

Directed Reading

Section: Formation of the Solar System

1. The sun and all of the planets and other bodies that revolve around it make up the _____.
2. Any primary body that orbits the sun, or a similar body that orbits another star, is called a(n) _____.
3. In 1796, the French mathematician Pierre-Simon, marquis de Laplace, advanced the _____ to explain the origins of the solar system.

THE NEBULAR HYPOTHESIS

- _____ 4. Laplace's hypothesis states that the sun and the planets condensed at about the same time out of a rotating cloud of dust and gas called a
- a. planet.
 - b. nebula.
 - c. supernova.
 - d. solar system.
- _____ 5. The rotating cloud of dust and gas from which our solar system is thought to have formed is called the
- a. solar nebula.
 - b. gas giant.
 - c. sun.
 - d. nova
- _____ 6. Energy from collisions and pressure from gravity caused the center of the solar nebula to become
- a. hotter and less dense.
 - b. cooler and denser.
 - c. cooler and less dense.
 - d. hotter and denser.
- _____ 7. Which of the following formed when the temperature at the center of the nebula reached about 10,000,000°C and hydrogen fusion began?
- a. Mars
 - b. Earth
 - c. the sun
 - d. the moon

Directed Reading *continued*

- _____ **8.** How much of the matter that was contained in the solar nebula makes up the sun?
- a.** 5%
 - b.** about 99%
 - c.** 25%
 - d.** about 75%

FORMATION OF THE PLANETS

- _____ **9.** Small bodies from which a planet originated in the early development of the solar system are called
- a.** atmospheres.
 - b.** planetesimals.
 - c.** suns.
 - d.** moons.
- _____ **10.** Some planetesimals joined together through collision and through the force of gravity to form larger bodies called
- a.** protoplanets.
 - b.** sunspots.
 - c.** protons.
 - d.** nebulas.
- _____ **11.** The smaller bodies that orbit the planets are called
- a.** solar nebulas.
 - b.** moons.
 - c.** planetesimals.
 - d.** suns.

12. Why are Mercury, Venus, Earth, and Mars called the *inner* planets?

13. Why did the inner planets, which contained large percentages of heavy elements such as iron and nickel, lose their less dense gases?

14. How do the surfaces of the inner planets compare with that of Earth today?

15. How do the inner planets differ from the outer planets?

Directed Reading *continued*

16. Jupiter, Saturn, Uranus, and Neptune are referred to as

_____ planets.

17. How did distance from the sun affect the formation of the outer planets?

18. Name the three reasons why the outer planets are referred to as *gas giants*.

19. Which outer planet is farthest from the sun?

20. In what way does Pluto differ from the other outer planets?

21. In what way is Pluto similar to the other outer planets?

22. Why do many scientists believe that Pluto should not be classified as a major planet?

FORMATION OF SOLID EARTH

_____ **23.** When Earth formed, its high temperature was NOT due to

- a.** heat produced when planetesimals collided with one another.
- b.** heat generated when the increasing weight of its outer layers compressed its inner layers.
- c.** the conversion of moving radioactive particles into heat energy.
- d.** an irregular orbit that brought it closer to the sun.

Directed Reading *continued*

- _____ **24.** Dense materials such as molten iron sank to Earth's center and less dense materials were forced to the outer layers in a process called
- a.** distinction.
 - b.** differentiation.
 - c.** distribution.
 - d.** delineation.
- _____ **25.** Which of the following did NOT form as one of Earth's layers when differentiation occurred?
- a.** core
 - b.** mantle
 - c.** atmosphere
 - d.** crust
- _____ **26.** Which of the following elements is NOT present in large amounts in Earth's three layers ?
- a.** gold
 - b.** iron
 - c.** silica
 - d.** magnesium
- _____ **27.** Earth's surface continued to change as a result of
- a.** increasing radiation.
 - b.** colliding planetesimals.
 - c.** the heat in Earth's interior.
 - d.** hydrogen fusion.

FORMATION OF EARTH'S ATMOSPHERE

- _____ **28.** The original atmosphere of Earth consisted of
- a.** oxygen and nitrogen.
 - b.** hydrogen and helium.
 - c.** nitrogen and helium.
 - d.** hydrogen and oxygen.
- _____ **29.** Today, hydrogen and helium occur mainly in the
- a.** oceans.
 - b.** middle atmosphere.
 - c.** lower atmosphere.
 - d.** upper atmosphere.
- _____ **30.** Earth's early atmosphere formed when volcanic eruptions released gases in a process called
- a.** outgassing.
 - b.** atmospheric composition.
 - c.** air generation.
 - d.** layering.

Directed Reading *continued*

_____ **31.** What is the molecule that contains three oxygen atoms and collects in Earth's upper atmosphere called?

- a. oxygen
- b. argon
- c. ozone
- d. carbon dioxide

32. Some of Earth's early organisms, such as cyanobacteria and early green plants, used _____ during photosynthesis.

33. Which byproduct of photosynthesis was released into the atmosphere?

34. When did the chemical composition of Earth's atmosphere reach that of today?

35. What is the present chemical composition of Earth's atmosphere?

36. How did Earth's first oceans form?

37. Comet collisions may have contributed a significant amount of

_____ to Earth's surface.

38. The first ocean was probably made of _____ water.

39. The concentration of certain _____ in the oceans increased as rainwater dissolved rocks on land and carried these dissolved solids into the oceans.

40. When ocean water evaporated, chemicals in the ocean combined to form

_____.

41. Earth's atmosphere and surface cooled because ocean water also dissolved much of the _____ in the atmosphere.

Skills Worksheet

Directed Reading**Section: Models of the Solar System**

- _____ 1. The first astronomers thought that the stars, planets, and sun revolved around
- the sun.
 - the Milky Way.
 - Earth.
 - the moon.

EARLY MODELS OF THE SOLAR SYSTEM

- _____ 2. More than 2,000 years ago, the Greek philosopher Aristotle suggested a model of the solar system that was Earth-centered, or
- geocentric.
 - geometric.
 - geologic.
 - geothermal.
- _____ 3. The pattern by which planets appear to move backward in the sky relative to the stars is called
- reverse motion.
 - restrained motion.
 - retrograde motion.
 - revolving motion.
- _____ 4. The Greek astronomer Claudius Ptolemy proposed that planets moved in small circles, or epicycles, as they
- revolved in larger circles around the moon.
 - revolved in larger circles around the sun.
 - revolved in even smaller circles around Earth.
 - revolved in larger circles around Earth.
- _____ 5. The Polish astronomer Nicolaus Copernicus proposed a model of the solar system that was sun-centered, or
- lunacentric.
 - astrocentric.
 - heliocentric.
 - celestracentric.
- _____ 6. According to Copernicus, all the planets revolved around
- the sun in the same direction but at different speeds and distances.
 - the moon in the same direction but at different speeds and distances.
 - the sun in different directions but at the same speeds and distances.
 - the sun in different directions and different speeds and distances.

Directed Reading *continued*

KEPLER'S LAWS

7. Upon whose observations did Johannes Kepler base his three laws of planetary motion?

In the space provided, write the letter of the definition that best matches the term or phrase.

- | | |
|--------------------------|--|
| _____ 8. eccentricity | a. a closed curve whose shape is determined by two points, or foci |
| _____ 9. ellipse | b. the time required for a body to complete a single orbit |
| _____ 10. orbital period | c. the degree of elongation of an elliptical orbit |

11. What does the *law of ellipses* state?

12. In planetary orbits, one focus is located within the _____, and no object is located at the other focus.

13. How is eccentricity determined?

14. What did Kepler discover about the orbit of Mars?

15. The law of equal areas states that equal areas are covered in equal amounts of time as an object orbits the _____.

16. Kepler's third law, the law of periods, describes the relationship between the average distance of a planet from the sun and the _____ of the planet.

Directed Reading *continued*

17. According to the law of periods, the cube of the average

_____ of a planet from the sun is always proportional to the square of the period.

18. What mathematical formula is used to explain the law of periods?

NEWTON'S EXPLANATION OF KEPLER'S LAWS

Use the terms from the list below to complete the sentences that follow. Each term may be used only once.

revolution gravity inertia

19. The tendency of a stationary body to remain at rest or of a moving body to remain in motion until an outside force acts upon it is called _____.

20. Newton discovered that an outside force called _____ causes the orbit of a planet to curve.

21. The outer planets have longer periods of _____ than the inner planets because the outer planets are less affected by the sun's gravitational pull.

Skills Worksheet

Directed Reading

Section: The Inner Planets

1. The planets closest to the sun are called the _____

2. Name the four inner planets.

3. The inner planets are also called _____ because they are like Earth.

4. Describe the composition of the inner planets.

5. Bowl-shaped depressions called _____ formed on the surfaces of inner planets when the planets collided with other objects in space.

MERCURY

_____ 6. Mercury, the closest planet to the sun, circles the sun every

- a. 44 days.
- b. 88 days.
- c. four years.
- d. 80 hours.

_____ 7. Mercury rotates on its axis once every

- a. 95 days.
- b. 45 days.
- c. 59 days.
- d. five years.

_____ 8. Mercury's surface features a long line of cliffs and

- a. dry ocean beds.
- b. a large number of craters.
- c. shallow fresh-water springs.
- d. lava plains.

Directed Reading *continued*

- _____ **9.** The absence of a dense atmosphere and Mercury's slow rotation contribute to
- a.** long days and short nights.
 - b.** short days and long nights.
 - c.** steady temperatures.
 - d.** a large daily temperature range.

VENUS

10. How long is the orbital period of Venus, the second planet from the sun?

11. How often does Venus rotate?

12. The planet that Venus most resembles in mass, size, and density is

_____.

13. Venus's atmospheric pressure is about _____ times the pressure on Earth.

14. What two factors cause the high temperatures on Venus?

15. What percentage of the atmosphere on Venus is composed of carbon dioxide?

16. What phenomenon occurs when solar energy heats Venus's surface and the high concentration of carbon dioxide in the atmosphere blocks most of the infrared radiation from escaping?

17. Venus appears to be very bright in the night sky because drops of _____ form a cloud layer that reflects sunlight.

18. Why is Venus commonly referred to as the *evening star* or *morning star*?

Directed Reading *continued*

19. The surface of Venus is composed of which two types of rock?

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **20.** *Magellan*

a. the highest volcano on Venus

_____ **21.** volcano

b. a U.S. satellite that collected data about Venus

_____ **22.** Maat Mons

c. a landform commonly found on Venus

23. How could the craters on Venus be described?

24. What evidence indicates that Venus undergoes a periodic resurfacing?

EARTH

25. Earth is the _____ planet from the sun.

26. The orbital period of Earth is _____ days.

27. Earth completes one _____ on its axis every day.

28. How many moons does Earth have?

29. Over the last _____ years, Earth's continents separated from a single landmass and drifted to their present positions.

30. What two factors have caused the surface of Earth to keep changing?

31. Why is Earth the only outer planet on which water exists in a liquid state?

Directed Reading *continued*

32. How was Earth able to maintain the moderate temperatures that were necessary to support life?

33. What three elements does Earth have in the proper combination necessary to support life?

MARS

34. Mars is the _____ planet from the sun.

35. How long is Mars's orbital period?

36. How often does Mars rotate on its axis?

37. Why are Mars's seasons similar to Earth's?

38. Mars is believed to have been geologically active because of its massive volcanoes and a system of deep _____ on its surface.

39. One of the many major volcanic regions on Mars is called _____.

40. The largest volcano on Mars is _____, which is three times the height of Mount Everest and has a base about the size of Nebraska.

41. Why do scientists think that Martian volcanoes have grown so large?

42. Two seismic wave-producing geological events called _____

_____ indicate that volcanoes on Mars may still be active.

Directed Reading *continued*

43. Why can water not exist as a liquid on Mars?

44. Which two spacecraft found evidence that liquid water once did exist on Mars's surface?

45. Mars has many surface features that are characteristic of _____ by water.

46. Where might water exist as permanent frost or as a liquid on Mars?

Skills Worksheet

Directed Reading**Section: The Outer Planets**

In the space provided, write the letter of the description that best matches the term or phrase.

- | | |
|------------------------|--|
| _____ 1. outer planets | a. a planet with a deep and massive gaseous atmosphere |
| _____ 2. asteroid belt | b. the planets farthest from the sun; include Jupiter, Saturn, Uranus, Neptune, and Pluto |
| _____ 3. gas giant | c. the smallest and usually most distant planet; differs from other outer planets |
| _____ 4. Pluto | d. a ring of debris that separates the inner planets from the outer planets |

GAS GIANTS

- _____ 5. How do the gas giants compare with the terrestrial planets?
- a.** Gas giants are larger and more dense.
 - b.** Gas giants are larger and less dense.
 - c.** Gas giants are smaller and more dense.
 - d.** Gas giants are smaller and less dense.
- _____ 6. Compared with the terrestrial planets, the gas giants
- a.** have more gravity, which helps them retain gases.
 - b.** have less gravity, which helps them retain gases.
 - c.** have the same amount of gravity, which helps them retain gases.
 - d.** have no gravity, which helps them retain gases.
- _____ 7. The thick atmosphere of the gas giants is made up of
- a.** oxygen and hydrogen.
 - b.** helium and carbon dioxide.
 - c.** hydrogen and helium.
 - d.** carbon dioxide and oxygen.
- _____ 8. The gas giants have ring systems that are made up of
- a.** orbiting moons.
 - b.** dust and icy debris.
 - c.** comets.
 - d.** asteroids and gases.

Directed Reading *continued*

JUPITER

9. Jupiter is the _____ planet from the sun.

10. Jupiter's mass is more than _____ times that of Earth.

11. How long is Jupiter's orbital period?

12. How often does Jupiter rotate on its axis?

13. Jupiter has at least 60 _____, four of which are the size of small planets.

14. How much of Jupiter's atmosphere is composed of hydrogen and helium?

15. Jupiter's atmosphere is much like the atmosphere of the _____.

16. Why didn't Jupiter become a star?

17. What do Jupiter's unique bands of orange, gray, blue, and white indicate?

18. How do the bands form?

19. Describe Jupiter's Great Red Spot.

Directed Reading *continued*

20. What do Jupiter's high wind speeds tell scientists about the planet's weather?

21. How does Jupiter's large mass affect its interior temperature and pressure?

SATURN

_____ **22.** How far is Saturn from the sun?

- a. It is the fourth planet from the sun.
- b. It is the sixth planet from the sun.
- c. It is the closest planet to the sun.
- d. It is the farthest planet from the sun.

_____ **23.** How long is Saturn's orbital period?

- a. 100 years
- b. 2,950 years
- c. three years
- d. 29.5 years

_____ **24.** How many moons does Saturn have?

- a. at least 30
- b. at least 60
- c. at least 75
- d. at least 125

_____ **25.** How large is Titan, Saturn's largest moon?

- a. half the size of Earth
- b. twice the size of Earth
- c. half the size of the sun
- d. twice the size of Venus

26. Saturn, like the planet _____, is made up almost entirely of hydrogen and helium and has a rocky, iron core.

27. Saturn is the least _____ planet in the solar system.

28. Saturn is known for its _____, which are two times the planet's diameter.

29. Like Jupiter, Saturn has _____ of colored clouds.

Directed Reading *continued*

30. How often does Saturn rotate on its axis?

31. NASA's _____ spacecraft will orbit Saturn for many years to gather information about the planet and its moon Titan.

URANUS

32. Uranus is the _____ planet from the sun and the third largest planet in the solar system.

33. Why is Uranus a difficult planet to study?

34. Uranus has at least _____ moons and at least 11 small rings.

35. The orbital period for Uranus is almost _____ years.

36. Although most planets rotate with their axis perpendicular to their orbital planes, Uranus's axis is almost _____ to the plane of its orbit.

37. How often does Uranus rotate?

38. The planet's blue-green color indicates that the atmosphere may contain significant amounts of _____, in addition to hydrogen and helium.

NEPTUNE

39. Neptune is the _____ planet from the sun and is similar to Uranus in size and mass.

40. Neptune's orbital period is nearly 164 years, and the planet rotates about every _____ h.

41. Neptune has at least _____ moons and possibly four rings.

Directed Reading *continued*

42. How was Neptune's existence predicted before the planet was actually discovered?

43. Neptune's atmosphere is made up of which gases?

44. What have images taken by *Voyager 2* and the *Hubble Space Telescope* told us about Neptune's weather?

PLUTO

45. Pluto is the _____ planet from the sun.

46. Pluto's orbit is an unusually elongated and tilted _____.

47. How does Pluto compare with the other planets in terms of its size and distance from the sun?

48. What is Pluto made of?

OBJECTS BEYOND PLUTO

49. Describe the Kuiper belt.

50. Name two objects that have been found beyond Pluto.

Directed Reading *continued*

EXOPLANETS

51. Define *exoplanet*.

52. Because exoplanets cannot be directly observed through telescopes or satellites, how do scientists know they exist?

53. How do scientists know that all of the exoplanets they have identified are larger than Saturn?
