ACTIVITY 3

How Big Are the Planets?

OBJECTIVES

To gain an appreciation for the actual sizes of objects in our solar system, and as a reference point for future activities, students work together to make a scale model of the solar system.

The students

- review the components of our solar system
- draw and cut out planets and the Moon for a class solar system model
- compare the sizes of the planets, Moon, and Sun

SCHEDULE

About 40 minutes

VOCABULARY

orbit
planet
solar system
star

MATERIALS

For each student

1	Activity Sheet 3

For each of 10 teams

1	compass, drawing*
1 sht	paper, construction
1	ruler, metric*
1 pair	scissors*

For the class

1	ball, foam, large
1 pc	cloth, yellow, 1.25 m × 1.25 m
1	globe, inflatable
1	marker*
1	measuring tape
10 pcs	paper, scrap*
1	poster, Solar System
1 roll	tape, masking

* provided by the teacher

PREPARATION

1. Make one copy of Activity Sheet 3 for each student.
2. If the kit is being used for the first time, you will need to prepare the model Sun as follows: Using one of the teams' pair of scissors, cut a 1.25-m-diameter circle out of the 1.25 m × 1.25 m yellow cloth square. Use a marker to label the model Sun.
3. Plan how to divide the class into 10 teams of up to four students each. Write the name of one planet (or Pluto or the Moon) and its model size on each sheet of scrap paper (see Figure 3-1). Do not include the Sun. Hide the model of the Sun somewhere near the board where you will display teams' model pieces. Do not hang the Solar System poster until instructed to do so.

BACKGROUND INFORMATION

Our ***solar system*** consists of a ***star***—the Sun—and the objects that ***orbit*** around it. The solar system includes the Sun, moons, ***planets,*** dwarf planets, comets, meteoroids,

and asteroids. The largest and most important parts of the solar system are the Sun and the planets.

In August 2006, the International Astronomical Union (IAU) adopted a new definition of a planet. The new definition is based on three criteria: the object (1) orbits the Sun; (2) is massive enough that its gravity makes it assume a nearly round shape; and (3) clears the area in which it orbits. As a result, our solar system is now recognized as having only eight planets, not nine. Pluto is now classified as a dwarf planet.

Students often have misconceptions concerning the relative sizes of the major components of the solar system. The Sun is about 100 times the diameter of the Earth and makes up more than 99 percent of the solar system's matter.

Scale models such as the one made in this activity are a useful way of comparing objects that are too big and too far away for direct study.

▼ **Activity Sheet 3**

How Big Are the Planets?

1. Use the chart below to identify each part of your class solar system model.

Part of the solar system	Actual diameter in km (1,000,000 mm)	Model diameter in mm
Mercury	4,898	4
Venus	12,104	11
Earth	12,756	12
Mars	6,787	6
Jupiter	142,980	128
Saturn	120,540	108
Uranus	49,530	44
Neptune	51,120	46
Pluto	2,300	2
Sun	1,392,000	1,250
Moon	3,476	3

2. Draw and label model diameter lines to show the relative sizes of the planets, Pluto, and Earth's Moon from largest to smallest.

Jupiter
Saturn
Neptune
Uranus
Earth
Venus
Mars
Mercury
Moon
Pluto

Guiding the Activity

1 Ask, **What is a solar system?**

Write *solar system* ~~on the board~~. To motivate students, ask, **If the Earth were not much larger than a pea, how big would the rest of our solar system be?**

Write *star* on the board and ask, **If a solar system consists of a star and the objects that travel around it, what is a star?**

Ask, **What do we call the star in our solar system? What are the objects that travel around the star in our solar system?**

Additional Information

Make sure that students understand that a solar system consists of a star and the objects that travel around it.

Students will have many different ideas of how large our solar system is, relative to a pea. For now, just allow them to speculate.

*While students can identify stars in the sky, they may not know that **stars** are huge self-luminous balls of hydrogen and helium gas. The North Star and most of the other dots of light they see in the sky are stars.*

*Students will know that our star is called the Sun. Our **solar system** consists of the central Sun, the planets that orbit it, and their moons. They may also mention objects such as dwarf planets, comets, meteoroids, and asteroids.*

Guiding the Activity

Additional Information

Write *planet* on the board and ask, **What is a planet? How is it different from a star or a moon?**

*Students may know that a **planet** is not self-luminous and may be composed of rock or gas. Also, planets orbit a star, while stars and moons do not. Moons orbit planets.*

2 Write *orbit* on the board. Hand the inflatable globe to one student and a large foam ball to another and tell them to demonstrate an orbit.

Explain that an **orbit** is the path followed by an object as it revolves around another body. Ask, **What shape is an orbit, generally?**

Students may know that orbits are generally circular. Some are more elliptical.

3 Ask, **What are our solar system's largest and most important components?**

Students should be led to realize that the largest and most important components of the solar system are the Sun and planets.

Ask, **What are the names of the planets in our solar system?** Write the names on the board under "Solar System" as students answer.

Students may know that the planets are Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune.

Add the Sun, the Moon, and Pluto to the end of the list.

Explain that the Moon is not a planet because it orbits the Earth, not a star. Even though it is not very important in the workings of the solar system (and other planets also have moons), we will include our Moon in our list because it is important to events that occur on Earth.

Nor is Pluto now considered a true planet. It was reclassified as a dwarf planet in 2006.

Ask, **How large do you think each of these parts of the solar system is in comparison with the Earth? Two times? Ten times?** Record student predictions beside the planet or other body.

These predictions are only for comparison with actual relative sizes later, so any answers are acceptable.

4 Next, tell students that each team will create a part of a scale model that shows the relative sizes of the planets that make up the solar system. (See Figure 3-1 for actual and model sizes.) Ask, **Why might scientists use scale models to help them study astronomy?**

Students should realize that most astronomical objects are too big and too far away for direct study.

Guiding the Activity

Order from the Sun

Part of the solar system	Actual diameter in km (1,000,000 mm)	Model diameter in mm
Mercury	4,898	4
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▲ *Figure 3-1. Actual and model sizes of the planets, Moon, and Sun.*

5 Distribute **Activity Sheet 3.** Allow students time to look over the chart on the activity sheet.

you have been given each planet in the correct size your group will need to: 1. Identify the planet by measuring its diameter in mm. 2. Label and cut out each planet. 3. Place the planets in order from the sun on the construction paper.

Guiding the Activity

Additional Information

6 When all 10 models have been labeled with their names, ask, **Which major part of the solar system is still missing? How does this last component compare to the planets and Moon in size?**

Have ~~some~~ students discuss ~~draw on the board~~ how large they think the Sun might be relative to their model planets. Lay out the string to guess how big around the sun is in comparison to the cut out planets.

Students should realize that the Sun is not yet a part of the model. Allow them to make predictions concerning the relative size of the Sun. Glue the word Sun on the paper.

M.A.D. Lab

Name_____ Date_____ **Activity Sheet 3**

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Order from Sun →

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2. Identify each planet by measuring its diameter in mm.

3. Label and cut out each planet.

4. Place the planets in order from the Sun and glue to the provided construction paper.