Section 25.1 Exploring the Solar System
(pages 790–794)

This section explores early models of our solar system. It describes the components of the solar system and scientific exploration of the solar system.

Reading Strategy (page 790)
Comparing and Contrasting After you read, compare the geocentric and heliocentric systems by completing the table below. For more information on this Reading Strategy, see the Reading and Study Skills in the Skills and Reference Handbook at the end of your textbook.

<table>
<thead>
<tr>
<th>Solar System Models</th>
<th>Location of Earth</th>
<th>Location of Sun</th>
<th>Developer(s) of Theory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geocentric System</td>
<td>Center of universe</td>
<td>Text</td>
<td>Text</td>
</tr>
<tr>
<td>Heliocentric System</td>
<td>Text</td>
<td>Text</td>
<td>Aristarchus, Copernicus</td>
</tr>
</tbody>
</table>

Models of the Solar System (pages 790–791)

1. Is the following sentence true or false? In the Northern Hemisphere, the stars appear to circle around the North Star. Text

2. Name the five planets besides Earth that ancient observers could see with the unaided eye.
   a. Text
   b. Text
   c. Text
   d. Text
   e. Text

3. Many ancient Greeks thought _______________ was the center of the universe.

4. Circle the letter of each sentence that is true about a geocentric model.
   a. Earth is stationary at the center.
   □ b. Objects in the sky move around Earth.
   □ c. The sun is the center of the solar system.
   □ d. The planets revolve around the sun.

5. Name the center of the solar system in a heliocentric model. Text

6. Is the following sentence true or false? The first heliocentric model was widely accepted by most ancient Greeks. Text
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7. Is the following sentence true or false? The sun, moon, and stars appear to move because the Earth is rotating on its axis.
   True  False

Planetary Orbits (page 792)
8. Planets move around the sun in orbits that are in the shape of a(n) ____________________

9. The plane containing Earth’s orbit is called the ____________________

10. Name the two factors that combine to keep the planets in orbit around the sun. ____________________

Components of the Solar System (pages 792–793)
11. Circle the letters that identify objects in our solar system.
   a. moons of the planets  b. nine planets
   c. the sun  d. the stars other than the sun

12. Name three planets that were identified after the invention of the telescope in the early 1600s.
   a. ____________________  b. ____________________  c. ____________________

13. Is the following sentence true or false? All of the planets have moons. ____________________

14. Unlike the sun, planets and moons do not produce their own ____________________

15. Is the following sentence true or false? The sun’s mass is smaller than the combined mass of the rest of the solar system. ____________________

Exploring the Solar System (pages 793–794)
16. Name three examples of types of modern technology that scientists use to explore the solar system.
   a. ____________________  b. ____________________  c. ____________________

17. Circle the letter that identifies the first person to walk on the moon.
   a. Alan Shepard  b. Yuri Gagarin
   c. Chuck Yeager  d. Neil Armstrong

18. An unpiloted vehicle that sends data back to Earth is called a(n) ____________________

19. Describe the space shuttle. ____________________

20. Is the following sentence true or false? The International Space Station is a permanent laboratory designed for research in space. ____________________
Section 25.2 The Earth-Moon System
(pages 796–801)

This section describes Earth’s moon, how it was formed, and its phases. It also explains solar and lunar eclipses and tides on Earth.

Reading Strategy (page 796)

Building Vocabulary As you read, complete the concept map with terms from this section. Make similar concept maps for eclipses and tides. For more information on this Reading Strategy, see the Reading and Study Skills in the Skills and Reference Handbook at the end of your textbook.

The Moon’s Surface

1. What is the force of gravity on the moon’s surface compared to the force of gravity on Earth’s surface? _______

Earth’s Moon (pages 796–797)

2. How does the moon’s lack of an atmosphere affect its temperatures? _______

3. Evidence of ice on the moon has been found near the moon’s _______.

Surface Features (page 797)

4. Circle the letter of each major surface feature of the moon.
   □ a. highlands   □ b. maria
   □ c. seas      □ d. craters

Match each lunar surface feature with its correct description.

<table>
<thead>
<tr>
<th>Description</th>
<th>Surface Feature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Text 5. A round depression caused by a meteoroid</td>
<td>a. maria</td>
</tr>
<tr>
<td>Text 6. Low, flat plains formed by ancient lava flows</td>
<td>b. crater</td>
</tr>
<tr>
<td>Text 7. A rough, mountainous region</td>
<td>c. highland</td>
</tr>
</tbody>
</table>
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Formation of the Moon (page 798)

8. Explain the leading hypothesis of how the moon formed. ____________________________
   - Text

Phases of the Moon (pages 798–799)

9. Circle the letter of each sentence that is true about phases of the moon.
   - a. The moon’s phases change according to an irregular cycle.
   - b. Phases are the different shapes of the moon visible from Earth.
   - c. Phases are caused by changes in the relative positions of the moon, sun, and Earth as the moon revolves around Earth.
   - d. The sunlit portion of the moon always faces Earth.

10. When does a full moon occur? ____________________________
    - Text

Eclipses (pages 799–800)

11. When the shadow of a planet or moon falls on another body in space, a(n) Text occurs.

   ![Solar Eclipse Diagram]

12. Look at the diagram showing a solar eclipse and label the parts.
    a. Text
    b. Text
    c. Text

13. Circle the letter of each sentence that is true about a lunar eclipse.
    - a. A lunar eclipse occurs when Earth casts a shadow on the moon.
    - b. A lunar eclipse occurs when the moon casts a shadow on a portion of Earth’s surface.
    - c. A lunar eclipse occurs during a full moon, when Earth is between the sun and moon.
    - d. A lunar eclipse occurs during a new moon, when the moon is between the sun and Earth.

Tides on Earth (page 801)

14. Describe the cause of tides. ____________________________
    - Text

15. Is the following sentence true or false? A spring tide is produced when the change between daily high and low tides is the greatest.
    - Text
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Section 25.3 The Inner Solar System (pages 803–809)

This section describes the terrestrial planets found in the inner solar system.

Reading Strategy (page 803)

Summarizing  Copy the table on a separate sheet of paper. Write all the headings for the section in the table. Write a brief summary of the text for each heading. For more information on this Reading Strategy, see the Reading and Study Skills in the Skills and Reference Handbook at the end of your textbook.

The Terrestrial Planets

I. The Terrestrial Planets
   • Four planets closest to the sun
   • Small, dense, with rocky surfaces

II.
   a.

III. Venus
   b. Thick atmosphere, very hot surface, many volcanoes

The Terrestrial Planets (pages 803–804)

1. Identify the four terrestrial planets.
   a. Text
   b. Text
   c. Text
   d. Text

2. Circle the letter of each sentence that is true about the terrestrial planets.
   □ a. They all are relatively small and dense.
   □ b. They all have rocky surfaces.
   □ c. They all have thick atmospheres.
   □ d. They all have a crust, mantle, and iron core.

Mercury (pages 804–805)

3. Circle the letter of each sentence that is true about Mercury.
   □ a. It is the closest planet to the sun.
   □ b. It is the smallest of the terrestrial planets.
   □ c. It is geologically dead.
   □ d. It is the slowest-moving planet.

4. Is the following sentence true or false? Mercury has a large number of craters, suggesting that the surface has been largely unchanged for billions of years.  Text
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**Venus (page 805)**

5. Circle the letter of each sentence that is true about Venus.
   a. It rotates in the direction opposite to which it revolves.
   b. It is the brightest object in Earth’s night sky besides the moon.
   c. It rotates once every 24 hours.
   d. Its rotation rate is very fast.

6. Describe the effect that carbon dioxide in Venus’s atmosphere has on its temperature. Text

**Earth (pages 805–806)**

7. Circle the letter of each sentence that is true about Earth.
   a. Its atmosphere is very thin and composed mostly of carbon dioxide.
   b. It supports millions of different species of living things.
   c. It has a suitable atmosphere and temperature for liquid water to exist.
   d. Its core has cooled down to the point where it is geologically dead.

8. Why does Earth’s surface continue to change? ____________________________

**Mars (pages 807–808)**

9. Circle the letter of each sentence that is true about Mars.
   a. The largest volcano in the solar system is on Mars.
   b. Iron-rich rocks on Mars’s surface give it a reddish color.
   c. It has a thick atmosphere that keeps the planet warm.
   d. The surface of Mars is colder than Earth’s surface.

10. Is the following sentence true or false? Mars shows evidence of once having liquid surface water. True

**Asteroids (page 809)**

11. Small, rocky bodies in space are called Text

12. Circle the letter of each sentence that is true about asteroids.
   a. Most small asteroids have irregular forms.
   b. The asteroid belt formed when a giant planet was shattered by a collision with a meteoroid.
   c. Most asteroids are found in the asteroid belt between Earth and Mars.
   d. Most asteroids are less than 1 kilometer in diameter.

13. What do scientists hypothesize about how the asteroids formed? ____________________________

Text
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Section 25.4 The Outer Solar System  
(pages 810–815)  
This section describes the planets in the outer solar system. It also describes comets and meteoroids and the edge of the solar system.

Gas Giants (page 811)
1. Circle the letter of each sentence that is true about Jupiter, Saturn, Uranus, and Neptune compared to the terrestrial planets.
   a. Their years are shorter than the terrestrial planets.  
   b. They are colder than the terrestrial planets.  
   c. They are further from the sun than the terrestrial planets.  
   d. They are much larger than the terrestrial planets.  

2. Why are the outer planets called the gas giants? __________________________  

3. Describe the cores of the gas giants. __________________________  

Jupiter (pages 811–812)
4. The _______ is a huge storm on Jupiter.  

5. Circle the letter of each sentence that is true about Jupiter’s moons.
   a. Callisto and Ganymede are Jupiter’s largest moons.  
   b. Scientists hypothesize that Europa could support life.  
   c. Ganymede has a metal core and rocky mantle.  
   d. Io is covered with ice.

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**Saturn (pages 812–813)**

6. Saturn has the largest and most visible _______ in the solar system.

7. Is the following sentence true or false? Saturn has the largest atmosphere and the lowest average density of all the planets in the solar system.

**Uranus (page 813)**

8. Is the following sentence true or false? Uranus gets its distinctive blue-green appearance from large amounts of methane in its atmosphere.

9. Uranus’s _______ is tilted more than 90°.

**Neptune (page 814)**

10. Circle the letter of each sentence that is true about Neptune.

   a. It has visible cloud patterns in its atmosphere.
   b. It has only five known moons.
   c. It has large storms in its atmosphere.
   d. It has no rings.

11. The _______ in Neptune’s atmosphere causes its bluish color.

**Pluto (page 814)**

12. Is the following sentence true or false? Pluto is both larger and denser than the other outer planets.

13. Describe Pluto’s probable composition. _________________________________________

**Comets and Meteoroids (page 815)**

14. A(n) _______ is made of ice and rock that partially vaporizes when it passes near the sun.

15. Chunks of rock, usually less than a few hundred meters in size, that travel through the solar system are called _______.

16. The radioactive dating of ancient meteoroids has allowed scientists to establish that the age of the solar system is _______.

**The Edge of the Solar System (page 815)**

17. The _______ contains tens of thousands of objects made of ice, dust, and rock that orbit the sun beyond Pluto.

18. The thick sphere of comets encircling the solar system out to a distance of about 50,000 AU is called the _______.

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Section 25.5 The Origin of the Solar System
(pages 818–820)
This section explains a theory of how the solar system originated. It also describes how this theory explains the composition and size of the planets.

The Nebular Theory (pages 818–819)
1. The generally accepted explanation for the formation of the solar system is called the _______.
2. Circle the letter of each sentence that is true about the nebular theory.
   □ a. The solar nebula formed from the remnants of previous stars.
   □ b. The explosion of a nearby star likely caused the solar nebula to start to contract.
   □ c. As the solar nebula contracted, it began to spin more slowly.
   □ d. The solar system formed from a rotating cloud of dust and gas.
3. Describe a solar nebula. _________________________________.
4. A large, spherical cloud of dust and gas in space is called a(n) _______.
5. Is the following sentence true or false? Most planets and moons are revolving now in the direction that the protoplanetary disk was spinning. _______.
6. Circle the letter of each sentence that is true about the formation of the protoplanetary disk.

☐ a. The disk was densest in the center and thinner toward the edges.
☐ b. At the center of the disk, nuclear reactions fused hydrogen and helium and the sun was formed.
☐ c. The temperature at the center of the disk was extremely low.
  d. Nearly all of the mass of the solar nebula became concentrated near the outer edge of the disk.

7. Asteroid-like bodies that combined to form planets were called

8. The process by which planetesimals grew is called

9. Put the following events about the formation of planetesimals and protoplanets in correct order. Number the events 1–5 in the order that they occurred.

   Text
   Balls of gas and dust collided and grew larger.
   Text
   Planetesimals became large enough to exert gravity on nearby objects.
   Text
   Planetesimals grew by accretion.
   Text
   Protoplanets joined to form the current planets in a series of collisions.
   Text
   Planetesimals grew into protoplanets.

Composition and Size of the Planets (page 820)

10. At pressures, such as those found in space, cooling materials can change from a gas directly into a solid.

11. Ice-forming materials at temperatures between 500 K and 1200 K.

12. Why are the terrestrial planets relatively small and rocky? _________________

13. Circle the letter of each sentence that is true about the formation of the gas giants.

☐ a. The gravity of the gas giants decreased as they grew larger.
☐ b. Ice-forming material could condense in the outer solar system.
☐ c. The planets grew large and were able to capture hydrogen and helium from nearby space.
☐ d. Less material was available for the gas giants to form than was available for the terrestrial planets.

14. Is the following sentence true or false? Scientists have found planets in orbit around distant stars that provide support for the nebular theory.

Text
Calculating Distances Between Objects in Space

Jupiter is, on average, 5.2 astronomical units (AU) from the sun. About how many kilometers is Jupiter from the sun?

1. Read and Understand
   What information are you given?
   Jupiter’s distance = 5.2 AU from the sun

2. Plan and Solve
   What are you asked to find?
   Jupiter’s distance = ? kilometers from the sun
   How many kilometers are in one AU?
   149,598,000 kilometers

   Write a conversion factor that can be used to change AU to kilometers.
   \[
   \frac{149,598,000 \text{ km}}{1 \text{ AU}}
   \]
   Multiply the distance from the sun to Jupiter in AU by the conversion factor.
   \[5.2 \text{ AU} \times \frac{149,598,000 \text{ km}}{1 \text{ AU}} = 780 \text{ million km}\]
   Jupiter’s distance = 780 million km from the sun

3. Look Back and Check
   Is your answer reasonable?
   To check your answer, convert the distance between the sun and Jupiter in kilometers back to AU.
   \[\frac{780,000,000 \text{ km}}{149,598,000 \text{ km/AU}} = 5.2 \text{ AU}\]

Math Practice

On a separate sheet of paper, solve the following problems.

1. Pluto is an average distance of 39.5 AU from the sun. How many kilometers from the sun is Pluto?
   Text

2. Mercury is \(58.3 \times 10^6\) km from the sun on average. How many AU is Mercury from the sun?
   Text

3. Mars is 1.52 AU from the sun on average. Saturn is 9.54 AU. About how far apart, in kilometers, are Mars and Saturn when they are closest to each other?
   Text