extension cord
1 Styrofoam ball or light-colored sphere (to use as model Moon)
Segmented hoops (10 segments)
Ping-pong balls: one for each student to use as a model Moon
Skewer sticks (may be used in place of pencils)

## 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: Sunspotter Activities

**DURATION OF ACTIVITY:** 40 minutes each (8 in all)

**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**

What do you think you will see with this solar telescope? Can you draw what the Sun will look like?

**TENNESSEE STATE STANDARDS**

8.ETS1.2 Research and communicate information to describe how data from technologies (telescopes, spectroscopes, satellites, and space probes) provide information about objects in the solar system and universe.

**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.

# **ACTIVITY** IX: Making a Sun Clock

**DURATION OF ACTIVITY:** 40 minutes

## LESSON OBJECTIVES

In this activity student construct sun clocks. They are challenged to determine the correct orientation needed for the Sun clock to function. Keeping track of the Sun's shadow with the Sun clock helps students visually understand the relationship between the Sun's motion and our concept of time. Students will construct pocket sun clocks, determine local noon using the Sun clocks, make observations about the passing of time using their Sun clocks and explain the relationship between the motion of the Sun and our concept of time.

## GUIDING QUESTION

How to indicate time based on the position of the Sun in the sky?

## TENNESSEE STATE STANDARDS

8.ETS1.2 Research and communicate information to describe how data from technologies (telescopes, spectroscopes, satellites, and space probes) provide information about objects in the solar system and universe.

## MATERIALS INCLUDED

Compass
Pocket Sun Clock pattern (for your location)
String, 20 centimeters (7 inches) long
Sun Clock Demonstrator

## MATERIALS PROVIDED BY TEACHER

Cardboard slightly larger than the sun clock (file folders, index cards, etc.)
Chalk or pencil
Glue
Scissors
Tape

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

# **ACTIVITY** X: Solar Motion Demonstrator

**DURATION OF ACTIVITY:** 1-2 class periods

## LESSON OBJECTIVES

From paper, glue and a brass fastener you can build a remarkably powerful device which accurately models the apparent motion of the Sun, any time of year, from any place in the northern hemisphere of Earth. It's a simple, direct way to learn the pattern of the changing solar rising and setting points-just what the builders of Stonehenge, according to Gerald Hawkins, wanted to mark. You can go far beyond Stonehenge, however, and see how the Sun moves as seen from the Equator, the North Pole, or your own hometown.

## GUIDING QUESTION

How to create and use a Solar Motion Demonstrator?

## TENNESSEE STATE STANDARDS

8.ETS1.2 Research and communicate information to describe how data from technologies (telescopes, spectroscopes, satellites, and space probes) provide information about objects in the solar system and universe.

## MATERIALS INCLUDED

Solar Motion Frame and Horizon Disk cutout sheets
Solar Motion Demonstrator
Solar Motion Model

## MATERIALS PROVIDED BY TEACHER

Rubber cement or glue stick
Scissors for each student
Photocopy paper or heavy card stock sufficient
For providing each student with one Solar Motion Frame and one Horizon Disk (using blue Paper for the frame and green for the disk Makes an attractive product)
1 long (1 inch) brass paper fastener (the type with spreadable flat prongs for each student
Manila file folder (for each student)

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<br>H.1: 9 illustrations<br>H.2 8 illustrations | |
| | | I | Lunar Photographs -8 | |
| | | J | Poster- The Sun | |

# 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 | |

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