

# Moon Phase Simulation

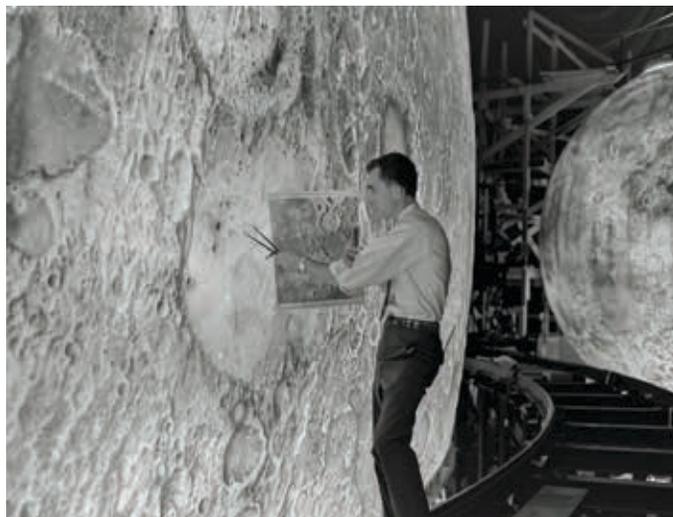
COMPUTER SIMULATION

**Y**OU HAVE PROBABLY used a model to see how different amounts of the Moon appear to be lit up by the Sun as the Moon orbits Earth. You have probably noticed that the Sun always lights up the half of the Moon facing toward the Sun, while the half of the Moon facing away from the Sun is in darkness. Depending on where the Moon is in its orbit, we can see some fraction of the half of the Moon that is lit up by the Sun.

In this activity, you will use a computer simulation that will allow you to observe the Moon's orbit around Earth from a different point of view. Scientists often use simulations and other models to study systems that are difficult to observe directly. In this case, your point of view will be looking down on the Earth–Moon system from out in space.

## GUIDING QUESTION

**How does the Moon's orbit around Earth cause the Moon's phases to repeat around every 29 days?**



*A NASA employee working on the Moon model for the Project LOLA simulator.*

## MATERIALS

For each pair of students

- 1 computer with Internet access

## PROCEDURE

### Part A: Exploring the Simulation

1. Open the Moon Phase Simulation on your computer.
2. Identify the sunlight, Earth, and Moon.  
*Note:* The view in the model is from above Earth's North Pole.
3. Think about what the large circle around Earth represents.
4. Press "Play," and observe what the Moon does and what Earth does.
5. Record your observations with your partner. Make sure to think about what Earth's rotation is modeling.

### Part B: Observing the Phases

6. After watching the Moon orbit Earth one time, press "Pause."
7. Select "new moon" in the drop-down menu under Select Moon Phase.
8. Look carefully at where the Moon is in relation to Earth and sunlight, and what its phase looks like. Make a labeled sketch of your observations. Title your sketch with the name of the moon phase.
9. Press "Play," and watch the simulation until the Moon is in the first quarter phase, and then press "Pause."
10. Make a sketch similar to the one you made in Step 8.
11. Make predictions of where you think the Moon will be in its orbit during the: full moon, third quarter moon, and waning crescent moon. Sketch your predictions i.
12. Select the phases described in Step 11 in the drop-down menu under Select Moon Phase, and observe whether your predictions in Step 11 were correct. Correct your sketches as needed.

13. Press “Play” and then press “Fast Forward” to make the simulation go more quickly. Observe the pattern between how the Moon’s position changes and how the Moon’s phase changes.

## ANALYSIS

1. In the simulation, what do the dark and light halves of the Moon and Earth represent?
2. Why are the light halves of the Moon and Earth always shown facing the incoming sunlight?
3. A simulation can be thought of as another type of model. Compare this computer simulation to the physical model your teacher showed you in “Explaining the Moon’s Phases” activity.
  - a. What are the advantages and disadvantages of using the ball and light to represent the Moon and the Sun?
  - b. What are the advantages and disadvantages of the computer simulation?
  - c. Why do we use models to understand how the Moon orbits Earth instead of traveling into space to observe the phenomenon?
4. Draw a model, and use it to explain the reason we see the cycle of the Moon’s phases.
5. NASA scientists often use simulations to prepare for space missions. During the Apollo program, NASA scientists and engineers built a simulator called Project LOLA. Using the simulator, astronauts could practice flying over the surface of the Moon to find their landing spot. Why do you think NASA engineers and scientists developed Project LOLA?