Inquiry Investigation 7-A

Modelling the Moon's Movement

In this investigation, you will model the motion of the Moon relative to Earth and the Sun.

Skill Check

Initiating and Planning

✓ Performing and Recording

✓ Analyzing and Interpreting

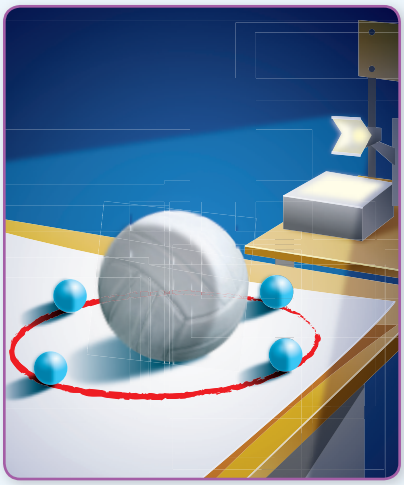
✓ Communicating

Safety Precautions

- Do not look at or let your eyes get in the path of the projector light.
- Do not touch the projector or the light. They can get very hot.
- To unplug the projector, pull on the plug, not the cord.

Materials

- flashlight or overhead projector
- volleyball
- baseball
- string, about 0.5 m
- wide-point, water-soluble black marker
- large sheet of white paper



Set-up for the investigation if using an overhead projector

Question

How does the Moon's position affect its phases?

Procedure

1. Lay the white paper on a large flat surface, such as four flat-topped student desks, pushed together.
2. Using a piece of string as a compass, draw a large circle on the paper to represent the orbit of the Moon.
3. Place the volleyball in the centre of the circle to represent Earth.
4. Place the light source at a height that is the *same level as the table* and about 3 m away. The light source is your simulated Sun.
5. Place the baseball on the circle so that it lies exactly between the volleyball and the light source. The baseball represents the new Moon phase in this position.
6. Assuming that the North Pole is at the top of the volleyball, move the baseball around the circle at 45° intervals in a counterclockwise direction. On the sheet of paper, write the lunar phase that the position of the baseball represents at each interval.

Analyze and Interpret

1. Can you see a full Moon during the day? Explain your answer.
2. Can you see a new Moon? Explain your answer.

Conclude and Communicate

3. At which phase of the Moon is a lunar eclipse possible?
4. At which phase of the Moon is a solar eclipse possible?
5. This model suggests that there should be an eclipse every month. In reality, there are usually only two lunar eclipses and two solar eclipses every year. Explain why.

Extend Your Inquiry and Research Skills

6. **Inquiry** Using direct observations, track the movement of the Moon over a period of one month in a notebook. How do your observations compare with the observations you made in this investigation?

Inquiry Investigation 7-B

Skill Check

Initiating and Planning

✓ Performing and Recording

✓ Analyzing and Interpreting

✓ Communicating

The Changing View of the Night Sky

Some constellations and stars are visible throughout the year but change position in the night sky. Other constellations and stars are only visible in certain seasons. As the planets orbit the Sun, they become visible from Earth in different parts of the night sky. The path that they follow through the sky is called the *ecliptic*. The ecliptic passes through 12 constellations, called the constellations of the zodiac, as shown in the diagram on page 309.

In this investigation, you will observe the motions of Polaris and one of three bright seasonal stars (Sirius in Canis Major, Vega in Lyra, or Regulus in Leo). Depending on the time of year, you may be able to observe Venus, Jupiter, or Saturn. You will use direct observation and star maps. Go to Appendix B to learn more about using star maps.

Safety Precautions

- Always observe the night sky with a trusted and responsible adult present.
- Check the forecasted weather conditions for your area, and dress appropriately.

Materials

- star maps for each season from your teacher
- a list of the visible planets from your teacher
- coloured pencils
- flashlight with a red filter, such as red cellophane (Red light does not interfere with night vision.)
- a clipboard or hard surface to use under the star maps

Questions

- Why are some constellations and stars visible throughout the year, while others are visible only in certain seasons?
- Why can you only observe Venus just before sunrise or just after sunset?

Hypotheses

- Some constellations and stars are visible throughout the year because they are close to Polaris. Other constellations and stars are only visible during a certain season because of Earth's revolution around the Sun.
- You can only observe Venus just before sunrise or just after sunset because it is so close to the Sun.

Procedure

1. Make a table like the one below. When observing a star or planet, estimate its direction (north, south, east, or west) and its height above the horizon in degrees. For example, halfway up from the horizon to overhead is 45°, one third of the way up is 33°, two thirds of the way up is about 67°, and overhead is 90°. Record the date and time of your observation, as well as a description of the object's appearance (for example, bright, whitish, reddish, twinkling).

Observation Table

Object	Direction and Height	Constellation	Date and Time of Observation	Appearance
Betelgeuse	south, about 50°	Orion	January 15, 9:00 P.M.	orangish, twinkling

2. Observe Polaris and the star for the season. You will have to check the star maps to determine which of the seasonal stars you can see. Record your observations in your table. Make the same observations again a few hours later, and record those observations as well.

3. Observe Venus and either Jupiter or Saturn (whichever is visible). Record your observations, and mark the positions of the planets on the appropriate star map.

Analyze and Interpret

1. **a.** Compare the positions of Polaris and your seasonal star using your observations. Which star does not appear to change position? Explain your answer.
   b. Which stars can you only see at certain times of the year?

2. In which seasons are the following constellations visible in the early evening: Orion, Leo, Scorpius, and Pegasus?

3. **a.** When did you observe Venus?
   b. In which constellation is Jupiter or Saturn? Determine the approximate length of time that Jupiter or Saturn will be in this constellation by dividing the planet's period (in years) by 12 (the number of zodiacal constellations).

4. How are the planets similar to the brighter nearby stars? How are they different?

Conclude and Communicate

5. Why will you never see a planet near the Big Dipper?

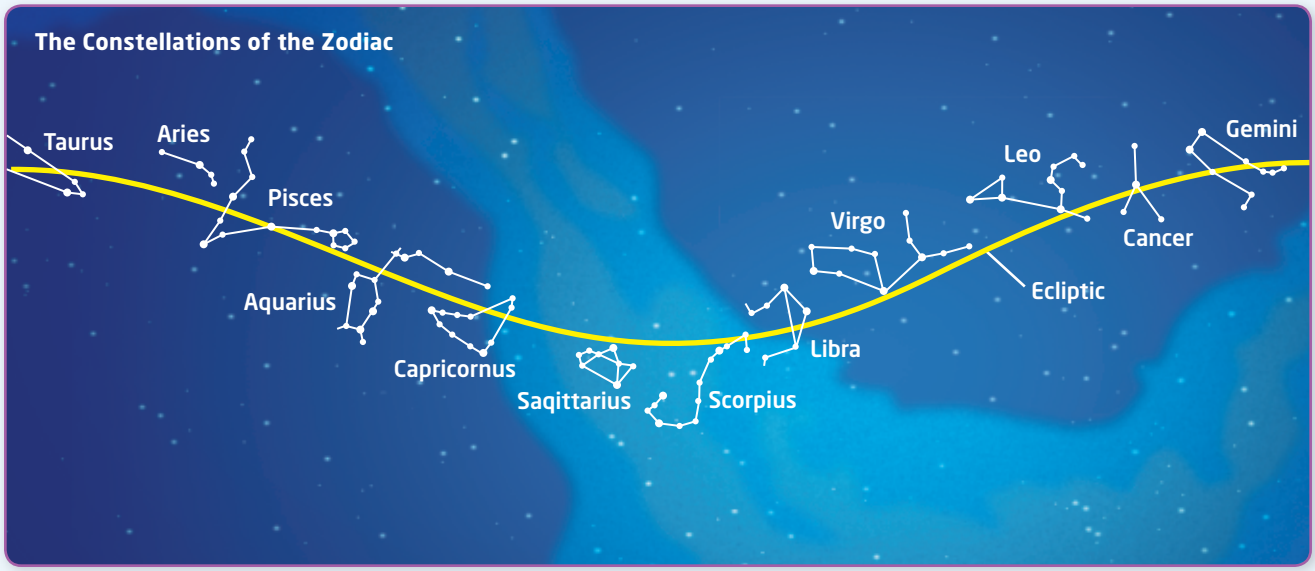
6. Why can you only observe Venus just before sunrise or just after sunset, while Jupiter or Saturn can be observed throughout the night? Compare your answer to the hypothesis.

7. Why are some constellations and stars visible throughout the year, while other constellations and stars are only visible during a certain season? Compare your answer to the hypothesis.

Extend Your Inquiry and Research Skills

8. **Inquiry** In this investigation, you observed and noted the motion of celestial objects. What new scientific questions has this experience made you think of?

9. **Research** Research star maps. What is the history of star maps?



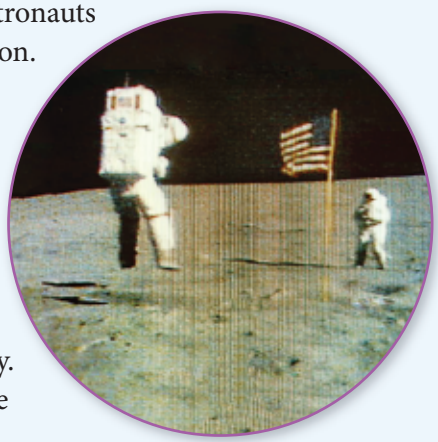
Data Analysis Investigation 7-C

Skill Check

- ✓ Initiating and Planning
- ✓ Performing and Recording
- ✓ Analyzing and Interpreting
- ✓ Communicating

Gravity on Other Planets

You have probably seen pictures of astronauts bouncing along the surface of the Moon. Even with their bulky spacesuits and oxygen tanks, they can jump much higher and drop back down more slowly than they could on Earth. The reason why astronauts can bounce this way on the Moon but not on Earth is because the Moon's gravity is different from Earth's gravity. In this investigation, you will compare the gravity on different planets.



Astronaut bouncing on the Moon

Science Skills

Go to **Science Skills Toolkit 7** for information about creating data tables.

Question

Which characteristics of a planet cause the planet to have more or less gravity: atmosphere, mass, and/or orbital radius?

Hypothesis

Write your own hypothesis.

Organize the Data

1. Make a table to record values of the planetary characteristics. Include a column headed "Gravity (Earth = 1.00)." Give your table a title.

Analyze and Interpret

1. Complete your table by conducting research on the Internet or using other sources. Enter the value for the gravity of each planet in terms of Earth's gravity. So, the value under "Gravity" for Earth is 1.00.
2. Does a planet's gravity depend on its atmosphere, mass, or orbital radius? Explain your answer.

Conclude and Communicate

3. Which characteristics affect a planet's gravity?

Extend Your Inquiry and Research Skills

4. **Research** What is your weight on Earth? Research what your weight would be on other planets in the solar system.