Kirsten Hurme
Matt Vogl
EDCI 5724

Our Solar System and Seasons:
Sixth Grade General Science
(Digital Video)

Purpose/Rationale: The purpose of this lesson is for students to investigate the relative diameters of planets (and the Moon) and distances between them, and the cause for seasons on Earth using the 5-E Learning Model. By participating in discrepant events, students will appreciate the sizes and distances involved with objects in the real universe. Students will understand why Earth experiences seasons, and discover the climatic differences between the poles, middle latitudes, and equator.

SOL's:

6.1 The student will plan and conduct investigations in which:

- differences in descriptions and working definitions are made;
- scale models are used to estimate distance, volume, and quantity;
- data are organized and communicated through graphical representation (graphs, charts, and diagrams); and,
- models are designed to explain a sequence.

6.10 The student will investigate and understand the organization of the solar system and the relationships among the various bodies that comprise it. Key concepts include:

- the, sun, moon, Earth, other planets and their moons, meteors, asteroids, and comets;
- relative size of and distance between planets;
- revolution and rotation;
- the relationship of the Earth's tilt and seasons

NSES: Content Standard for Science as Inquiry:

- Identify questions that can be answered through scientific investigations.
- Use appropriate tools and techniques to gather, analyze, and interpret data.
- Develop descriptions, explanations, predictions, and models using evidence.
- Communicate scientific procedures and explanations.
- Use mathematics in all aspects of scientific inquiry.

Materials/Resources:

Activity sheet	Earth globes
Basketball	flashlights
Pin	Cardboard
Light bulb	Marbles (small and large)
Tape Measure	Grain of sand
Thumbtacks	Pens
Thermometers	Probeware equipment (optional)

Learning Websites: http://www.weatherchannel.com/education/index.html
http://nesen.unl.edu/teacher.html

Safety: No safety goggles are needed to perform these activities.

Procedures:

Engage

1. The teacher will engage the students in learning about Earth-Moon-Sun relationships by demonstrating the discrepant event "A Long Trip." The teacher will probe students' prior knowledge of astronomical distances by asking the students to determine how a scale model of the nine planets (and Earth's Moon) in our solar system should be arranged. This activity could be made into a competition among the students to see who can most accurately predict the distances between objects. You should do this activity **outside** on the playground. The teacher will review the concepts of "revolution" and "rotation" using these objects. [30 minutes]

   If your students have strong math skills, they could complete the "Real Universe Distance from the Sun" column for homework. The other option is to give the students these numbers during the lab.

   Key information for the Activity Sheet table students will complete:

Object	True Scale Model Distance from Sun (m)	Real Universe Distance from Sun (km)
Mercury	1.0	57,910,000
Venus	2.0	108,200,000
Earth	2.6	150,000,000
The Moon	2.5	149,620,000
Mars	4.0	227,940,000
Jupiter	13.0	778,600,000
Saturn	24.0	1,429,400,000
Uranus	49.0	2,870,990,000
Neptune	77.0	4,504,300,000
Pluto	100.0	5,870,000,000

Explore

2. Students will explore seasons on Earth by completing the discrepant event "The Four Seasons." The teacher will use a light bulb and globe to show why there are four seasons in a year (for most of the planet). Stop at four points in the path to show the four seasons. The teacher will review the definition of "seasons", and the rotation and revolution periods of Earth. [20 minutes]

Explain

3. Students will discuss the terms "solstice" and "equinox." After this discussion, students can refer to the textbook for more information to help them label the two solstices and two equinoxes on their Earth diagram. [10 minutes]

Elaborate

4. Students will extend their understanding of seasonal change by completing the "Direct and Slant Rays" and "Lighted Globe" activities. (The "Lighted Globe" activity requires the teacher to set up a globe with light directed towards the equator for 20 minutes. A thermometer is placed near the North Pole and equator on the globe. Probeware equipment could be used in place of "regular" thermometers, if desired.) Students will discuss the difference between direct and slanted angle sunlight, and how the intensity of sunlight at a given location on Earth affects climate. [30 minutes]

Evaluate

5. Students will provide the following evidence for understanding the relative distances between the Earth, Moon, and Sun, and the cause for seasons on Earth.

Performance Criteria	**Evidence**	**Points***
Student understands the relative sizes of planetary objects and distances between them.	Completion of "A Long Trip" activity with properly drawn diagrams on activity sheet.	
Student demonstrates ability to create a table of data.	Completion of "A Long Trip" activity; proper placement of data in table.	
Student understands that the tilt of the Earth on its axis is the primary cause of the seasons on Earth.	Student answers question on activity sheet.	
Student discusses how the terms "solstice" and "equinox" relate to seasonal changes.	Student discussion and reading textbook; properly labels diagram on activity sheet.	
Student understands that the intensity of sunlight at a given location on Earth affects climate.	Completion of "Direct and Slant Rays" and "Lighted Globe" activities; Student answers questions on activity sheet.	

*2 = completes activity and explanation without mistakes.
1 = completes activity but provides incomplete explanation
0 = does not complete activity or explanation

Kirsten Hurme and
Matt Vogl: EDCI 5724

Our Solar System and Seasons Activity Sheet

Purpose: In this activity, you will investigate our solar system and the seasons on Earth by completing the following activities.

Engage: A Long Trip

Materials: Basketball, Pin, Pens, Marbles (large and small), Thumbtacks, Grain of sand

1. Think about the nine planets in our solar system being squeezed into an area of 100 m. Please write your prediction for the distance from the Sun for each of the nine planets (and our Moon) in our **scale model** in the table below.

Real Object	**Scale Model Object**	**Real Universe Equatorial Diameter (km)**	***Predicted* Scale Model Distance from Sun (m)**	**True Scale Model Distance from Sun (m)**	**Real Universe Distance from Sun (km)**
Sun	Basketball	1,392,000	0	0	0
Mercury	Tip of thumbtack	4,880			
Venus	Tip of pen	12,104			
Earth	Tip of pen	12,756			
The Moon	Tip of pin	3,475			
Mars	Tip of thumbtack	6,794			
Jupiter	Large marble	142,984			
Saturn	Large marble	120,536			
Uranus	Small marble	51,118			
Neptune	Small marble	49,532			
Pluto	Grain of sand	2,320			

2. Create a model of the planets in our solar system on the playground. Remember that all of the planets in our model fit in an area of 100 m! After returning to the classroom, complete the rest of the table above with the help of your teacher.

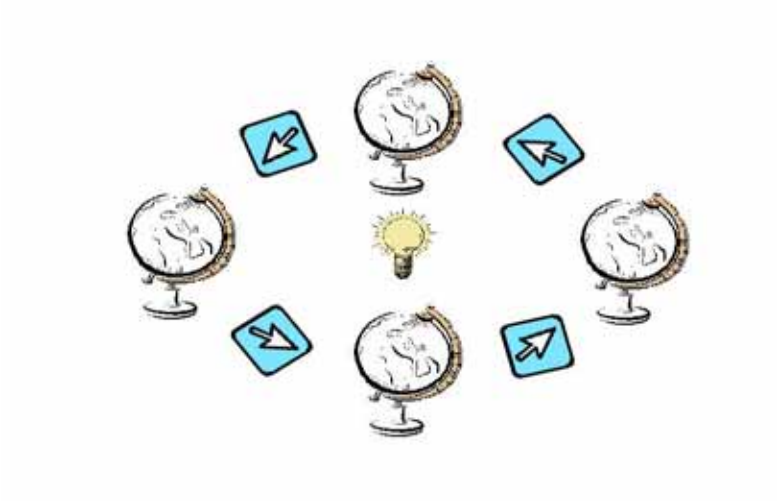
*Draw a scale diagram of the Earth, Moon, and Sun. Label the **real universe distances from the Sun** for the Earth and Moon. Show the relative sizes and distances for these objects.*

Explore: The Four Seasons

Materials: light bulb, globe

3. Use a light bulb and globe to show why most of the Earth has four seasons in a year. Set the light source on a table and move the globe in a path around it.

   Use your pencil to shade in the area on each globe where there is no light.



Explain: *Your friend in the Fifth Grade tells you that summer occurs when the Earth is closest to the Sun, and winter occurs when the Earth is farthest from the Sun. Is your friend correct? Why or why not?*

What happens on the two "equinoxes" at every location on Earth?

Under <u>each</u> globe above, write the word "solstice" or "equinox", the date for that event, and the season that has begun in the Northern Hemisphere. (Use the textbook if you need help.)

Elaborate: Direct and Slant Rays

Materials: globe, cardboard

4. Draw six parallel lines on a piece of cardboard to represent rays from the Sun. Cut out arcs on the cardboard that correspond to the curvature of the globe at three locations: North Pole, a mid-latitude location (such as Washington, DC), and equator.

   Hold the curved end of the cardboard against the globe so that one set of six lines (sun's rays) is on each of the three locations. Measure the area covered by rays at each location.

   North Pole: _____ cm Mid-latitude: _____ cm Equator: _____ cm

   Which one of these locations has the longest length on the globe? Why?

Lighted Globe

Materials: globe, light

5. Check out the globe with the light directly hitting the equator at the front of the classroom.

   What is the temperature of the probe near the North Pole? _____ Equator? _____

   How do these measurements show why the North Pole is cold and the equator is warm?

   *Why does the equator **not** have four seasons each year as the rest of Earth?*