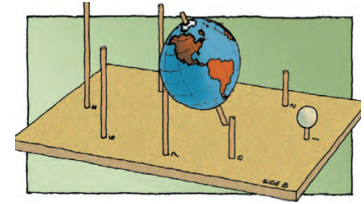


## Inquiry 2.1 (Investigating Lunar Phases)

**Purpose:** What causes Earth to see the moon go through different moon phases?

### Background Information:

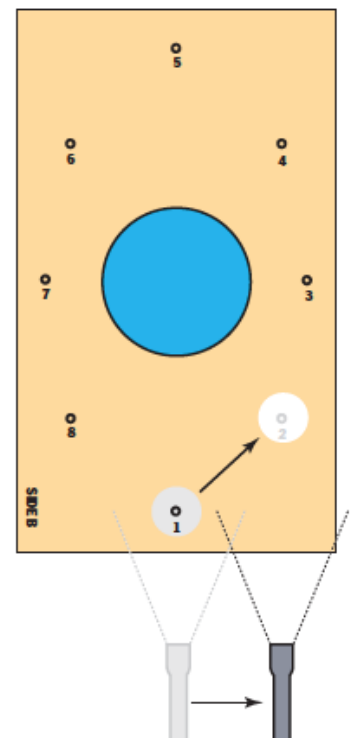
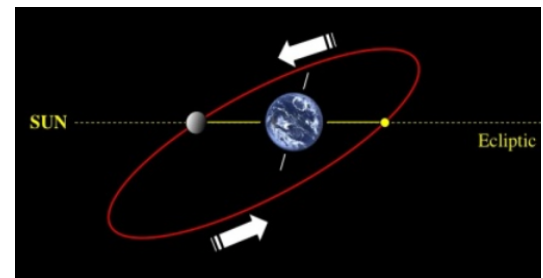
- What is an orbital plane?
- What does “lunar” mean?
- What does illuminated mean?
- Does the moon give off or reflect light?



**Hypothesis:** From Earth we see different moon phases because....

### Procedures:

- 1) Push the smaller sphere onto rod #1 through the already existing hole in the sphere. This sphere will represent the Moon in its orbit around Earth.
- 2) Look at the image to the right. What do you notice about the Moon's orbital plane (RED CIRCLE), compared to the Earth and Sun? Discuss your ideas with your group then write down your answer.
- 3) Now compare the picture above to your SEM Board. What do you think the rods on your board represent? Why are the rods different heights? Why does the rod go through the globe at an angle and not straight up and down? Discuss and write down your answers. *Show the teacher* your answers to receive you ½ worksheet.
- 4) Shine the flashlight directly on the sphere on rod #1. Keep the flashlight steady. Look at the sphere from all directions as if you are looking down at the Moon from space above (standing over the top of the board not next to it). How much of the sphere reflects light at any one time? Discuss your observations with your group. Shade in circle #1 on the worksheet to show exactly much of the Moon is dark and leave white how much of the light is reflected by the Moon. Make sure that the ½ worksheet is facing the same direction as your SEM Board.
- 5) Move the sphere to rod #2. Shine the flashlight directly on your white sphere as you did with rod #1 (see the picture to the right) the flashlight should **ALWAYS** be on the side that is labeled SUN with tape because the Sun does not move. The flashlight should be the same height as the blue peg and moon. Discuss your observations with your group. Record what you see in circle #2 on the ½ worksheet.
- 6) Repeat Step 7 with rods #3–#8. Record your observations on ½ worksheet each time. Show your teacher when you have completed the worksheet.



### Analyzing the Data

Answer the following questions after discussing them with your group, put part of the question into the answer.

- a) As seen from space, how much of the moon is always illuminated (lit up) by the Sun?
- b) Given your results from this inquiry, why do you think the Moon appears to change its shape (moon phases) when viewed from Earth? (This is your best guess)

9) Cut along the circle on your 1/2 worksheet. You **will** be cutting through each of the moons. See the image below. Tape this onto your lab notes.



**Analyzing the Data**

- 10) Create the data table below on your paper.
- 11)
  - c) Fill in what part of the Moon’s lite side you can see from Earth using your cut out circle.
    - Your answer will be one of the following: (All – more than half – half – less than half – none). You will do the moon phase *after* inquiry Part II not now.

Moon Position	Illuminated Amount of moon	Moon Phase
1		
2		YOU
3		WILL
4		FILL
5		THIS IN
6		AFTER PART II
7		NOT NOW
8		

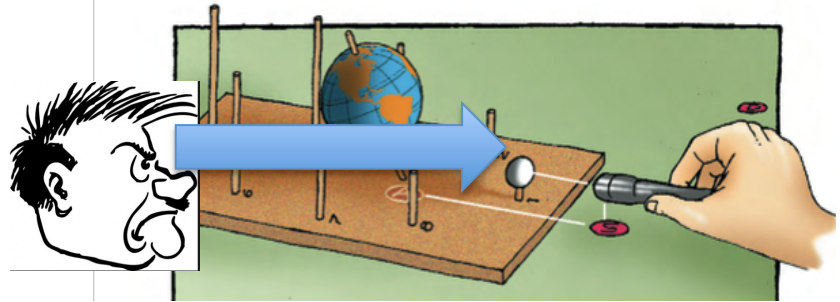
- d) What pattern do you notice moving from position 1 up to 5?
- e) What pattern do you notice is taking place from position 5 up to 8?
- f) What pattern do you notice in the data table from 1 all the way around to 8?  
 Show your teacher when you have completed the analyzing the data questions and they will hand you part 2’s worksheet.

**Part II - Modeling Lunar Phases**

- 1) Remove the globe of the Earth from the blue peg on the SEM board.
- 2) Put the Moon back at position #1 on the SEM board. Shine the flashlight at the Moon again like you did for Part I, holding the flashlight on the side labeled Sun.
- 3) While one group member holds the flash light have the other group member look from the opposite side of the SEM board (looking from behind position #5 at the moon). Make sure your head is level with the moon, you will have to squat down to do this.

4) Observe how much of the Moon is lit up by the flashlight (Sun) at this angle. Shade in the outside circle on worksheet of position #1 how much of the Moon is illuminated (lit up). Make sure the worksheet's Sunlight side is the same side as your flashlight / SEM board.

5) Move the Moon to position #2 on the SEM board and shine the flashlight on the Moon. Make sure you keep the flashlight on the side labeled Sun and the light is directed at the moon.



6) While one group member holds the flash light have the other group member look from the opposite side of the SEM board (looking from behind position #6 at the moon). Make sure you are head is level with the moon.

7) Observe how much of the Moon is lit up by the flashlight (Sun) at this angle. Shade in the outside circle on worksheet of position #2 to show how much of the Moon is illuminated (lit up).

8) Continue this procedure for the remaining positions. Remember to always look from the opposite side of the SEM board and have the worksheet the same way the SEM board is positioned.

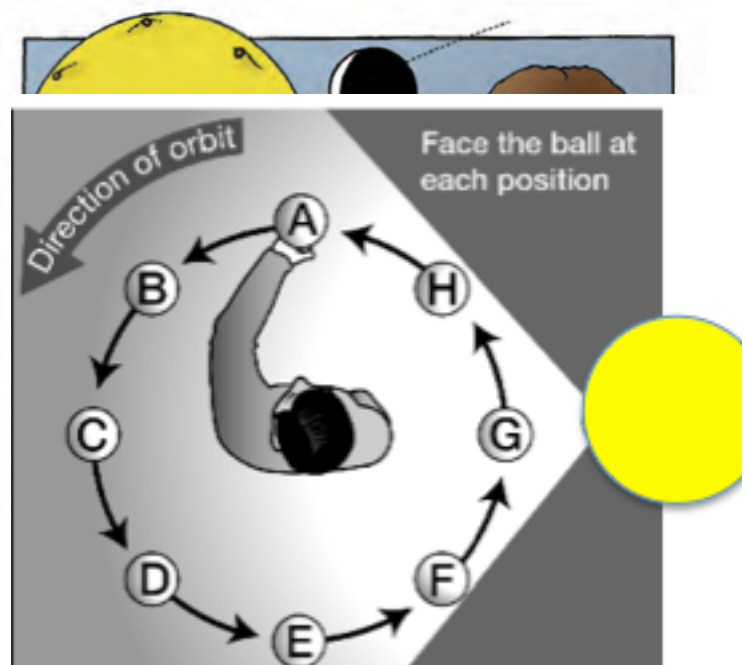
9) Put the Earth back on the center peg and return the SEM board and get the 2 large Styrofoam Moons.

### Part III Modeling the Moon Phases

1) Place the large black-and-white sphere on the end of a pencil. This will represent the Moon.

2) Face the Sun on the overhead projector. Hold the Moon out in front of you so that the white half of the Moon is facing the Sun, as shown in the picture. How much of the white part of the moon can you see?

3) Orbit the Moon around you (like the second image to the right) Stop when your back is facing the Sun. The **WHITE** part of the Moon will **ALWAYS** face the Sun. Your head represents Earth. Does the



white part of the moon appear to be growing larger or smaller?

- 4) Continue to turn looking at the moon until you are facing the Sun again. Does the white part of the moon appear to be growing larger or smaller?
- 5) Compare your observations of this moon phase to the answers you drew on worksheet #2. Make sure that the Sun on your worksheet is facing the same direction as the cloth Sun in your lab setup
- 6) Switch roles within your group. Have another student hold the Moon, and repeat, Steps 2–4. Do this until everyone has had a turn to observe all 8 positions.
- 7) Watch the Video on Ragaller's Website (first link) called [Moon Movie](#)

**Analyzing Data:**

A. Why do we see different moon phases?

## Part IV Reading for understanding

Get and **read** “How Moon Phases Work” from the teacher’s website.

### Analyzing Data

Directions. *First discuss the following questions in your group. Then answer the following questions on paper, make sure to put part of the question into the answer.*

- a) As seen from Earth, what causes the Moon to change its apparent shape throughout the month?
- b) Approximately how long does it take for the Moon to go through one set of phases?
- c) Is the Moon visible only in the nighttime sky? Why or why not? Hint” Think about what you saw when you were facing the Sun – which represents daytime on Earth
- d) Does everyone on Earth see the same phases of the Moon on any given day? Why or why not?
- e) Is the same side of the Moon always dark? Why or why not. (Think about when you were rotating the moon in Part III).
- f) What pattern do you notice in the moon phases data table?
- g) Why do we only see half the moon illuminated during a quarter moon?
- h) Why do we not see any of the moon illuminated during a new moon?
- i) Which moon phase do you see more than half of the moon illuminated?
- j) Which moon phases do you see less than half of the moon illuminated?
- k) If the illuminated side of the moon is getting larger from one day to the next, is that waxing or waning?
- l) If the illuminated side of the moon is getting small from one day to the next, is that waxing or waning?
- m) What was the manipulated variable in the inquiry? (what did we change)
- n) What was the responding variable in this inquiry? (what did we measure)

Show your teacher the answers to the questions and receive your rubric for this inquiry.

### Conclusion

- Restate your entire hypothesis.
- Was your hypothesis correct or incorrect
- Explain why your hypothesis was correct or incorrect?
- What was the manipulated variable in the inquiry?
- What was the responding variable in this inquiry?
- How much of the moon, at all times, is always illuminated by the Sun?
- What are the main reasons we see different moon phases?
- Explain why Earth does not see any of the moon illuminated during a New Moon phases.
- Describe the pattern the illuminated side of the moon goes through from New Moon to New Moon.