Base your answers to questions 1 through 4 on the passage and diagram below. The diagram shows the orbits of the four inner planets and the asteroid Hermes around the Sun. Point $A$ represents a position along Hermes' orbit.

**The Curious Tale of Asteroid Hermes**

It’s dogma [accepted belief] now: an asteroid hit Earth 65 million years ago and wiped out the dinosaurs. But in 1980 when scientists Walter and Luis Alvarez first suggested the idea to a gathering at the American Association for Advancement of Sciences, their listeners were skeptical. Asteroids hitting Earth? Wiping out species? It seemed incredible.

At that very moment, unknown to the audience, an asteroid named Hermes halfway between Mars and Jupiter was beginning a long plunge toward our planet. Six months later it would pass 300,000 miles from Earth’s orbit, only a little more than the distance to the Moon....

Hermes approaches Earth’s orbit twice every 777 days. Usually our planet is far away when the orbit crossing happens, but in 1937, 1942, 1954, 1974 and 1986, Hermes came harrowingly [dangerously] close to Earth itself. We know about most of these encounters only because Lowell Observatory astronomer Brian Skiff rediscovered Hermes on Oct. 15, 2003.

Astronomers around the world have been tracking it carefully ever since....

1. How does the period of revolution of Hermes compare to the period of revolution of the planets shown in the diagram?

   A) Hermes has a longer period of revolution than Mercury, but a shorter period of revolution than Venus, Earth, and Mars.

   B) Hermes has a shorter period of revolution than Mercury, but a longer period of revolution than Venus, Earth, and Mars.

   C) **Hermes has a longer period of revolution than all of the planets shown.**

   D) Hermes has a shorter period of revolution than all of the planets shown.

2. Why is evidence of asteroids striking Earth so difficult to find?

   A) Asteroids are made mostly of frozen water and gases and are vaporized on impact.

   B) Asteroids are not large enough to leave impact craters.

   C) Asteroids do not travel fast enough to create impact craters.

   D) **Weathering, erosion, and deposition on Earth have destroyed or buried most impact craters.**

3. According to the diagram, as Hermes and the planets revolve around the Sun, Hermes appears to be a threat to collide with

   A) Earth, only

   B) Earth and Mars, only

   C) **Venus, Earth, and Mars, only**

   D) Mercury, Venus, Earth, and Mars

4. When Hermes is located at position A and Earth is in the position shown in the diagram, the asteroid can be viewed from Earth at each of the following times except

   A) sunrise

   B) sunset

   C) **12 noon**

   D) 12 midnight
5. It is inferred that during the early Archean Era the atmosphere of Earth contained water vapor, carbon dioxide, nitrogen, and other gases in small amounts. These gases probably came from

A) precipitation of groundwater  
B) volcanic eruptions  
C) evaporation of Paleozoic oceans  
D) convection currents in the mantle

6. Base your answer to the following question on the diagram below. The diagram represents the inferred stages in the formation of our solar system. Stage 1 shows a contracting gas cloud. The remaining stages show the gas cloud flattening into a spinning disk as planets formed around our Sun.

Which force was mostly responsible for the contraction of the gas cloud?

A) friction  
B) gravity  
C) magnetism  
D) inertia
7. Which statement correctly compares the size, composition, and density of Neptune to Earth?

A) Neptune is smaller, more gaseous, and less dense.
B) Neptune is larger, more gaseous, and less dense,
C) Neptune is smaller, more solid, and more dense.
D) Neptune is larger, more solid, and more dense.

8. Which is the largest planet in our solar system?

A) Earth  B) Uranus  C) Saturn  D) Jupiter

9. The diagram below shows the orbital paths of Earth, Mars, Jupiter, and a comet named Wild 2.

What is the approximate distance between the Sun and Wild 2 when this comet is closest to the Sun?

A) 150 million kilometers
B) 228 million kilometers
C) 778 million kilometers
D) 820 million kilometers

10. Which two characteristics do all Jovian planets have in common?

A) small diameters and low densities
B) small diameters and high densities
C) large diameters and low densities
D) large diameters and high densities
11. Base your answer to the following question on the diagram of the solar system below.

On which planet would a measuring instrument placed at the planet's equator record the longest time from sunrise to sunset?

A) Mercury  B) Venus  C) Earth  D) Mars

12. Which statement best explains why Earth and the other planets of our solar system became layered as they were being formed?

A) Gravity caused less-dense material to move toward the center of each planet.
B) **Gravity caused more-dense material to move toward the center of each planet.**
C) Materials that cooled quickly stayed at the surface of each planet.
D) Materials that cooled slowly stayed at the surface of each planet.

13. The diagram below represents Earth.

Which diagram best represents Mars, drawn to the same scale?

A)  
B)  
C)  
D)  

14. Compared to the Jovian planets in our solar system, Earth is

A) less dense and closer to the Sun
B) less dense and farther from the Sun
C) **more dense and closer to the Sun**
D) more dense and farther from the Sun
15. Compared to the terrestrial planets, the Jovian planets are
   A) smaller and have lower densities  
   B) smaller and have greater densities
   C) larger and have lower densities  
   D) larger and have greater densities

16. The terrestrial planets differ from the Jovian planets because the terrestrial planets are
   A) less dense and larger  
   B) less dense and smaller
   C) more dense and larger  
   D) more dense and smaller

17. Most of a Earth's atmosphere comes from
   A) the gas surrounding Earth at the time of its formation
   B) gas released from the interior of our planet
   C) gas captured as Earth passed through a gas cloud
   D) escaped gas from the sun

18. In describing a model for the origin of our solar system, which one of the following facts would not be included?
   A) The planets' orbits lie pretty much in the same plane.  
   B) The planets revolve around the sun in the same direction.
   C) The Solar system revolves around the center of our galaxy.
   D) The planets' orbits are mostly close to being circular.

19. Which event occurred approximately 4.6 billion years ago?
   A) evolution of the earliest fish  
   B) evolution of stromatolites
   C) formation of the oldest known Earth rocks
   D) formation of Earth and our solar system
20. Which bar graph best represents the equatorial diameters of the eight planets of our solar system?

A)  

B)  

C)  

D)  

21. Compared to Jupiter and Saturn, Venus and Mars have greater

A) periods of revolution  
B) **orbital velocities**  
C) mean distances from the Sun  
D) equatorial diameters
22. Base your answer to the following question on the diagram below. This diagram shows a portion of the solar system.

What is the average distance, in millions of kilometers, from the Sun to the asteroid belt?

A) 129  B) 189  C) **503**  D) 85

23. Compared to the average density of the terrestrial planets (Mercury, Venus, Earth, and Mars), the average density of the Jovian planets (Jupiter, Saturn, Uranus, and Neptune) is

A) less  B) greater  C) the same

24. Whether a planet or moon has an atmosphere depends mostly upon its

A) orbital speed  
B) **mass**  
C) distance from the sun  
D) temperature
25. The solar system object in the photograph below is 56 kilometers long.

The object in the photograph is most likely

A) an asteroid  B) Neptune  C) Earth's Moon  D) Mercury

26. What was the most abundant gas present in the original planetary atmosphere?

A) methane  B) hydrogen  C) water vapor  D) carbon dioxide

27. Base your answer to the following question on the passage below.

**A Newly Discovered Planet**

Scientists studying a Sun-like star named Ogle-Tr-3 discovered a planet that is, on the average, 3.5 million kilometers away from the star’s surface. The planet was discovered as a result of observing a cyclic decrease in the brightness of Ogle-Tr-3 every 28.5 hours. The changing brightness is the result of the planet blocking some of the starlight when it is between Ogle-Tr-3 and Earth. This observation allowed scientists to find not only the planet, but also to determine the planet’s mass and density. The mass has been calculated to be approximately 159 times the mass of Earth. The planet is only 20% as dense as Jupiter. Scientists think that this low density is the result of being very close to Ogle-Tr-3.

The density of the discovered planet has been estimated to be approximately

A) 5.5 g/cm³  B) 2.0 g/cm³  C) 1.3 g/cm³  D) 0.3 g/cm³

28. Which of the following planets is a terrestrial planet?

A) Jupiter  B) Saturn

C) Mars  D) Neptune
29. Three planets that are relatively large, gaseous, and of low density are
A) Mercury, Jupiter, and Saturn
B) Venus, Jupiter, and Neptune
C) Mars, Jupiter, and Uranus
D) Jupiter, Saturn, and Uranus

Base your answers to questions 30 through 32 on the diagram below, which shows a portion of the solar system.

30. Which graph best represents the relationship between a planet's average distance from the Sun and the time the planet takes to revolve around the Sun?
A)  
B)  
C)  
D)  

31. Which of the following planets has the lowest average density?
A) Mercury  B) Venus  C) Earth  D) Mars

32. Which scale diagram best compares the size of Earth with the size of Venus?
A)  
B)  
C)  
D)  
33. Which graph best represents the relative periods of rotation of Mercury, Venus, Earth, and Mars?
34. Which pair of shaded circles best represents the relative sizes of Earth and Venus when drawn to scale?

A) ![Shaded circles representing Earth and Venus](image1)

B) ![Shaded circles representing Earth and Venus](image2)

C) ![Shaded circles representing Earth and Venus](image3)

D) ![Shaded circles representing Earth and Venus](image4)

35. Which sequence correctly shows the relative size of the nine planets of our solar system?

A) ![Sequence of shaded circles representing the planets](image5)

B) ![Sequence of shaded circles representing the planets](image6)

C) ![Sequence of shaded circles representing the planets](image7)

D) ![Sequence of shaded circles representing the planets](image8)

36. Which of the following has the lowest density?

A) the planet Saturn  
B) the planet Jupiter  
C) the planet Earth  
D) salt water

37. How do Jupiter’s density and period of rotation compare to Earth’s?

A) Jupiter is less dense and has a longer period of rotation.

B) Jupiter is less dense and has a shorter period of rotation.

C) Jupiter is more dense and has a longer period of rotation.

D) Jupiter is more dense and has a shorter period of rotation.

38. Scientists infer that most of Earth’s earliest atmosphere was produced by

A) a collision with a giant gas cloud

B) capturing gases from a nearby planet

C) vaporizing comets that impacted Earth’s surface

D) the escape of gases from Earth’s molten surface

39. Why do the planets in our solar system have a layered internal structure?

A) All planets cooled rapidly after they formed.

B) The Sun exerts a gravitational force on the planets.

C) Each planet is composed of materials of different densities.

D) Cosmic dust settled in layers on the planets’ surfaces.
Base your answers to questions 40 and 41 on the graphs below. The graphs show the composition of the atmospheres of Venus, Earth, Mars, and Jupiter.

40. Which gas is present in the atmospheres of Venus, Earth, and Mars but is not present in the atmosphere of Jupiter?
   A) argon (Ar)   B) methane (CH₄)   C) hydrogen (H₂)   D) water vapor (H₂O)

41. Which planet has an atmosphere composed primarily of CO₂ and a period of rotation greater than its period of revolution?
   A) Venus   B) Mercury   C) Earth   D) Mars

42. Which planet would float if it could be placed in water?
   A) Mercury   B) Earth   C) Saturn   D) Pluto

43. Compared to the terrestrial planets, the Jovian planets are
   A) larger and less dense   B) smaller and more dense   C) closer to the Sun and less rocky   D) farther from the Sun and more rocky

44. The diagram below represents two planets in our solar system drawn to scale, Jupiter and planet A.

   Planet A most likely represents
   A) Earth   B) Venus   C) Saturn   D) Uranus

45. According to current data, the Earth is apparently the only planet in our solar system that has
   A) an orbiting moon   B) an axis of rotation   C) atmospheric gases   D) liquid water on its surface

46. A belt of asteroids is located an average distance of 503 million kilometers from the Sun. Between which two planets is this belt located?
   A) Mars and Jupiter   B) Mars and Earth   C) Jupiter and Saturn   D) Saturn and Uranus

47. Compared to the size and density of Earth, the Moon has a
   A) smaller diameter and lower density   B) smaller diameter and higher density   C) larger diameter and lower density   D) larger diameter and higher density

48. Three planets known as gas giants because of their large size and low density are
   A) hydrogen and helium   B) carbon dioxide   C) iron   D) rocky materials

49. The giant planets are composed primarily of
   A) hydrogen and helium   B) carbon dioxide   C) iron   D) rocky materials
50. Compared to the Jovian planets, terrestrial planets are
A) more dense and more massive.
B) less dense and more massive.
C) more dense and less massive.
D) less dense and less massive.

51. Which list of three planets and Earth’s Moon is arranged in order of increasing equatorial diameter?
A) Earth’s Moon, Pluto, Mars, Mercury
B) Pluto, Earth’s Moon, Mercury, Mars
C) Mercury, Mars, Earth’s Moon, Pluto
D) Mars, Mercury, Pluto, Earth’s Moon

52. As a rotating cloud collapses its rate of rotation
A) decreases
B) increases
C) remains the same

53. Which planet has completed less than one orbit of the Sun in the last 100 years?
A) Mars
B) Mercury
C) Neptune
D) Uranus

54. The average temperature of the planets
A) increases with greater distance from the Sun
B) decreases with greater distance from the Sun
C) has no relationship to the distance from the Sun
D) depends only on the chemical composition of the atmosphere of each planet

55. Which planet takes more time to complete one rotation on its axis than to complete one revolution around the Sun?
A) Mercury
B) Venus
C) Mars
D) Jupiter

56. The atmosphere of Venus is composed primarily of
A) hydrogen and helium
B) carbon dioxide
C) methane
D) ammonia

57. Compared to Jovian planets, terrestrial planets have
A) larger masses
B) larger equatorial diameters
C) shorter periods of revolution
D) shorter periods of rotation

58. Why are impact structures more obvious on the Moon than on Earth?
A) The Moon's gravity is stronger than Earth's gravity.
B) The Moon has little or no atmosphere.
C) The rocks on the Moon are weaker than those on Earth.
D) The Moon rotates at a slower rate than Earth does.

59. Which planet has the most eccentric orbit?
A) Mercury
B) Venus
C) Neptune
D) Pluto

60. Scientists believe that Earth’s early atmosphere changed in composition as a result of
A) the appearance of oxygen-producing organisms
B) the drifting of the continents
C) the changes in Earth’s magnetic field
D) a transfer of gases from the Sun
61. Which graph best illustrates the average temperatures of the planets in the solar system?

A)  

B)  

C)  

D)  

Base your answers to questions 62 and 63 on the data table below, which shows information about the four largest asteroids found in our solar system.

<table>
<thead>
<tr>
<th>Name</th>
<th>Average Diameter (kilometers)</th>
<th>Period of Revolution (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ceres</td>
<td>848.4</td>
<td>4.60</td>
</tr>
<tr>
<td>Pallas</td>
<td>498.1</td>
<td>4.61</td>
</tr>
<tr>
<td>Juno</td>
<td>247.0</td>
<td>4.36</td>
</tr>
<tr>
<td>Vesta</td>
<td>468.3</td>
<td>3.63</td>
</tr>
</tbody>
</table>

62. Compared to the diameter of Earth’s Moon, the diameter of Ceres is about

A) **one-fourth of the Moon’s diameter**  
B) one-half of the Moon’s diameter  
C) twice the diameter of the Moon  
D) four times the diameter of the Moon
63. The asteroids shown in the data table are located between the orbits of

A) Venus and Earth  
C) Mars and Jupiter

64. Because Venus has greater atmospheric carbon dioxide (CO\textsubscript{2}) content than Earth has, the surface temperature of Venus is

A) warmer, due to absorption of long-wave (infrared) radiation by a greenhouse gas

B) warmer, due to absorption of short-wave (ultraviolet) radiation by a greenhouse gas

C) cooler, due to absorption of long-wave (infrared) radiation by a greenhouse gas

D) cooler, due to absorption of short-wave (ultraviolet) radiation by a greenhouse gas

65. Which characteristic of the planets in our solar system increases as the distance from the Sun increases?

A) equatorial diameter

B) eccentricity of orbit

C) period of rotation

D) period of revolution

66. Which diagram most accurately represents the relative diameters of Earth and Mercury?

A) 

B) 

C) 

D) 

67. Which object has the most elongated orbit?

A) Mercury  
B) Earth's moon  
C) Neptune  
D) Pluto

68. An astronomical unit (A.U.) is

A) a term for defining the luminosity of a star

B) the average distance from the Earth to the sun

C) the average distance of any given planet to the sun

D) equal to a light year
Base your answers to questions 69 and 70 on the data table below, which provides information about the Moon, based on current scientific theories.

<table>
<thead>
<tr>
<th>Information About the Moon</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Subject</strong></td>
</tr>
<tr>
<td>Origin of the Moon</td>
</tr>
<tr>
<td>Craters</td>
</tr>
<tr>
<td>Presence of water</td>
</tr>
<tr>
<td>Age of rocks in terrae highlands</td>
</tr>
<tr>
<td>Age of rocks in maria plains</td>
</tr>
<tr>
<td>Composition of terrae highlands</td>
</tr>
<tr>
<td>Composition of maria plains</td>
</tr>
<tr>
<td>Composition of mantle</td>
</tr>
</tbody>
</table>

69. Which statement is supported by the information in the table?
A) The Moon was once a comet.
B) The Moon once had saltwater oceans.
C) Earth is 4.5 billion years older than the Moon.
**D) Earth was liquid rock when the Moon was formed.**

70. Which Moon feature is an impact structure?
A) crater  B) maria plain  C) terrae highland  D) mantle

71. The impacts of large asteroids on Earth are inferred to be associated with
A) free oxygen entering Earth’s atmosphere
B) seafloor spreading
C) the creation of subduction zones
**D) global climatic changes**

72. Compared to the other planets in our solar system, Jupiter, Saturn, and Neptune have
A) shorter periods of rotation
B) shorter periods of revolution
C) greater eccentricities
D) greater densities

73. Compared to the terrestrial planets, the Jovian planets have
A) smaller diameters
B) greater average densities
C) slower rates of rotation
**D) longer periods of revolution**

74. Which planet below has the highest average density?
A) Earth  B) Uranus  C) Jupiter  D) Saturn

75. Compared to the distances between the planets of our solar system, the distances between stars are usually
A) much less  B) much greater  C) about the same
76. Which planet has vast amounts of liquid water at its surface?

A) Venus  B) Mars  C) Jupiter  D) Earth

Base your answers to questions 77 and 78 on the diagrams below. The diagrams represent the events that occur when a large meteor, such as the one believed to have caused the extinction of many organisms, impacts Earth's surface. Diagram A shows the meteor just before impact. Diagram B represents the crater forming, along with the vapor and ejecta (the fragmented rock and dust) thrown into the atmosphere.

77. Many meteors are believed to be fragments of celestial objects normally found between the orbits of Mars and Jupiter. These objects are classified as

A) stars  B) asteroids  C) planets  D) moons

78. Which statement best explains how global climate would most likely be affected after this large meteor impact?

A) Large quantities of ejecta in the atmosphere would block insolation and lower global temperatures.
B) An increase in vapor and ejecta would allow radiation to escape Earth's atmosphere and lower global temperatures.
C) Ejecta settling in thick layers would increase the absorption of insolation by Earth's surface and raise global temperatures.
D) Forest fires produced from the vapor and ejecta would raise global temperatures.

79. The primary chemical constituent of the Jovian planets is

A) iron  B) oxygen  C) hydrogen  D) ammonia

80. What is the inferred age of our solar system, in millions of years?

A) 544  B) 1300  C) 4600  D) 10,000
81. Base your answer to the following question on the diagram below and on your knowledge of Earth science. The diagram represents the orbital paths of the four Jovian planets and Halley's comet around the Sun. Halley's comet has a revolution period of 76 years. In 1986, Halley's comet was at perihelion, its closest point to the Sun. Letters A, B, C, and D represent locations of Halley's comet in its orbit. Location D represents Halley's comet at aphelion, its farthest point from the Sun. The comet's tail is shown at perihelion and at locations B and C.

Based on the pattern shown above, which diagram best represents the correct position of the comet's tail at location A relative to the Sun?

A) ![Diagram A]
B) ![Diagram B]
C) ![Diagram C]
D) ![Diagram D]
82. The density of the sun is closest to the density of
A) Earth  B) Jupiter
C) Earth’s moon  D) an asteroid

83. Compared to Pluto, Mercury moves more rapidly in its orbit because Mercury
A) is larger  B) is more dense  C) is closer to the Sun  D) has a more elliptical orbit

84. What is the approximate average density of the Earth?
A) 2.80 g/cm³  B) 5.52 g/cm³
C) 9.55 g/cm³  D) 12.0 g/cm³

85. Which planet is located approximately ten times farther from the Sun than Earth is from the Sun?
A) Mars  B) Jupiter  C) Saturn  D) Uranus

86. Which graph best indicates the densities of the planets in our solar system?

87. Compared to Jovian planets, terrestrial planets have a
A) more rocky composition.  B) lower density.
C) more rapid rotation.  D) larger size.

88. Which planet’s diameter is approximately four times Earth’s diameter?
A) Venus  B) Jupiter  C) Saturn  D) Uranus

89. Earth's early atmosphere contained carbon dioxide, sulfur dioxide, hydrogen, nitrogen, water vapor, methane, and ammonia. These gases were present in the atmosphere primarily because
A) radioactive decay products produced in Earth's core were released from Earth's surface
B) evolving Earth life-forms produced these gases through their activity
C) Earth's growing gravitational field attracted these gases from space
D) volcanic eruptions on Earth's surface released these gases from the interior
90. Base your answer to the following question on the diagram below, which shows an inferred sequence in which our solar system formed from a giant interstellar cloud of gas and debris. Stage A shows the collapse of the gas cloud, stage B shows its flattening, and stage C shows the sequence that led to the formation of planets.

After the young Sun formed, the disk of gas and dust

A) became spherical in shape  
B) formed a central bulge  
C) became larger in diameter  
D) eventually formed into planets

91. Which object in our solar system has the greatest density?

A) Jupiter  
B) Earth  
C) the Moon  
D) the Sun

92. Which of the following is not a characteristic of the Jovian planets?

A) they have low average density.  
B) they have orbits outside the asteroids.  
C) **their composition lacks hydrogen.**  
D) they have large diameters.

93. Which sequence lists the Jovian planets in order of increasing mass?

A) Jupiter, Saturn, Neptune, Uranus  
B) **Uranus, Neptune, Saturn, Jupiter**  
C) Jupiter, Saturn, Uranus, Neptune  
D) Neptune, Uranus, Saturn, Jupiter

94. Why are impact structures (craters) more common on the surface of Mars than on the surfaces of Venus, Earth, and Jupiter?

A) Mars has the greatest surface area and receives more impacts.  
B) The tiny moons of Mars are breaking into pieces and showering its surface with rock fragments.  
C) Mars has a strong magnetic field that attracts iron-containing rock fragments from space.  
D) **The thin atmosphere of Mars offers little protection against falling rock fragments from space.**

95. Terrestrial planets move more rapidly in their orbits than the Jovian planets because terrestrial planets are

A) rotating on a tilted axis  
B) more dense  
C) more massive  
D) closer to the Sun
Planets of the Solar System

2. D  37. B  72. A
3. C  38. D  73. D
5. B  40. A  75. B
6. B  41. A  76. D
7. B  42. C  77. B
8. D  43. A  78. A
10. C  45. D  80. C
12. B  47. A  82. B
15. C  50. C  85. C
17. B  52. B  87. A
19. D  54. B  89. D
20. A  55. B  90. D
22. C  57. C  92. C
25. A  60. A  95. D
27. D  62. A
28. C  63. C
29. D  64. A
30. B  65. D
31. D  66. A
32. D  67. D
33. A  68. B
34. B  69. D
35. D  70. A