INTRODUCTION

After Parts 1 and 3 of this module, you will be assessed on your ability to show what you know and what you can do as it relates to your study of the solar system. You have now completed Part 1: Sun-Earth-Moon System of Earth in Space, and this lesson will assess your grasp of the concepts and skills in Lessons 1–8. This assessment is divided into three parts. During Part A, you will conduct an investigation and record your observations and conclusions. You also will be asked to describe how the investigation relates to the Sun-Earth-Moon system. For Part B, you will complete multiple-choice and short-answer questions about the Sun, Earth, and Moon. You also will review diagrams and interpret data plotted on a graph. In Part C, you will revisit an activity from Lesson 2 to see how much you have learned.

OBJECTIVES FOR THIS LESSON

Review and reinforce concepts and skills from Part 1: Sun-Earth-Moon System.

Complete a three-part assessment of the concepts and skills addressed in Part 1.
Getting Started

1. Examine the parts of the digital thermometer. Read the Safety Tip.

2. Read the temperature using the Celsius scale. Place the metal rod of the thermometer between your finger and thumb. Which part of the metal on the thermometer registers the temperature? How can you get the temperature to change? How can you get it to return to room temperature? Discuss your ideas with your group and class.

SAFETY TIP

The digital thermometers have a sharp point; remember to handle them carefully.

MATERIALS FOR LESSON 9

For you

1 copy of the planning sheet
1 copy of Inquiry Master 9.1a: Sun-Earth-Moon Performance Task (Part A)
1 copy of Student Sheet 9.1a: Sun-Earth-Moon Performance-Based Assessment (Part A)
1 copy of Inquiry Master 9.1b: Sun-Earth-Moon Written Assessment (Part B)
1 copy of Student Sheet 9.1b: Sun-Earth-Moon Assessment Answer Sheet (Part B)
1 copy of Student Sheet 9.1c: What We Now Know About the Sun-Earth-Moon System (Part C)

For your group

2 bookends
1 clamp lamp with reflector
1 100-W lightbulb
1 digital thermometer
1 student timer (or other timepiece)
1 metric measuring tape, or \( \frac{1}{2} \)-meter stick
1 protractor
1 white foil square
1 black foil square
3. To keep results consistent among groups, discuss with your class how to hold the thermometer. See Figure 9.1, which shows one method.

4. How will a clamp lamp affect the temperature of the thermometer at different distances from the lamp? Discuss your ideas with the class. You will formally test your ideas in this lesson.

**PROCEDURE**

**Part A**

1. Collect one copy of the planning sheet, one copy of Student Sheet 9.1a, and one copy of Inquiry Master 9.1a.

2. Review the Inquiry Master 9.1a and the planning sheet with your class. Examine the equipment. Note that you will not use all the equipment; the equipment you use depends on the question you test.

3. Discuss with your teacher how you will be assessed in this lesson.

4. Complete your planning sheet. Review it with your teacher.
REFLECTING ON WHAT YOU’VE DONE

1. After you have reviewed this assessment with your teacher, compare your responses on Student Sheet 9.1c with your science notebook entries from Lesson 2. How have your ideas about the Sun-Earth-Moon system changed since Lesson 2?

2. Read “Fast Plants: Ready for Liftoff!”

5. Review the Safety Tip. Then obtain your lab equipment. Although you will share a set of materials with other students, you should complete Student Sheet 9.1a in your own words.

6. Complete your investigation. Turn in Student Sheet 9.1a when you are finished. Shut off all clamp lamps. Your teacher will tell you where to put your equipment.

Part B
Complete Part B. Do not write on the sheet of questions; other classes throughout the day will use it. Write answers on your answer sheet.

Part C
Complete Student Sheet 9.1c.

SAFETY TIP
Do not touch the metal reflector on the clamp lamp while it is turned on or while it is cooling.
FAST PLANTS:
Ready for Liftoff!

Wisconsin Fast Plants™ were grown aboard the Soviet space station Mir, as well as on numerous U.S. space shuttles. In this interview, Dr. Paul Williams, retired university professor at the University of Wisconsin and the creator of Fast Plants, answers several questions about Fast Plants’ role in space.

Q: Why take Fast Plants—or any plants—into space?
A: For many reasons. First, it’s hoped that on long space missions or on space stations, plants will recycle the air. Carrying the oxygen needed by big crews on long missions would be impossible. So, space scientists hope to use plants to take in expelled carbon dioxide and release necessary oxygen in space, just as they do on Earth.

Another reason we experiment with plants in space is to find out if they can provide food for astronauts. Astronauts get tired of freeze-dried and packaged foods. Fast Plants are small. They don’t take up much room, and they grow fast. They also belong to one of the largest and most diverse families of plants, Brassica. From various seeds, we can grow edible and industrial oil and a range of veggies—cabbage, broccoli, lettuce, turnips, cauliflower, and many others.

A third reason to take plants into space is that they remind astronauts of Earth. This can add to a sense of well-being and reduce homesickness. Michael Foale, an American astronaut aboard Mir, said that tending the plants helped him and his two cosmonaut companions stay hopeful during some tough days.

Q: Do Fast Plants grow in space the same way they grow on Earth?
A: Until Mir in 1997, we didn’t know if plants would reproduce successfully in space. That was the first time seeds sown in space grew into plants that flowered and produced more seeds. And to our delight, the Fast Plants took the same amount of time to do all that in space that they take on Earth—about 6 weeks.

Q: What are Fast Plants?
A: Fast Plants are plants that are specially bred for rapid development. In 5 to 6 weeks, these little relatives of turnip and mustard plants go through an entire life cycle, from seed to seed.
Fast Plants™, which were grown in space aboard the Columbia space shuttle, were kept in a special growth chamber.

However, in space the plants are kept in a special growth chamber where temperature, air quality, humidity, and light are controlled. We have to give them lots of light, especially at first. We also give them extra carbon dioxide. On Earth, gravity and light direct growth in plants. But in space, in microgravity, light alone guides the direction of growth.

Q: What is microgravity?
A: It means “very little gravity.” The farther away we travel from Earth, the weaker Earth’s gravity becomes. As a spacecraft orbits around Earth, gravity is extremely weak.

Q: How do you water space plants?
A: Astronauts use a syringe to inject a solution of water and nutrients into the foam bed that secures each plant.

Q: How are space plants pollinated?
A: They have to be pollinated by hand because there are—as of yet—no insect pollinators in space. Astronauts use “bee sticks”—toothpicks with dead bees glued on one end that can pick up pollen grains and deposit them on the stigma of plants.

It’s not hard, but as you might imagine, it takes time. Astronauts have to mark each plant to make sure each one is included. I’m waiting for someone to experiment with live butterflies and bees as pollinators in space. That would be a terrific next step!®