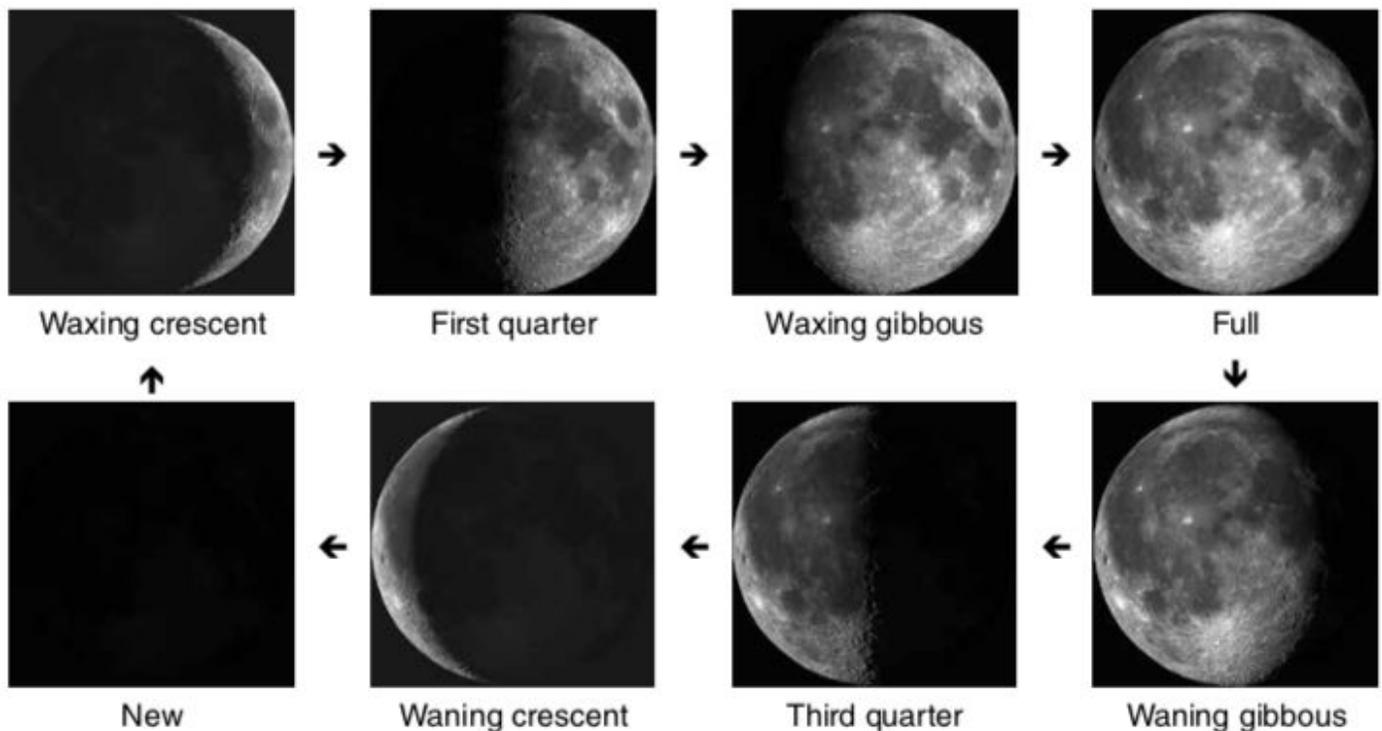


Moon Phases: Why Does the Appearance of the Moon Change Over Time in a Predictable Pattern?

NO LAB REPORT FOR THIS LAB! Instead you will be drawing a model and writing an explanation in order to answer the guiding question.

Introduction

We have all seen the Moon in the sky and how it looks different at various times of the month. In fact, differences in the appearance of the Moon over time were the basis for the Chinese, Islamic, Hindu, and Judaic calendars, as well as most of the other calendar systems that were used in ancient times. People can use the appearance of the Moon to mark the passage of time because the Moon's appearance changes in a predictable pattern over a period of 29.5 days. The figure below shows the pattern that the appearance of the Moon follows. As can be seen in this figure, the portion of the Moon that is illuminated gradually increases until the Moon is full, and then the portion of the Moon that is illuminated gradually decreases until it is completely dark. People often describe this pattern as a lunar cycle. Each phase, or how the Moon looks at a given point in the lunar cycle, has a specific name.



The phases of the Moon follow a predictable pattern over a period of 29.5 days

There are some other important facts that we know about the Moon in addition to the fact that it goes through a series of phases over the course of a lunar cycle. First, the Moon rises in the east and sets in the west once every 24 hours. The Moon, therefore, travels from east to west across the sky just like the Sun. Second, the time that the Moon rises and sets in the sky changes each day. Sometimes the Moon will rise at dusk and set at dawn, and other times it will rise late at night and set in the morning. The Moon can even rise at dawn and set at dusk just like the Sun. The times that we can see the Moon in the sky therefore change over the course of a lunar cycle. Third, we always see the same light and dark regions on the surface of the Moon regardless of its current

phase. We always see the same surface features when we look at the Moon because the same side of the Moon is always facing Earth. Finally, we see solar and lunar eclipses from time to time. A solar eclipse occurs during the day. A solar eclipse results in the light from the Sun being blocked for about 5 to 10 minutes (see first figure below). A lunar eclipse, in contrast, occurs at night. A lunar eclipse causes the full Moon to get darker and turn red for a few minutes (see second figure below). All of these different facts about the Moon can be explained if you understand what causes the lunar cycle.

A solar eclipse



A lunar eclipse



To explain the lunar cycle and all these different facts about the Moon, it is important to know a little about the types of objects that are found in our solar system and how all these objects move over time in relation to each other. The solar system consists of the Sun, the eight official planets, at least five dwarf planets, more than 130 moons, and numerous small bodies (including comets and asteroids). At the center of the solar system is the Sun. The inner solar system includes the planets Mercury, Venus, Earth, and Mars; the dwarf planet Ceres; and three moons. The outer solar system includes the planets Jupiter, Saturn, Uranus, and Neptune; the four other dwarf planets; and the remaining moons. In our solar system, all the planets and dwarf planets orbit (revolve around) the Sun, and all the moons orbit planets or dwarf planets. All the planets in our solar system travel around the Sun in a counterclockwise direction (when looking down from above the Sun's north pole). All of the planets and dwarf planets, with the exception of Venus, Uranus and Pluto, also spin (or rotate) in a counterclockwise direction.

Your Task

Use what you know about the Earth-Sun-Moon system to create a visual model and a written summary that explains the phases of the Moon. To complete this task, you will need to explore an online interactive called *The Moon's Orbit*. Once you understand the lunar phases, you will create an explanation and a visual model that explains the phases of the Moon as well as why there are occasional lunar and solar eclipses. You should be able to use your model to predict when and where you will be able to see the Moon in the sky during a lunar cycle.

The guiding question of this investigation is: **Why does the appearance of the Moon change over time in a predictable pattern and why are there occasional lunar and solar eclipses?**

Materials

You will use the following link for *The Moon's Orbit* interactive during your investigation:
http://sepuplhs.org/middle/third-edition/simulations/moon_phase_simulation.html

Getting Started

You can use this model to see how light shines on Earth and the Moon when they are in different positions relative to each other. You can also use this model to test your different ideas about the underlying cause of the Moon phases and eclipses.

First, go through the interactive once (press the "play" button) to understand how the orbit of the Moon causes the Moon phases. Next, go through the interactive again, choosing each of the different phases (from the drop down menu) to see where the Moon is in relation to the Earth and the Sun. Finally, create a visual model (labeled diagram with arrows) of the Moon phases. Include a written summary of 5-7 sentences explaining the lunar cycle. Explain where in the cycle lunar and solar eclipses would occur and why.

Rubric

Your model includes:

- ❑ A labeled diagram with arrows showing each phase of the lunar cycle (16 points)
- ❑ A written summary of the lunar cycle (at least 5-7 sentences), including when in the cycle a lunar and a solar eclipse would occur and why (10 points)

You can draw your labeled diagram on paper, then take a picture and upload it to your Google Doc or you can make your diagram using the drawing tools on Google Docs. You may NOT just upload a diagram from the Internet.

If you would prefer to upload a video of you explaining the lunar cycle using props or pictures and explaining eclipses, that would work, too!