### Chapter 14 The Solar System

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1. What is the sun and where is it within the solar system?
   a. a planet; at the center of the system
   b. a planet; at the outer edge of the system
   c. a star; at the center of the system
   d. a star; at the outer edge of the system
1. What is the sun and where is it within the solar system?
   a. a planet; at the center of the system
   b. a planet; at the outer edge of the system
   **c. a star; at the center of the system**
   d. a star; at the outer edge of the system
2. Which four planets are closest to the sun?
   a. Mercury, Venus, Earth, Mars
   b. Mercury, Earth, Pluto, Neptune
   c. Jupiter, Saturn, Uranus, Neptune
   d. Mercury, Earth, Mars, Jupiter
2. Which four planets are closest to the sun?

a. Mercury, Venus, Earth, Mars

b. Mercury, Earth, Pluto, Neptune

c. Jupiter, Saturn, Uranus, Neptune

d. Mercury, Earth, Mars, Jupiter
3. What are some general characteristics of Jupiter and Saturn?
   a. small, rocky, many moons
   b. large, ringed, many moons
   c. large, rocky, no atmospheres
   d. small, thick atmospheres
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Chapter Preview Questions

3. What are some general characteristics of Jupiter and Saturn?
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   c. large, rocky, no atmospheres
   d. small, thick atmospheres
Chapter Preview Questions

4. What makes life as we know it possible on Earth?
   a. rocky surface, one moon, water vapor
   b. ice, suitable temperatures, thick air
   c. rocky surface, water in three states, thin air
   d. liquid water, suitable temperatures and atmosphere
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Chapter Preview Questions

4. What makes life as we know it possible on Earth?
   a. rocky surface, one moon, water vapor
   b. ice, suitable temperatures, thick air
   c. rocky surface, water in three states, thin air
   d. liquid water, suitable temperatures and atmosphere

   [Correct Answer: d. liquid water, suitable temperatures and atmosphere]
Suppose you were twirling a ball attached to a string over your head. If the string were to suddenly break, what do you think would happen to the ball? Explain your answer.

What types of objects are found in the solar system?
## Greek Word Origins

<table>
<thead>
<tr>
<th>Greek Word</th>
<th>Meaning</th>
<th>Key Terms</th>
</tr>
</thead>
<tbody>
<tr>
<td>astron</td>
<td>star</td>
<td>astronomy, asteroid</td>
</tr>
</tbody>
</table>
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<thead>
<tr>
<th>Greek Word</th>
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</thead>
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<tr>
<td>chrióma</td>
<td>color</td>
<td>chromosphere</td>
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<td>geo</td>
<td>Earth</td>
<td>geocentric</td>
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<tr>
<td>helios</td>
<td>sun</td>
<td>heliocentric</td>
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<th>Greek Word</th>
<th>Meaning</th>
<th>Key Terms</th>
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</thead>
<tbody>
<tr>
<td>Kentron</td>
<td>near the center, central</td>
<td>geocentric, heliocentric</td>
</tr>
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</table>
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<thead>
<tr>
<th>Greek Word</th>
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<th>Key Terms</th>
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</thead>
<tbody>
<tr>
<td>photo</td>
<td>light</td>
<td>photosphere</td>
</tr>
</tbody>
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<tbody>
<tr>
<td>sphaira</td>
<td>sphere</td>
<td>photosphere, chromosphere</td>
</tr>
</tbody>
</table>
Apply It!

Use what you have learned about geocentric to predict what heliocentric means. Revise your definition as you read Section 1.

Sample: Helios means “sun” in Greek, so heliocentric must mean “sun-centered.”
End of Chapter Preview
Section 1: Observing the Solar System

- What are the geocentric and heliocentric systems?
- How did Copernicus, Galileo, and Kepler contribute to our knowledge of the solar system?
- What objects make up the solar system?
Geocentric System

In a geocentric system, Earth is at the center of the revolving planets and stars.
Heliocentric System

In a heliocentric system, Earth and the other planets revolve around the sun.
The Sun and Planets

Shown below are the average distances of the planets and Pluto from the sun. The solar system also includes smaller objects, such as comets and asteroids.
Click the Active Art button to open a browser window and access Active Art about the solar system.
Johannes Kepler discovered a relationship between the speed of a planet and its distance from the sun. Use the graph to discover what Kepler learned.
Chapter 14 The Solar System

Math Analyzing Data

Planet Speed Versus Distance

Reading Graphs:

Q. According to the graph, what is Earth’s average speed?

A. About 30 km/s
Chapter 14 The Solar System

Planet Speed Versus Distance

Interpreting Data:

Q. Which is closer to the sun, Mercury or Mars? Which moves faster?

A. Mercury; Mercury
Planet Speed Versus Distance

Math Analyzing Data

Chapter 14 The Solar System

Drawing Conclusions:

Q. What is the general relationship between a planet’s speed and its average distance from the sun?

A. Planets that are closer to the sun move faster.
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Planet Speed Versus Distance

Predicting:

The planet Uranus is about 2,900 million km from the sun. Predict whether its speed is greater or less than Jupiter's speed. Explain your answer.

A. Uranus’s speed is less than that of Jupiter because Uranus is farther from the sun than Jupiter.
End of Section: Observing the Solar System
Section 2: The Sun

How does the sun produce energy?
What are the layers of the sun’s interior and the sun’s atmosphere?
What features form on or above the sun’s surface?
Nuclear Fusion

During nuclear fusion, two atomic nuclei collide and fuse.

Two small nuclei (A and B) collide and fuse, forming a nucleus with a higher atomic number (C).

Two larger nuclei collide and fuse, forming a still larger nucleus (D).

Small nuclei may be released also.
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The Layers of the Sun

The sun has an interior and an atmosphere, each of which consists of several layers.
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More on the the Sun

Click the Planet Diary button for an activity about the sun.
End of Section: The Sun
Section 3: The Inner Planets

What characteristics do the inner planets have in common?

What are the main characteristics that distinguish each of the inner planets?
The Inner Planets

The inner planets take up only a small part of the solar system. Note that sizes and distances are not drawn to scale.

<table>
<thead>
<tr>
<th>Planet</th>
<th>Size (kilometers)</th>
<th>Period of Rotation (Earth days)</th>
<th>Average Distance From Sun (AU)</th>
<th>Period of Revolution (Earth years)</th>
<th>Number of Moons</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Diameter</td>
<td>Radius</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mercury</td>
<td>4,879</td>
<td>2,440</td>
<td>59</td>
<td>0.39</td>
<td>0.24</td>
</tr>
<tr>
<td>Venus</td>
<td>12,104</td>
<td>6,052</td>
<td>243</td>
<td>0.72</td>
<td>0.62</td>
</tr>
<tr>
<td>Earth</td>
<td>12,756</td>
<td>6,378</td>
<td>1</td>
<td>1.0</td>
<td>1</td>
</tr>
<tr>
<td>Mars</td>
<td>6,794</td>
<td>3,397</td>
<td>1.03</td>
<td>1.5</td>
<td>1.9</td>
</tr>
</tbody>
</table>
Earth’s Layers

Earth has three main layers—a crust, a mantle, and a core.
Mercury

Mercury is the smallest terrestrial planet and the planet closest to the sun.

Size of Mercury compared to Earth
Venus

This figure combines images of Venus taken from space with a camera (left) and radar (right). The camera image shows Venus’s thick atmosphere. Radar is able to penetrate Venus’s clouds to reveal the surface. Both images are false color.
Venus

Venus’s density and internal structure are similar to Earth’s. But, in other ways, Venus and Earth are very different.
Mars

Mars has ice caps at both poles. Scientists think that a large amount of liquid water flowed on Mars's surface in the distant past.
Click the SciLinks button for links on the planets.
End of Section:
The Inner Planets
Section 4: The Outer Planets

- What characteristics do the gas giants have in common?
- What characteristics distinguish each of the outer planets?
Gas Giants and Pluto

The four outer planets—Jupiter, Saturn, Uranus, and Neptune—are much larger and more massive than Earth, and they do not have solid surfaces. Pluto is small and rocky.

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<th>Planet</th>
<th>Size (kilometers)</th>
<th>Period of Rotation (Earth days)</th>
<th>Average Distance from Sun (AU)</th>
<th>Period of Revolution (Earth years)</th>
<th>Number of Moons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jupiter</td>
<td>143,000</td>
<td>0.41</td>
<td>5.2</td>
<td>12</td>
<td>63+</td>
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<tr>
<td>Saturn</td>
<td>120,500</td>
<td>0.45</td>
<td>9.6</td>
<td>29</td>
<td>47+</td>
</tr>
<tr>
<td>Uranus</td>
<td>51,120</td>
<td>0.72</td>
<td>19.2</td>
<td>84</td>
<td>27+</td>
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<tr>
<td>Neptune</td>
<td>49,530</td>
<td>0.67</td>
<td>30.0</td>
<td>164</td>
<td>13+</td>
</tr>
<tr>
<td>Pluto</td>
<td>2,390</td>
<td>6.4</td>
<td>39.2</td>
<td>248</td>
<td>3</td>
</tr>
</tbody>
</table>
Jupiter’s Structure

Jupiter is composed mainly of the elements hydrogen and helium.

- Hydrogen and helium gas
- Liquid hydrogen and helium
- Liquid “ices” such as water and methane
- Rocky core
The astronomer Galileo discovered Jupiter’s four largest moons. They are named Io, Europa, Ganymede, and Callisto.
Saturn has the most spectacular rings of any planet.
Uranus

Although the gas giant Uranus is about four times the diameter of Earth, it is still much smaller than Jupiter and Saturn.

Size of Uranus compared to Earth
Uranus’s axis of rotation is tilted at an angle of about 90 degrees from the vertical.
Neptune

Neptune is a cold, blue planet. Its atmosphere contains visible clouds.

Size of Neptune compared to Earth
Pluto

Pluto has a solid surface and is much smaller than any of the planets. It is now considered to be a dwarf planet.
Circumference

To calculate the circumference of a circle, use this formula:

\[ C = 2\pi r \]

In the formula, \( \pi \approx 3.14 \), and \( r \) is the circle’s radius, which is the distance from the center of the circle to its edge. The same formula can be used to calculate the circumference of planets, which are nearly spherical.

Neptune’s radius at its equator is about 24,760 km. Calculate its circumference.

\[
C = 2\pi r \\
= 2.00 \times 3.14 \times 24,800 \text{ km} \\
= 156,000 \text{ km}
\]
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Circumference

Practice Problem

Q. Saturn’s radius is about 60,250 km. What is its circumference?

A. $2 \times 3.14 \times 60,250 \text{ km} = \text{about } 378,500 \text{ km}$
More on the Planets

Click the PHSchool.com button for an activity about the planets.
End of Section: The Outer Planets
Section 5: Comets, Asteroids, and Meteors

What are the characteristics of comets?
Where are most asteroids found?
What are meteoroids and how do they form?
Structure of a Comet

The main parts of a comet are the nucleus, the coma, and the tail. The nucleus is deep within the coma. Most comets have two tails—a bluish gas tail and a white dust tail.
Comet Orbits

Most comets revolve around the sun in very long, narrow orbits. Gas and dust tails form as the comet approaches the sun.
Most asteroids revolve around the sun in fairly circular orbits between the orbits of Mars and Jupiter. This region of the solar system is called the asteroid belt.
Links on the Comets, Asteroids, and Meteors

Click the SciLinks button for links on comets, asteroids, and meteors.
End of Section: Comets, Asteroids, and Meteors
Section 6: Is There Life Beyond Earth?

- What conditions do living things need to exist on Earth?
- Why do scientists think Mars and Europa are good places to look for signs of life?
Life on Mars?

Since life as we know it requires water, scientists hypothesize that Mars may have once had the conditions needed for life to exist.
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Links on Extraterrestrial Life

Click the SciLinks button for links on extraterrestrial life.
End of Section: Is There Life Beyond Earth?
QuickTake Quiz

Click to start quiz.