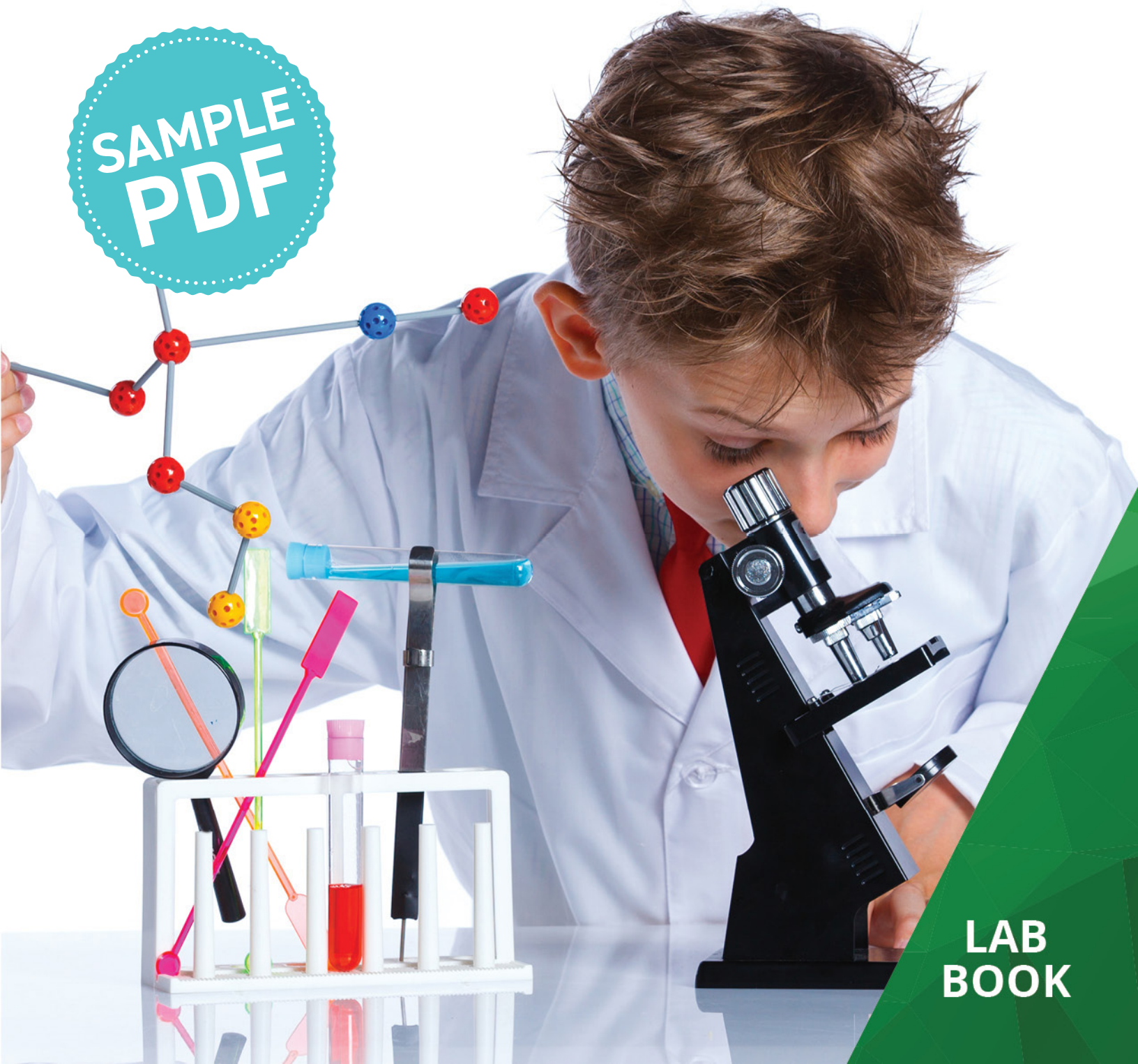


Discover!

General Science 1

SAMPLE
PDF



LAB
BOOK

The Tilted Moon

Upon completion of the lab, you will be able to:

- explain why solar eclipses don't occur every month
- identify the points when a solar eclipse can occur in a model

Key Concepts

- The moon makes a complete revolution around Earth approximately every 27.3 days.
- Earth makes a complete revolution around the sun approximately every 365 days.
- The moon is orbiting Earth as Earth orbits the sun.
- A solar eclipse is caused by the shadow of the moon projecting onto Earth as the moon passes between the sun and Earth.
- There are full and partial solar eclipses.
- Solar eclipses do not occur every month.

Materials

- two tall nails or pushpins
- clay (enough to make a sphere 2 cm in diameter and a sphere 0.5 cm diameter)
- 30 cm x 30 cm piece of cardboard
- 60 cm string
- white paper
- the sun or a very bright light
- tape
- poster board
- markers

START!

While daydreaming about the solar eclipse you saw, you ask your friend if they remember it. "Yes," they reply. "Why do you ask?"

"Well, I looked it up, and there won't be another one here for a long time," you answer.

"Wow! Then I'm especially glad we saw that one!" they exclaim.

"Me too, but I'm still confused about something. A solar eclipse is caused by the moon's shadow when the moon is between the sun and Earth. The moon makes a revolution around Earth once a month, so why isn't there a solar eclipse every month?"

There must be something you are missing.

Solar Eclipse Calendar

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2025			 partial						 partial			
2026		 annular						 total				
2027		 annular						 total				
2028	 annular					 total						

Calendar of solar eclipses occurring somewhere in the world from 2025 to 2028.

Solar eclipses are a relatively rare event, and total eclipses only happen every few years. Every year there is a season for eclipse events.

Look at the calendar of solar eclipse events on the prior page.

Do you see any patterns? Why do you think solar eclipses don't occur once every month?

In this lab, you will make a more geometrically accurate model of the Earth-moon-sun system to better understand the frequency of solar eclipse events.

Answer the questions posed above in your Lab Notes before you begin the lab.

Can you write a hypothesis? Use the Lab Notes page to record your predictions about this assignment.

SEARCH

Model Preparation:

Step 1: Set the 30 cm x 30 cm piece of cardboard flat on a surface.

Step 2: Stick the push pins (or nails) into two corners of the cardboard diagonally from each other.

Step 3: Tie one end of the string to each push pin making sure it is tight between them. You might have to leave extra string at the end to make sure it is a taut line.

Step 4: Put the smaller clay sphere on the top of one pin and the larger clay sphere on the top of the other.

Step 5: Put your bright lamp on a flat surface about a meter or two from a wall, and point the light toward the wall.

Step 6: Tape the white paper to the part of the wall illuminated by the lamp.

What is each part of the model? The small sphere is the moon, and the big sphere is Earth. The light is the sun. The cardboard is Earth's orbital plane. The string is the moon's orbital plane.

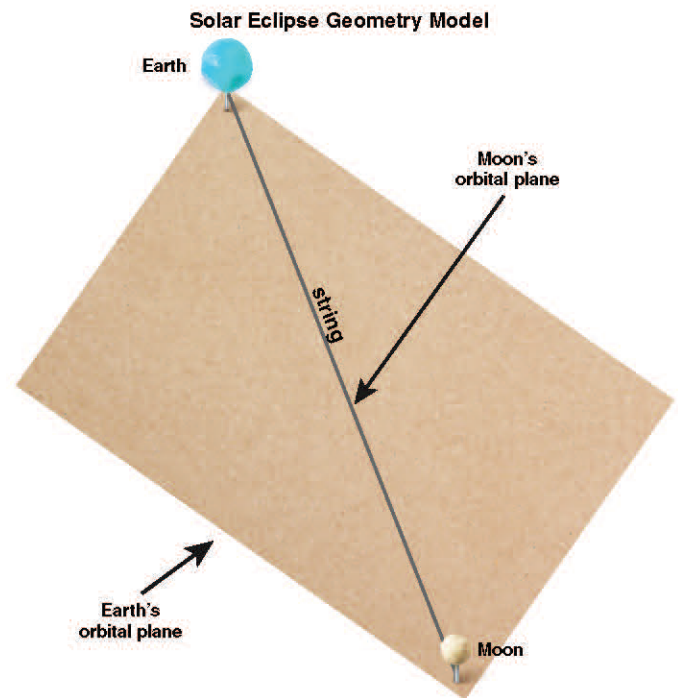
Observation Notes Preparation:

Step 1: Draw three columns across a sheet of paper.

Step 2: Title first column "Parallel Planes."

Step 3: Title second column "Moon Tilted 5° Above Earth's Plane."

Step 4: Title the third column "Moon Tilted 5° Below Earth's Plane."



What is happening during the experiment? Use the Lab Notes page to record your observations about this assignment.

SEARCH

Procedures:

Step 1: Put both pins at equal heights where the string makes a flat 180° plane with the cardboard.

Step 2: Put the model approximately 30 cm in front of the light, with the sun, moon, and Earth lined up in that order. The shadows of the spheres should be shown on the white paper. The cardboard should be level with the ground.

Step 3: What do you notice about the shadows? Do you see both?

Step 4: Write your observations about the shadows in the first column of your observation notes.

Step 5: Pull up the moon pin, making it about 1.5 cm higher than Earth's pin.

Step 6: Did the shadows change?

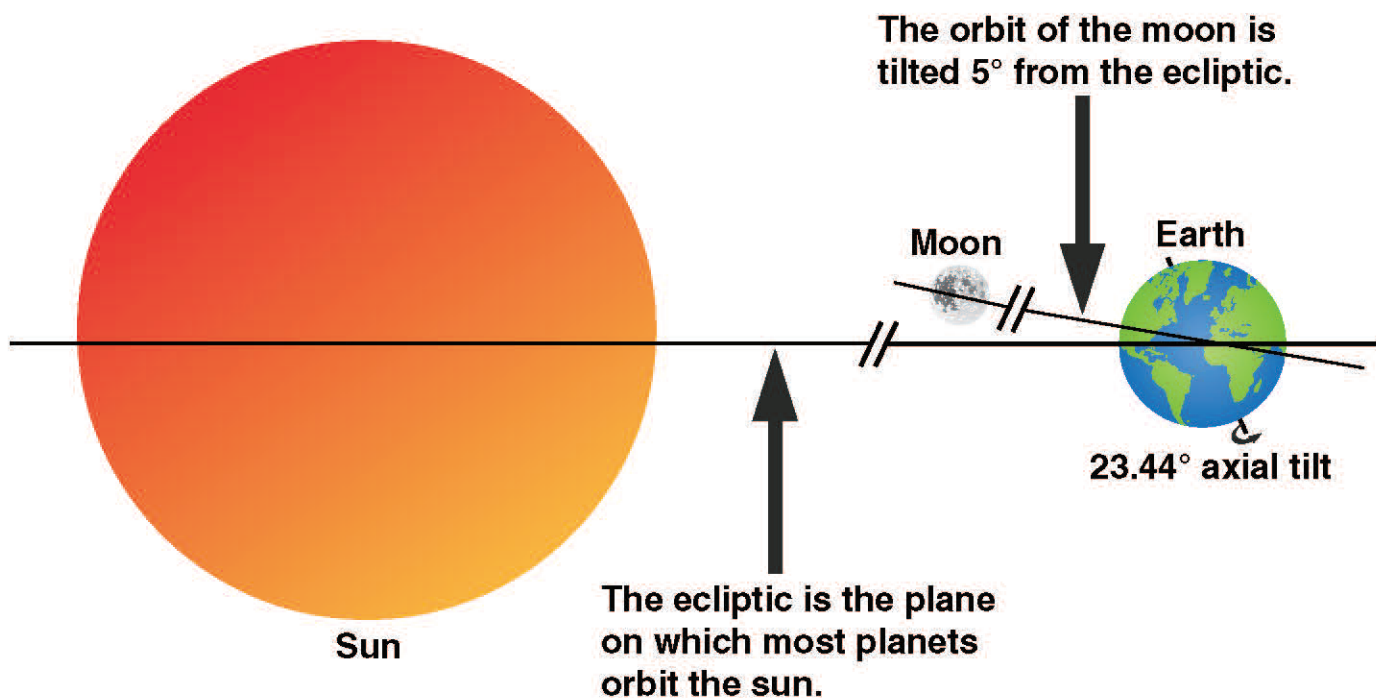
Step 7: Write your observations about the shadows you see with this arrangement in the second column of your observation notes.

Step 8: Push the moon pin down, keeping the moon at the top of the pin, where the moon is about 1.5 cm lower than the earth.

Step 9: Did the shadows change?

Step 10: Write your observations about the shadows you see with this arrangement in the third column.

This model demonstrates how the tilt of the moon's orbit can affect the location of shadows when the sun, moon, and Earth are in a line.



Model of the 5° tilt of the moon's orbital plane compared to the Earth's orbital plane.

What is happening during the experiment? Use the Lab Notes page to record your observations about this assignment.

SYNTHESIZE

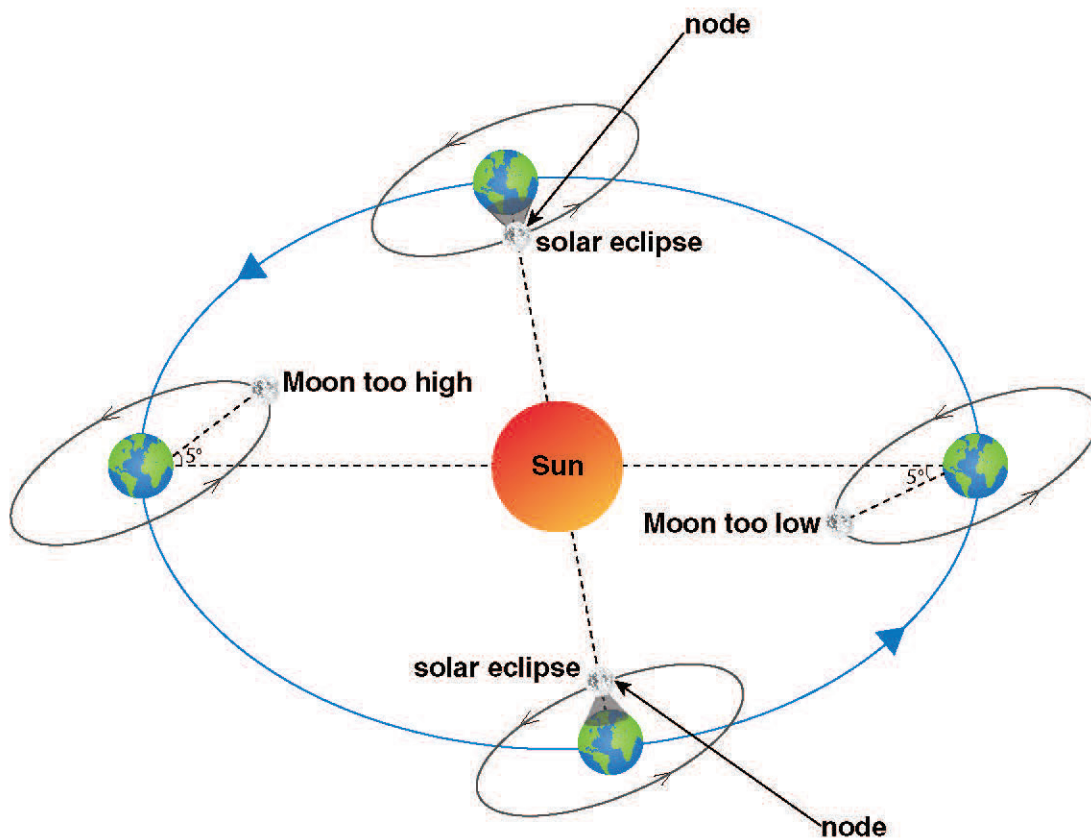
How do you think the moon's tilted orbit affects the frequency of solar eclipses?

As you saw in the model, a tilted orbit sometimes causes the moon's shadow to miss Earth when it lines up with the sun and Earth. However, there are times when the moon's orbital path aligns with Earth's orbital path. The two points at which the moon's orbital path and Earth's orbital path meet are called lunar nodes. When the moon is at a node and falls between the sun and Earth, there is a solar eclipse.

That's a lot of things that have to line up!

To synthesize this information and demonstrate your understanding of the solar eclipse phenomenon, create a solar eclipse poster. The poster should include what a solar eclipse is and everything that must occur for one to happen.

You can be as creative as you like with the poster. For example, you could make a movie poster or a public announcement.



Can you describe any results? Use the Lab Notes page to record your observations about this assignment.

STRETCH

Lunar eclipses are also affected by the geometry of the moon's orbit. Like solar eclipses, they only occur a few times a year, but it is much more likely that you will see a lunar eclipse than a solar eclipse in any given year.

Why do you think this is? Discuss your ideas with your instructor.

LAB NOTES

Predict

Before starting this lab, I predict...

Observe

While completing the lab, I observed...

Explain

Upon completion of this lab, I learned...

Keep Going

I still have questions about...

