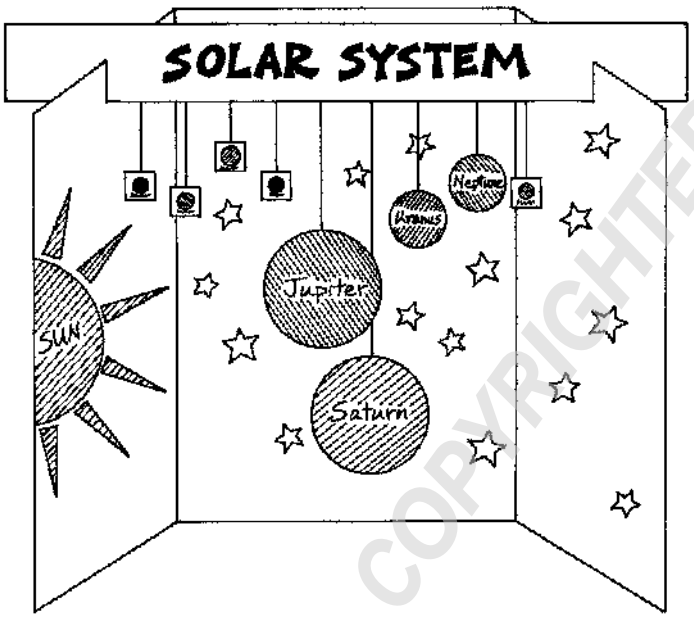
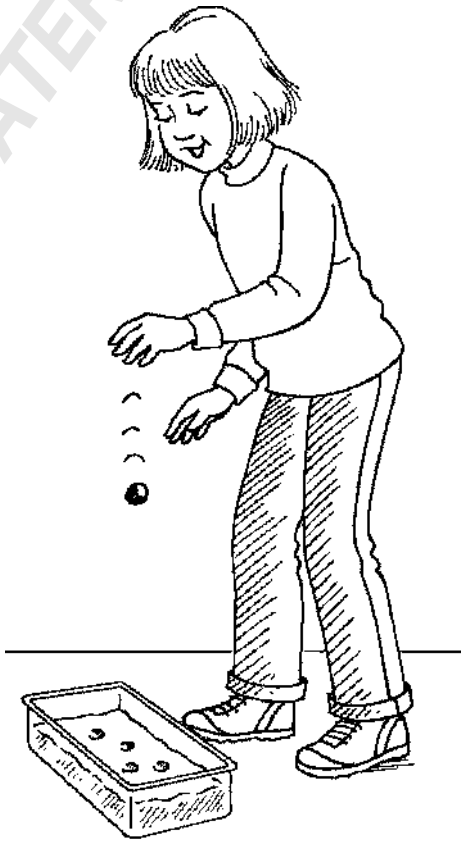
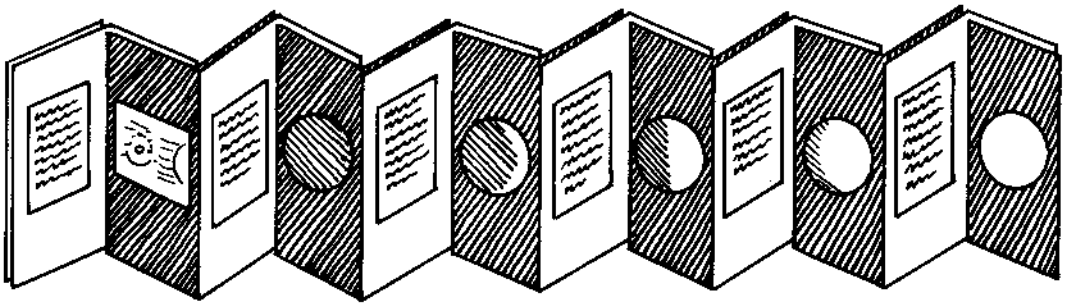
I

ASTRONOMY







1

Line Up

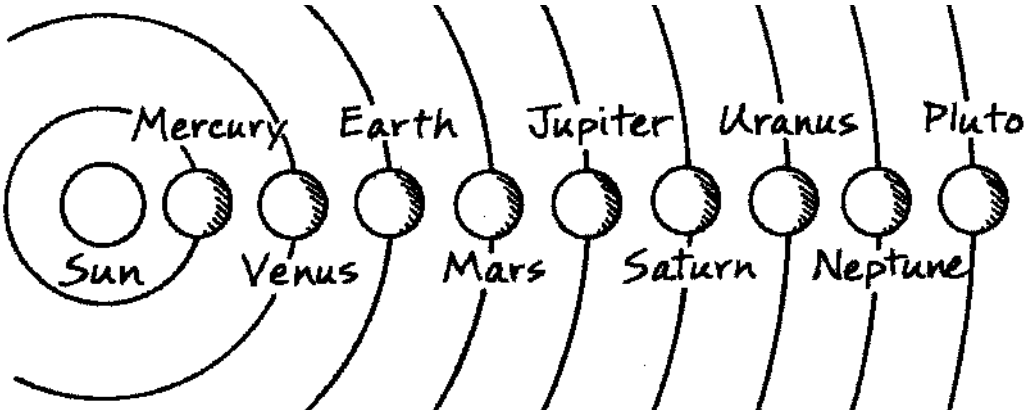
Make a Model of the Solar System!

Celestial bodies are natural things in the sky, such as **stars** (bodies made of gases that are so hot they give off light), **planets** (bodies that revolve around a sun and shine only by the light they reflect), and **moons** (bodies that revolve around planets and shine only by the light they reflect). **Revolve** or **orbit** means to move in a curved path around another body. The curved path one celestial body takes around another is also called an orbit. A **solar system** is a group of celestial bodies that revolve around a central body that is a star called a **sun.**

The bodies that orbit our Sun include **minor planets** (small rocky bodies mainly between the orbits of Mars and Jupiter; also called **asteroids**), nine **major planets** (planets with diameters larger than Ceres, the largest asteroid) and their moons, **comets** (bodies of dust, gases, and ice that move in an extremely elongated path), and space debris.

The major planets in order from the Sun are Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, and Pluto. One way to remember the order of the planets is to remember the sentence, My Very Eager Mother Just Served Us Nice Pizza. (The first letter of each word is the first letter of the name of each planet in order from the Sun.) The diagram shows the planets in order from the Sun but does not represent their distance.

The **universe** is Earth and everything else in space. Early models of the universe were **geocentric** (Earth-centered). The Greek astronomer Aristotle (384–322 B.C.) supported the geocentric view, and his ideas about the universe were considered true by most people for almost 2,000 years. Ptolemy (87–165), an influential Roman astronomer, agreed with Aristotle's geocentric view. No one seriously questioned Ptolemy's theory until 1543, when the Polish astronomer Nicolaus Copernicus (1473–1543) published a book suggesting a **heliocentric** (Sun-centered) model. The Italian scientist Galileo Galilei (1564–1642) agreed with Copernicus's view that the Sun was the



Heliocentric

Mercury and Venus are called **inferior planets** because their orbits are closer than Earth's orbit to the Sun. Mercury is the smallest inferior planet and the one closest to the Sun. It orbits the Sun once in about 88 Earth days. (An **Earth day** is about 24 hours and is the time it takes Earth to **rotate,** or turn about its **axis**—the imaginary line through the center of a body about which the body rotates.) Venus is the second planet from the Sun. It orbits the Sun in 225 Earth days. Venus is generally the easiest planet to see in the sky and shines more brightly than any star.

The planets whose orbits are farther than Earth's orbit from the Sun are called **superior planets.** The superior planets include Mars, Jupiter, Saturn, Uranus, Neptune, and Pluto. Mars is called the red planet because of its reddish glow. The red color is due to the rusty iron in its soil. Mars orbits the Sun in 1.9 Earth years. (An **Earth year** is the time it takes Earth to orbit around the Sun, or about 365 days.)

Jupiter is the largest planet. It is made mostly of gases and has a storm in its **atmosphere** (the blanket of gas surrounding a celestial body) that looks like a red spot. This spot is larger than the Earth. It takes 11.9 Earth years for Jupiter to orbit the Sun.

Saturn is 9.4 times larger than Earth. It is the most distant planet that is relatively easily viewed in the sky without a telescope. Through a telescope, rings can be viewed around Saturn. It takes 29.5 Earth years for Saturn to orbit the Sun.

Uranus is four times larger than Earth. It can be seen with the naked eye if conditions are right. It looks like a faint star. It was the first planet to be discovered through a telescope. It takes 84 Earth years for Uranus to orbit the Sun.

Neptune is almost four times as large as Earth. The German astronomer Johann Galle (1812–1910) first observed this planet through a telescope in 1846. It takes 164.8 Earth years for Neptune to orbit the Sun.

Pluto is about one-fourth as large as Earth. The American astronomer Percival Lowell (1855–1916) predicted that Pluto existed, and in 1930 the American astronomer Clyde William Tombaugh (1906–1997) found Pluto near that position. It takes Pluto 247.7 Earth years to orbit the Sun.

center of the universe. But it wasn't until the end of the 1600s that the heliocentric model was generally accepted by astronomers. Today it is known that our solar system is a very tiny part of a **galaxy** (a group of millions of stars, gas, dust, and other celestial bodies) called the Milky Way. This galaxy is just one of many galaxies in the universe. It is also known that our Sun is not in the center of the universe, only the center of our solar system.

ACTIVITY: PLANET ORDER

Purpose

To make a model of the order and relative sizes of the planets in our solar system.

Materials

two 22-by-28-inch (55-by-70-cm) pieces of blue poster board
glue
yardstick (meterstick)
drawing compass
pen
2 sheets of 9-by-12-inch (22.5-by-30-cm) construction paper—1 orange, 1 white
scissors
two black markers—1 wide-point, 1 fine-point
metric ruler
pencil
two 22-by-28-inch (55-by-70-cm) pieces of white poster board
square of white poster board
9 different colored crayons—1 blue, 1 red, and 7 other colors except yellow
transparent tape
string

Procedure

1. Use the blue poster board to make a narrow three-paneled backboard with a title strip, using the instructions in Appendix 1, Part A.

2. Using the compass, draw a large semicircle (with 8" diameter) on the orange construction paper. Also draw long, thin (4") triangles to represent rays of sunlight. Cut out the semicircle and triangles. Use the wide-point marker to label the curved figure "Sun." Glue the Sun and light rays to the left panel of the backboard, as shown.

3. Fold the white construction paper in half two times. Draw four stars on the folded paper. Cut out the stars, cutting through all four layers of paper. Glue the stars to the center and right panels of the backboard.

4. Use the wide-point marker to label the title strip of the backboard "Solar System."

5. Use the ruler and pencil to draw a 1½-inch (3.75-cm) square on the white poster board. Cut out the square and use it to trace four more squares on the white poster board. Cut out the four squares.

6. Draw a circle of about 0.2 cm diameter in the center of each side of one poster board square. Label both sides of the poster board square "Pluto."

7. Repeat step 6 using the remaining poster board squares for each of the planets in the following table.

Planet Model Sizes

Planet Name	Diameter of Model
Pluto	0.2 cm
Mercury	0.5 cm
Mars	0.7 cm
Venus	1.2 cm
Earth	1.3 cm

8. On the remaining poster board, use the compass to draw a 5-cm–diameter circle. Cut out the circle and label both sides of the circle "Uranus."

9. Using the sizes in the following table, repeat step 8 to make circles for each of the remaining planets.

Planet Model Sizes	
Planet Name	**Diameter of Model**
Uranus	5 cm
Neptune	5 cm
Saturn	12 cm
Jupiter	12 cm

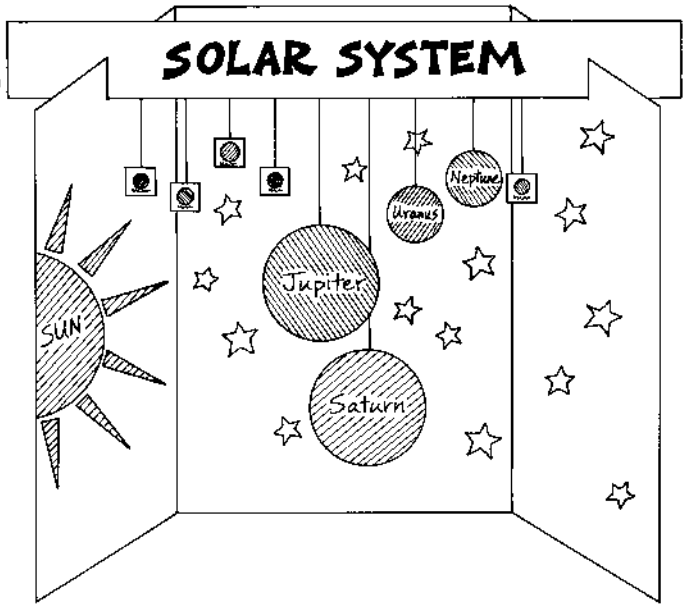
10. Using the blue crayon, color the circles on the front and back of the square for planet Earth. Color the circle for Mars red. Use the remaining crayons to color the remaining seven planet models whatever you like.

11. Cut two 16-inch (35-cm) pieces of string. Tape one piece of string apiece to the tops of the Jupiter and Saturn models.

12. Cut seven 10-inch (25-cm) pieces of string. Tape each piece of string to the top of each of the remaining planet models.

13. With the title strip in place on the backboard, attach the free ends of the strings to the title strip so the models start at 6 inches (15 cm) from the left bottom edge of the title strip and are spaced 2 inches (10 cm) apart in this order from the left: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, Pluto.

14. Adjust the lengths of the strings so that the planet models do not overlap, making some strings longer than others.

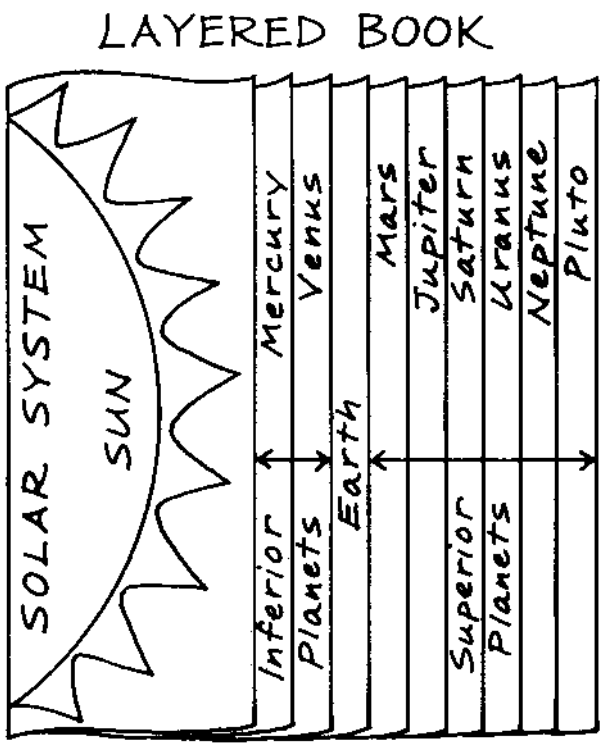


Results

You have made a model of the relative sizes of the planets in their order from the Sun.

Why?

The model represents the known planets in order from the Sun. While it does show the relative sizes of the planets, it does not represent the actual distance between them.



Planet Facts and Figures							
Celestial Body	**Diameter, miles (km)**	**Average Density g/ml (water = 1)**	**Albedo**	**Aphelion or Greatest Distance from Sun, millions of miles (millions of km)**	**Perihelion or Least Distance from Sun, millions of miles (millions of km)**	**Average Distance from Sun, millions of miles (millions of km)**	**Period of Rotation, hours**
Mercury	3,047 (4,878)	5.4	0.1	44 (70)	29 (46)	36 (58)	1,407.5
Venus	7,562 (12,100)	5.3	0.76	68 (109)	67 (107)	68 (108)	5,832
Earth	7,973 (12,757)	5.5	0.39	95 (152)	92 (147)	93 (149)	24
Mars	4,247 (6,796)	3.9	0.16	156 (249)	129 (207)	143 (228)	24.6
Jupiter	89,875 (143,800)	1.3	0.52	510 (816)	463 (741)	486 (778)	9.8
Saturn	75,412 (120,660)	0.7	0.61	942 (1,507)	842 (1,347)	892 (1,427)	10.2
Uranus	31,949 (51,118)	1.2	0.35	1,875 (3,000)	1,712 (2,740)	1,794 (2,870)	15.2
Neptune	30,937 (49,500)	1.7	0.35	2,838 (4,540)	2,782 (4,452)	2,810 (4,497)	16
Pluto	1,434 (2,294)	2.0	0.5	4,604 (7,366)	2,771 (4,434)	3,688 (5,900)	153

ON YOUR OWN

Another way to make a model of the solar system is with a layered book. This book can be made using five sheets of different colored copy or construction paper and the instructions in Appendix 2, Part C.

In the layered solar system book, include facts you find in your research as well as facts from the introduction to this chapter and those listed in the table shown, "Planet Facts and Figures."

BOOK LIST

Becklake, Sue. *Space: The Official Planetarium Book.* Rocklin, Calif.: Prima, 1994. A journey through the solar system, including a study of the planets in our solar system.

Snowden, Sheila. *The Young Astronomer.* London: Usborne, 1989. A guide to introduce beginners to the study of the heavens, including the study of the planets and their order in the solar system.

VanCleave, Janice. *Janice VanCleave's Solar System.* New York: Wiley, 2000. Experiments about the order of the planets and other solar system topics. Each chapter contains ideas that can be turned into award-winning science fair projects.