Solar System Explorer

Answer Key

Vocabulary: astronomical unit, dwarf planet, eccentricity, ellipse, gas giant, Kepler's laws, orbit, orbital radius, period, planet, solar system, terrestrial planet

Prior Knowledge Questions (Do these BEFORE using the Gizmo.)
[Note: The purpose of these questions is to activate prior knowledge and get students thinking. Students are not expected to know the answers to the Prior Knowledge Questions.]

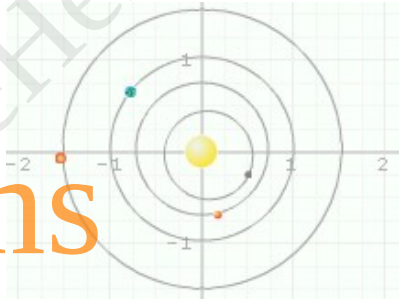
1. List all of the **planets** you can think of in our **solar system**. Try to list them in order from closest to farthest from the Sun.

   Answers will vary. [Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune]

2. Which planets are most like Earth? Which are most different from Earth? Explain.

   Answers will vary. [Venus and Mars are both rocky planets that contain atmospheres.]

Gizmo Warm-up
The *Solar System Explorer* Gizmo™ shows a model of the solar system. All of the distances, but not the sizes of the planets, are shown to scale. To begin, turn on **Show orbital paths** and click **Play** (▶). You are looking at the four inner planets.

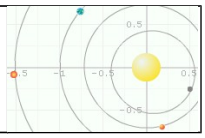


1. In which direction do planets go around the Sun, clockwise or counterclockwise? *Counterclockwise*

2. An **orbit** is the path of a body around another body. What is the shape of the planetary orbits around the Sun? *Planetary orbits are nearly circular.*

3. Click **Pause** (⏸). You can see the name of each planet by holding your cursor over the planet. What is the order of the eight planets, starting from the Sun? Click the "zoom out" button (−) to see the outer planets and Pluto, which is classified as a **dwarf planet**.

   The eight planets are Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune.

Activity A: **Classifying planets**	Get the Gizmo ready: • Click **Reset** (↺).	

Question: How are planets classified?

1. Think about it: How do you think astronomers group planets? *Answers will vary.*

2. Gather data: Select **Mercury** from the **Solar system** menu at left. Turn on **Additional data**. In the table below, record Mercury's **Mass**, **Mean radius**, and **Density**. Then repeat for each of the other planets as well as the dwarf planet Pluto. Include units.

Planet	Mass ($\times 10^{23}$ kg)	Mean radius (km)	Density (g/cm^3)
Mercury	*3.3 $\times 10^{23}$ kg*	*2,440 km*	*5.427 g/cm^3*
Venus	*48.7 $\times 10^{23}$ kg*	*6,052 km*	*5.243 g/cm^3*
Earth	*59.7 $\times 10^{23}$ kg*	*6,378 km*	*5.515 g/cm^3*
Mars	*6.4 $\times 10^{23}$ kg*	*3,397 km*	*3.933 g/cm^3*
Jupiter	*18,990 $\times 10^{23}$ kg*	*71,490 km*	*1.326 g/cm^3*
Saturn	*5,680 $\times 10^{23}$ kg*	*60,270 km*	*0.687 g/cm^3*
Uranus	*869 $\times 10^{23}$ kg*	*25,560 km*	*1.270 g/cm^3*
Neptune	*1,020 $\times 10^{23}$ kg*	*24,760 km*	*1.638 g/cm^3*
Pluto (dwarf planet)	*0.1 $\times 10^{23}$ kg*	*1,195 km*	*1.750 g/cm^3*

3. Analyze: What patterns do you notice in your data table?

   Answers will vary. [Mercury, Venus, Earth, and Mars all have masses below 100 $\times 10^{23}$ kg, radii below 10,000 km, and densities greater than 3.0 g/cm^3. Jupiter, Saturn, Uranus, and Neptune all have masses above 800 $\times 10^{23}$ kg, radii above 20,000 km, and densities less than 2.0 g/cm^3. Pluto has characteristics of both groups.]

4. Analyze: Based on the data you have collected, how would you divide the planets into two groups? Explain your reasoning. (Note: Do not include Pluto in these groups.)

   Answers will vary. [Astronomers divide the planets into two groups, the terrestrial planets (Mercury, Venus, Earth, and Mars) and gas giants (Jupiter, Saturn, Uranus, and Neptune).]

(Activity A continued on next page)