Football Review - Earth, Moon, Sun

The Earth, Sun & Moon

1. During a total solar eclipse, when almost all of the Sun's light traveling to the Earth is blocked by the Moon, what is the order of the Earth, Sun, and Moon?

   - A. Moon, Sun, Earth
   - B. Earth, Moon, Sun
   - C. Earth, Sun, Moon
   - D. Sun, Earth, Moon

The Universe

2. Asteroids are larger than

   - A. planets.
   - B. the Sun.
   - C. meteoroids.
   - D. stars.

The Earth, Sun & Moon

3. What event happens about once every month?

   - A. a rotation of the Earth
   - B. a lunar eclipse
   - C. a revolution of the Earth around the Sun
   - D. a full Moon

The Universe

4. In 1801, the Italian astronomer Giusseppe Piazzi discovered a large, rocky body orbiting the Sun. The body was surrounded by other similar rocky bodies that traveled in the same orbit.

   What did Piazzi most likely discover?

   - A. a planet
   - B. an asteroid
   - C. a moon
D. a comet

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**The Earth, Sun & Moon**

5. There are two days every year when daytime and nighttime are equal. These days happen when the Sun appears in a special position in the sky. The exact moment when the Sun appears in this position is called an equinox (EE-kwuhn-noks).

During which two seasons do equinoxes happen?

- A. winter and summer
- B. autumn and spring
- C. autumn and winter
- D. spring and summer

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**The Universe**

6. Stars are hot, burning balls of gas that produce their own light. When stars are arranged in patterns, they are called _______.

- A. constellations
- B. asteroids
- C. black holes
- D. astrology

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**The Earth, Sun & Moon**

7. Shelly saw a full moon in the night sky. It looked like the picture below.

What can Shelly conclude?

- A. The Moon will next enter the first quarter phase.
- B. She will see a new moon in approximately one month.
- C. The other side of the Moon is currently dark.
D. The other side of the Moon is currently lit.

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The Universe

8. Our solar system includes the Earth, the Sun, and the seven other planets that are in orbit around the Sun. Which of the following galaxies does our solar system belong to?

- A. the Milky Way Galaxy
- B. the Andromeda Galaxy
- C. the Whirlpool Galaxy
- D. the Ursa Minor Galaxy

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The Earth, Sun & Moon

9. Why does the Moon have a greater influence on Earth’s tides than the Sun does?

- A. because the Moon is more massive than the Sun
- B. because the Moon is less massive than the Sun
- C. because the Moon is closer to Earth than the Sun is
- D. because the Moon is farther away from Earth than the Sun is

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The Universe

10. What object is shown in the picture?
A. a planetary satellite  
B. a planet  
C. an asteroid  
D. a comet

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**The Earth, Sun & Moon**

11. During a total lunar eclipse, when the Moon is completely dark, what is the order of the Sun, Moon, and Earth?

- A. Earth, Moon, Sun  
- B. Sun, Moon, Earth  
- C. Moon, Sun, Earth  
- D. Sun, Earth, Moon

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**The Universe**

12. How are most meteoroids formed?

- A. They are small pieces of debris that are the result of collisions of asteroids, comets, moons, and even planets within our solar system.  
- B. As the Sun burns, it throws off small, solid particles at a regular rate which are launched into our solar system.  
- C. They are created in the explosions that occur when stars die and eventually reach our solar system.  
- D. They are small pieces that are left over from the formation of our solar system.

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**The Earth, Sun & Moon**

13. Tides describe the regular rising and falling of ocean water. Tides are caused by

- A. the rotation of the Moon on its axis.  
- B. large storm systems over oceans.  
- C. the gravitational pull of the Sun and Moon.  
- D. earthquakes on the ocean floor.
The Universe

14. Which of the following statements about comets is true?

- **A.** Comets rarely fall into an orbit around the Sun. They usually enter the inner solar system only once and then are gone forever.
- **B.** Most comets have a circular orbit that keeps them in the space between Mars and Jupiter.
- **C.** Comets have very elliptical orbits that usually take them far beyond the orbit of Pluto, but also take them closer to the Sun than Earth.
- **D.** Comets have very elliptical orbits that usually take them closer to the Sun than Earth, but rarely do they get further away than Pluto.

The Earth, Sun & Moon

15. What unit of time on Earth is based on the rotation of the Earth?

- **A.** year
- **B.** month
- **C.** day
- **D.** hour

The Universe

16. Which of the following is a result of gravitational forces in the Solar System?

- **A.** the orbit of moons around their planets in the Solar system
- **B.** Saturn is further away from the Sun than Earth
- **C.** the radiation given off by Jupiter
- **D.** the difference in surface temperature on each of the planets

The Earth, Sun & Moon

17. If the Earth has revolved exactly once around the Sun since the last time that Samson went to the zoo, how much time has passed?

- **A.** one month
- **B.** ten years
- **C.** one day
- **D.** one year
The Universe

18. The image of a cluster of galaxies known as Abell 2218, shown below, was taken by the Hubble Space Telescope.

![Image of Abell 2218](image.jpg)

Image courtesy of NASA.

The lensing effect is a phenomenon in which light is distorted as it travels toward the observer. In the image above, lensing can be seen as thin streaks of light, which have been circled.

What causes the light from far away galaxies to bend in this manner?

- A. collisions with gas clouds
- B. electromagnetic attractions
- C. friction with the air
- D. the influence of gravity

The Earth, Sun & Moon
19. The image above shows the positions of the Earth, Moon, and Sun during a

- A. solar eclipse, in which the Moon casts a shadow on the Earth.
- B. lunar eclipse, in which the Moon casts a shadow on the Earth.
- C. lunar eclipse, in which the Earth casts a shadow on the Moon.
- D. solar eclipse, in which the Earth casts a shadow on the Moon.

The Universe

20. Many events that occur on Earth and in the solar system are related to the fact that most objects in the solar system move in regular and predictable patterns.

What causes objects in the solar system to move in these regular and predictable patterns?

- A. frictional forces
- B. nuclear forces
- C. gravitational forces
- D. electrical forces

The Earth, Sun & Moon

21. The time at which the Moon rises changes by about 50 minutes every day. Why is this the case?

- A. The speed at which the Moon moves through space varies according to the time of day.
- B. The Earth spins on its axis in a counterclockwise direction and the Moon revolves around Earth in a clockwise direction.
- C. The Moon's period of revolution is 24 hours and 8 minutes.
- D. The Moon revolves around the Earth at a different rate than the Earth rotates on its
The Universe

22. How do meteoroids and asteroids compare?

- A. Meteoroids are smaller and have a very different composition than asteroids.
- B. They are alike except for their composition—meteoroids contain more metals than asteroids.
- C. Asteroids are smaller and have a very different composition than meteoroids.
- D. They are alike except for their size—meteoroids are smaller than asteroids.

The Earth, Sun & Moon

23. Dustin saw the following moon phase in the sky.

![Moon phase image]

What moon phase will he most likely see in 14 days?

- A. a first-quarter moon
- B. a full moon
- C. a new moon
- D. a last quarter moon

The Universe

24. Where is the Sun located?

- A. near the center of the galaxy, below the galactic disk of other stars
- B. directly in the center of our galaxy
C. millions of light years above our galaxy's disk of stars

D. on our galaxy's disk of stars, about halfway out from the center

The Earth, Sun & Moon

25. The diagram below shows positions of the Moon as it orbits the Earth. Half of the Moon’s surface is lit by sunlight no matter what the Moon’s position. But the amount of the lit surface visible from Earth varies with the Moon’s position. Examine the diagram below, and answer the question that follows.

Which phase of the Moon is represented by position 4?

A. third quarter
B. waxing crescent
C. waning gibbous
D. waxing gibbous

The Universe

26. Meteoroids fall into three main classifications. What are they?

A. rocky, metallic rock, and metallic
B. stony, stony iron, and iron
C. stone, rock, and iron
27. What type of eclipse occurs if the Earth, Moon, and Sun are in the below order?

- A. martian eclipse
- B. lunar eclipse
- C. planetary eclipse
- D. solar eclipse

28. Which type of force holds galaxies together?

- A. electrostatic forces
- B. gravity
- C. friction
- D. magnetic forces

29. The Moon completes one orbit around the Earth in approximately _______ and completes one cycle of its phases in approximately _______.

- A. 27 $\frac{1}{3}$ days, 24 hours
- B. 24 hours, 29 $\frac{1}{2}$ days
- C. 365 $\frac{1}{4}$ days, 29 $\frac{1}{2}$ days
- D. 27 $\frac{1}{3}$ days, 29 $\frac{1}{2}$ days
The Universe

30. What makes the Moon shine?

- A. The Sun's light is reflected off of the Moon.
- B. Light from the Earth reflects off of the Moon.
- C. A star from outside of the Solar System shines on the Moon.
- D. The Moon gives off its own light.

The Earth, Sun & Moon

31. What unit of time on Earth is based on the revolution of the Moon around the Earth?

- A. year
- B. day
- C. hour
- D. month

The Universe

32. Use the table below to answer the following question.

<table>
<thead>
<tr>
<th>Star</th>
<th>Distance from Earth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sun</td>
<td>15.8 x 10^{-6} light years</td>
</tr>
<tr>
<td>Proxima Centauri</td>
<td>4.2 light years</td>
</tr>
<tr>
<td>Epsilon Eridani</td>
<td>10.5 light years</td>
</tr>
<tr>
<td>Procyon</td>
<td>11.4 light years</td>
</tr>
</tbody>
</table>

Which of the following most likely appears brightest from Earth?

- A. Sun
- B. Epsilon Eridani
- C. Proxima Centauri
- D. Procyon
33. The Earth rotates counterclockwise on its axis. Because of this, in which direction does the Moon appear to move across the sky?

- A. from south to north
- B. from west to east
- C. from east to west
- D. from north to south

34. Which of the following statements about stars is true?

- A. none of these
- B. stars vary greatly in size
- C. all stars are the same size
- D. stars rarely differ in size

35. Seasonal changes occur when the Earth tilts either toward or away from the Sun. What will happen to the amount of sunlight in the Northern Hemisphere as the Earth's tilt changes?

- A. The amount of sunlight in the Northern Hemisphere will remain the same as the Earth's tilt changes.
- B. When the Northern Hemisphere tilts toward the Sun, the amount of sunlight decreases in the Northern Hemisphere.
- C. When the Northern Hemisphere tilts away from the Sun, the amount of sunlight increases in the Northern Hemisphere.
- D. When the Northern Hemisphere tilts toward the Sun, the amount of sunlight increases in the Northern Hemisphere.

36. When Albert Einstein developed his general theory of relativity in 1915, he noticed that one of the theory's consequences was that there could be objects that were so massive that nothing, not even light, could escape their gravitational fields.
At first, Einstein found this prediction so strange that he did not believe it. However, later investigations proved that such objects do exist. Today, these objects are known as _______.

- A. supernovae
- B. neutron stars
- C. black holes
- D. quasars

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**The Earth, Sun & Moon**

37. The regular rising and falling of ocean water due to the gravitational pull of the Sun and Moon is called

- A. a tsunami.
- B. the tide.
- C. the Doppler effect.
- D. a hurricane.

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**The Universe**

38. According to the Law of Universal Gravitation, two objects are attracted to each other. The greater the total mass of the two objects, the stronger the attraction, or gravitational force. The greater the distance between the objects, the weaker the gravitational force.

The orbital speed of a planet is a direct result of the gravitational force between that planet and the Sun. The greater the force, the faster the speed.

The planet Mercury has a mass that is about 5% of Earth's mass and is the closest planet to the Sun. Jupiter has a mass more than 300 times greater than Earth's mass and is the fifth planet from the Sun.

Which of the following explains why Mercury's orbital speed is faster than Jupiter's?

- A. Although Mercury has less mass than Jupiter, Mercury is faster because it is closer to the Sun than Jupiter is.
- B. Because it is farther from the Sun than Mercury is, Jupiter is colder and therefore has a slower orbital speed.
- C. Mercury is faster because it has more mass than Jupiter and is closer to the Sun than Jupiter is.
- D. Jupiter is slowed down by its greater mass, while Mercury's lesser mass makes it faster.
The Earth, Sun & Moon

39. Teresa woke up and looked out the window. She could see the Sun just above the eastern horizon. If she looks out the window exactly one day later, where will the Sun be?

- A. setting on the western horizon
- B. not visible yet
- C. high up in the sky
- D. in about the same place

The Universe

40. Which of the following objects is usually the smallest?

- A. planets
- B. moons
- C. asteroids
- D. comets

The Earth, Sun & Moon

41. What positions of the Sun, Earth, and Moon produce the highest possible tide?
The Universe

42. The image below was taken by the Hubble Space Telescope. It shows stars forming out of an enormous cloud of gas and dust, which is about 6,500 light years from Earth.

What causes stars to form out of such gas clouds?
A. chemical transformations
B. evaporation
C. heat from starlight
D. gravity

The Earth, Sun & Moon

43. During what type of tide is the high tide the highest and the low tide the lowest?

A. spring tide
B. gibbous tide
C. new tide
D. neap tide

The Universe

44. Examine the picture below.

Except for the Sun, all of the bodies shown in this picture should be classified as...

A. comets.
B. planets.
C. asteroids.
D. moons.

The Earth, Sun & Moon

45. Which of the following causes the change in seasons on Earth?
46. While observing a planet through a telescope, a scientist observes a natural satellite orbiting the planet. What is the best classification for this satellite?

- A. planet
- B. comet
- C. asteroid
- D. moon

47. The diagram below shows positions of the Moon as it orbits the Earth.

Half of the Moon's surface is lit by sunlight no matter what the Moon's position, but the amount of the lit surface that is visible from Earth varies with the Moon's position.

Which phase of the Moon is represented by position 1?

- A. waning gibbous
The Universe

48. A meteor is what is seen when a ______ enters Earth's atmosphere and becomes visibly bright.

- A. meteoroid
- B. star
- C. man-made satellite
- D. moon

The Earth, Sun & Moon

49. The different phases of the Moon refer to...

- A. changes in seasons on the Moon.
- B. changes in the Moon's shape.
- C. changes in the Moon's rotation.
- D. changes in the Moon's visibility.

The Universe

50. What tool is commonly used to help see more details about the universe?

- A. telescope
- B. stethoscope
- C. periscope
- D. microscope

The Earth, Sun & Moon

51. Different seasons arise as the Earth revolves around the Sun because the Earth's axis is tilted. When the Northern Hemisphere is tilted towards the Sun, what seasons will the two hemispheres be experiencing?
A. Both hemispheres will be in winter.

B. The Northern Hemisphere will be in summer, and the Southern Hemisphere will be in winter.

C. The Northern Hemisphere will be in winter, and the Southern Hemisphere will be in summer.

D. Both hemispheres will be in summer.

The Universe

52. The closer a planet is to the Sun, the _______ the gravitational force between them and the _______ the planet's orbital speed.

A. stronger; faster
B. stronger; slower
C. weaker; slower
D. weaker; faster

The Earth, Sun & Moon

53. The image above shows the positions of the Earth, Moon, and Sun during a

A. solar eclipse, in which the Earth casts a shadow on the Moon.
B. solar eclipse, in which the Moon casts a shadow on the Earth.
C. lunar eclipse, in which the Moon casts a shadow on the Earth.
D. lunar eclipse, in which the Earth casts a shadow on the Moon.

The Universe

54. Which of the following is true about the Sun?

A. The Sun is the only star in the universe.
B. The Sun is the only star in the Solar System.
C. The Sun is the only star in the Milky Way.
D. The Sun is not a star.

The Earth, Sun & Moon

55. What unit of time on Earth is based on the revolution of the Earth around the Sun?

A. hour
B. day
C. year
D. month

The Universe

56. In areas without excessive light pollution, a band of light can be seen spanning the night sky. This band of light comes from

A. planets in the solar system.
B. stars at the edge of the universe.
C. stars in the Milky Way.
D. moons in the solar system.

The Earth, Sun & Moon

57. Day and night are caused by

A. the rotation of the Sun on its axis.
B. the Sun completing a full orbit around the Earth.
C. the rotation of Earth on its axis.
D. the Earth completing a full orbit around the Sun.
The Universe

58. The table below describes the temperature of different colors of stars.

<table>
<thead>
<tr>
<th>Color</th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>red</td>
<td>under 3,500 K</td>
</tr>
<tr>
<td>orange-red</td>
<td>3,500 - 5,000 K</td>
</tr>
<tr>
<td>white-yellow</td>
<td>5,000 - 6,000 K</td>
</tr>
<tr>
<td>blue-white</td>
<td>6,000 - 7,500 K</td>
</tr>
<tr>
<td>blue</td>
<td>7,500 - 25,000+ K</td>
</tr>
</tbody>
</table>

Antares is a supergiant with a temperature of 3,500 K. Antares is most likely _______ in color.

- A. yellow
- B. blue
- C. red
- D. white

The Earth, Sun & Moon

59. It takes the Earth _______ to complete one revolution around the Sun.

- A. one year
- B. one month
- C. one hour
- D. one day

The Universe

60. A piece of solar system debris that passes through Earth's atmosphere and strikes the ground is a/an _______.

- A. asteroid
- B. meteor
- C. meteoroid
Answers

1. B
2. C
3. D
4. B
5. B
6. A
7. C
8. A
9. C
10. D
11. D
12. A
13. C
14. C
15. C
16. A
17. D
18. D
19. C
20. C
21. D
22. D
23. C
24. D
25. D
26. B
27. D
28. B
29. D
30. A
Explanations

1. The correct order is: Earth, Moon, Sun. During a total solar eclipse, the Moon blocks almost all of the Sun's light that would usually be seen on Earth.

2. Asteroids are rocky bodies orbiting the Sun in our Solar System that are larger than
meteoroids and smaller than planets.

3. The length of a month is based on the cycle of the phases of the Moon. So, a full Moon happens about once every month.

4. Asteroids are small, rocky bodies that orbit the Sun. Asteroids can be any shape, and they range in size from a few meters across to almost 1,000 km across.

5. As the Earth revolves around the Sun, the Sun appears to move across the sky. This motion changes with the seasons. During winter, the Sun appears lower in the sky, and nighttime lasts longer than daytime. During summer, the Sun appears higher in the sky, and daytime lasts longer than nighttime.

An equinox happens halfway between the Sun's lowest and highest position, when daytime and nighttime are equal. Equinoxes happen during spring and autumn.

6. Stars can form patterns called constellations.

Stars within constellations do not move relative to each other, but from Earth, they appear to move across the night sky from east to west. Stars and constellations appear to move because of the rotation of the Earth on its axis.

7. One half of the Moon is always facing the Sun. Thus, one half of the Moon is always lit while the other half is dark.

8. The Earth, the Sun, and the seven other planets that are in orbit around the Sun are part of our solar system. Our solar system also contains all of the meteoroids, asteroids, and comets that are in orbit around the Sun and all of the moons that orbit the eight planets.

Our solar system is located in the Milky Way Galaxy. The Milky Way Galaxy is a spiral galaxy and is one of billions of galaxies in the universe.

9. The Moon has a greater influence on Earth's tides than the Sun does because the Moon is closer to Earth than the Sun is.

Every object exerts a gravitational force on every other object based on the objects' masses and distance apart. The Sun is much more massive than the Moon. So if they were the same distance from Earth, the Sun's influence on the tides would be much greater than the Moon's. However, the Moon is much closer to the Earth, which is the reason it influences the tides more.

10. A comet is shown in the picture.

Comets are generally made of rock, dust, and ice. When a comet's orbit passes near the Sun, the ice begins to melt, or vaporize. When light from the Sun is reflected in the ice and vapor, it can be viewed from Earth as a shining tail.

11. The correct order is: Sun, Earth, Moon. During a total lunar eclipse, the Earth blocks all of the Sun's light that would usually reflect off the Moon.
12. Most meteoroids are small pieces of debris that are the result of collisions of asteroids, comets, moons, and even planets within our solar system.

Meteoroids, like asteroids, comets, and other chunks of rock, orbit the Sun as a result of the force of gravity.

13. Tides are caused by the gravitational pull of the Sun and Moon on ocean water.

Because the Earth is shaped like a ball, there is always an area on Earth that is closer to the Moon than the other areas. Since the Moon has mass, the Moon has a gravitational pull. When ocean water gets close to the Moon's gravity, the Moon pulls the water "upward." In fact, the water forms a "dome" above the Earth's surface as it is pulled toward the Moon. When a body of water is in a "dome" phase, this is called high tide.

Tides are caused by the Sun in the same way that they are caused by the Moon. However, because the Sun is so much farther away from the Earth than the Moon, the gravitational force of the Sun upon the water is much less, resulting in lower tides. Tides caused by the Moon are called lunar tides, and tides caused by the Sun are called solar tides.

14. Comets have very elliptical orbits that usually take them far beyond the orbit of Pluto, but also take them closer to the Sun than Earth.

15. When an object rotates, it spins around its own axis, like a top.

The Earth makes one complete rotation every day (i.e., every 24 hours). It is the rotation of the Earth that causes changes from night to day.

16. The gravitational force of the planets pulls inward on their moons, forcing the moons to stay in orbit around the planets. If not for the gravitational force of the planets on their moons, the moons would quickly move away from their planets.

17. Revolution refers to one object moving around another object. It takes the Earth exactly one year to revolve one time around the Sun. It has been a year since Samson went to the zoo.

18. Einstein's general theory of relativity describes how matter, space, time, and radiation are influenced by gravity. The theory describes the way in which objects with mass cause space and time to bend around them. The more massive the object, the stronger its gravitational field, and the more space and time are distorted by it.

It is this bending of space and time that makes light appear to change its direction when it passes by very massive objects, such as galaxies.

Astronomers call this apparent bending of light gravitational lensing.

19. The image shows the positions of the Earth, Moon, and Sun during a lunar eclipse, in which the Earth casts a shadow on the Moon.

During a lunar eclipse the Earth prevents some of the Sun's light from reaching the
20. **Gravitational forces** cause most objects in the solar system to maintain regular and predictable patterns of motion. For example, gravity causes moons to orbit around their planets and planets to orbit around the Sun.

These motions can also be used to explain events, such as the length of a day, the length of a year, the phases of the Moon, eclipses, and tides.

21. It takes the Moon 27 days and 8 hours to complete its period of revolution. Thus, the moon travels 13.8 degrees around the Earth in one day. Meanwhile, the Earth makes a full 360 degree turn. Because of this, the Moon seems to rise approximately 1 hour later every day.

22. Asteroids and meteoroids are alike except for their size—meteoroids are smaller than asteroids. In terms of composition, they are both made mostly of rock.

23. The appearance of the Moon (moon phases) that can be seen from Earth changes approximately every 28 days in an observable pattern. The pattern is as follows:

   new moon → first quarter moon → full moon → last quarter moon

24. Our solar system, including the Sun, planets, moons, asteroids, and comets, is located on the disk of our galaxy about half to two-thirds of the way out from the galactic center. The Sun is just one of billions of stars in our galaxy, which is known as the Milky Way.

25. Position 4 represents the waxing gibbous phase. During this phase, between half and all of the Moon's lit surface is visible from Earth, and the lit portion appears on the right side of the Moon.

26. The 3 main classifications of meteoroids are stony, stony iron, and iron.

27. If the Moon is positioned between the Sun and the Earth, a **solar eclipse** occurs.

   An eclipse of the Sun, or solar eclipse, occurs when the Moon's shadow blocks the view of the Sun from the people on Earth.

28. **Gravity** is the non-contact force that attracts objects to each other in space.

29. The Moon completes one orbit around the Earth in approximately $27 \frac{1}{3}$ days and completes one cycle of its phases in approximately $29 \frac{1}{2}$ days. The complete cycle of the Moon's phases takes longer than Moon's orbit around the Earth due to the Earth's orbit around the Sun. The Earth's orbit around the Sun changes the angle at which the Sun's rays hit the Moon.

30. Stars are the source of light for all bright objects seen in the night sky. The Moon shines because it reflects light from the Sun.
31. The separation of the days in our year into months is based on the amount of time it takes the Moon to revolve, or orbit, around the Earth.

   It takes about 27.3 days for the Moon to make one revolution around the Earth.

32. In general, the closer a star is to the Earth, the brighter it appears. The Sun is the closest star to Earth, with the next closest star being Proxima Centauri at 4.2 light years away.

33. Both the Moon and the Sun appear to rise in the east and set in the west as the Earth spins on its axis in a counterclockwise direction.

34. There are billions of stars which vary greatly in size, temperature and color.

35. The amount of sunlight received by a given area of Earth changes with the seasons.

   When the Northern Hemisphere tilts toward the Sun, it is summer in that region. During the summer, an area receives more sunlight, the Sun is higher in the sky, and daytime is longer.

   When the Northern Hemisphere tilts away from the Sun, it is winter in that region. During the winter, an area receives less sunlight, the Sun is lower in the sky, and daytime is shorter.

36. A black hole is a region of space that contains so much mass and has such a strong gravitational field that nothing, not even light, can escape.

   Einstein's general theory of relativity describes gravity in terms of how mass bends space and time. One consequence of this theory is that light is bent when it passes by very massive objects. This idea can be expanded to imagine an object that is so massive that even light cannot move fast enough to leave its gravitational field.

   Despite the strangeness of this prediction, the evidence for black holes is very strong. In fact, there is most likely a black hole at the center of our own galaxy, the Milky Way.

37. The rising and falling of ocean water due to the gravitational pull of the Sun and Moon is called the tide.

38. Mercury orbits the Sun much faster than Jupiter does because the gravitational force between Mercury and the Sun is stronger than the gravitational force between Jupiter and the Sun. If the two planets were the same distance from the Sun, Jupiter’s greater mass would make its attraction to the Sun stronger than Mercury's. But, because Mercury is so much closer to the Sun than Jupiter is, Mercury’s attraction to the Sun is stronger than Jupiter’s.

   Mercury’s orbital speed is faster than Jupiter’s because Mercury is closer to the Sun than Jupiter is.

39. A day measures how long it takes the Earth to rotate once on its axis. If Teresa saw the Sun in the morning and looked out the same window exactly one day later, the Sun
would be **in about the same place** in the sky.

40. Although comets appear very large when they are near the Sun because of the large dust cloud that follows behind them, they are actually the smallest of the objects listed. Comets typically have a diameter of less than 6 miles, which is much smaller than the typical diameter of the other objects listed above.

41. When the Sun, Earth, and Moon are lined up, the tidal affect of the Sun and Moon add together to produce the highest tide on Earth. The highest high tide will occur when the gravity of the Sun and Moon are pulling in the same direction. This is shown in picture **III only**.

42. **Gravity** is the force that governs the movement of bodies in the universe.

Stars form out of vast clouds of gas and dust, which collect in the space between other stars. Once a cloud has reached a certain mass and density, its own gravity causes it to collapse on itself. This process is responsible for giving birth to new stars.

43. The highest and lowest tides on Earth are called **spring tides**. Spring tides occur during Full and New Moon phases, when the Sun, Earth, and Moon are aligned.

During New Moon, this alignment creates the highest net gravitational pull on the Earth region that is closest to the Moon and Sun, resulting in the highest tides.

During Full Moon, this alignment creates the highest net gravitational pull on the regions on opposite sides of the Earth that are closest to the Sun and Moon, which also results in the highest tides.

The lowest tides on Earth are found at the regions that are farthest from the regions of the highest tides.

44. The International Astronomical Union defines a **planet** as a spherical object that orbits a star and has cleared the neighborhood around its orbit.

45. Because **the Earth is tilted on its axis** and because **the Earth revolves around the Sun**, different parts of the Earth are tilted toward the Sun at different times throughout the year.

The combination of the Earth's axial tilt and the Earth's revolution around the Sun causes different amounts of the Sun's energy to hit the surface of the Earth at different times of the year, and it causes variations in the length of "daytime".

These variations in the intensity of the sunlight reaching the Earth and the length of daytime result in different seasons throughout the year.

46. **Moons** are natural satellites that orbit a planet.

47. Position 1 represents the **new Moon** phase. During this phase, none of the Moon's lit surface is visible from Earth. The Moon's unlit side can be seen during this phase, although it is very faint.
Position 2 represents the waxing crescent phase.
Position 3 represents the first quarter phase.
Position 4 represents the waxing gibbous phase.
Position 5 represents the full Moon phase.
Position 6 represents the waning gibbous phase.
Position 7 represents the third quarter phase.
Position 8 represents the waning crescent phase.

The phases of the Moon are a result of the Earth's orbit around the Sun (once per year) and the Moon's orbit around the Earth (once every 28 days).

These orbits change the part of the Moon that is illuminated by the Sun, and they affect the amount of the illuminated portion that is visible from Earth.

48. **Meteoroids** are the small pieces of debris that are the result of collisions of asteroids, comets, moons, and even planets within our solar system. They are smaller than asteroids and are kept in orbit around the Sun due to the force of gravity.

When a meteoroid enters the Earth's atmosphere and becomes visible (i.e., emits a bright streak of light), it is known as a meteor.

A meteorite is the part of a meteor that hits the ground and is not destroyed in the impact.

49. The different phases of the Moon refer to the changes in the Moon's visibility from the vantage point of Earth. The amount of the lighted half of the Moon that is visible from Earth constantly changes because the Moon is revolving around the Earth and the Earth is revolving around the Sun.

50. A **telescope** is commonly used to help see more details about the universe. Telescopes magnify objects that are far away.

51. When either the Northern Hemisphere or Southern Hemisphere is tilted towards the Sun, it is receiving more solar radiation and is experiencing summer.

The opposite hemisphere is tilted away from the Sun. It is receiving less radiation and is experiencing winter.

52. The closer a planet is to the Sun, the **stronger** the gravitational force between them and the **faster** the planet's orbital speed. Planets that are closer to the Sun are more attracted to the Sun and have faster orbital speeds than planets that are farther from the Sun. Also, a given planet's speed will vary along its orbit as its distance from the Sun varies.

53. The image shows the positions of the Earth, Moon, and Sun during a solar eclipse, in which the Moon casts a shadow on the Earth. During a solar eclipse the Moon prevents some of the Sun's light from reaching the Earth.

54. The Sun is the only star in the Solar System. It is the closest star to Earth. The Sun is one of many billions of stars in the Milky Way galaxy, which is one of billions of galaxies
in the universe.

55. *Revolution* refers to one object moving around another object.

   It takes about one *year* for the Earth to make one revolution, or orbit, around the Sun.

56. The band of light that can be seen spanning the night sky comes from *stars in the Milky Way* Galaxy. The Milky Way Galaxy is a spiral galaxy that contains hundreds of billions of stars.

57. The *Earth* experiences night and day because it *rotates on its axis* once every 24 hours.

   At a given location on Earth (e.g., your city), the Earth is facing toward the Sun during the day and away from the Sun at night.

58. The stars can be classified in many ways, including by mass, color, and temperature. The color and the temperature of a star are usually related.

   Antares is a *red* supergiant.

59. It takes the Earth *one year* to complete one revolution around the Sun.

   The Earth follows an orbit around the Sun, which takes 365 days to complete. Planets that are closer to the Sun take less time to revolve around the Sun than do planets that are farther away from the Sun.

60. A piece of solar system debris that passes through Earth's atmosphere and strikes the ground is a *meteorite*. Most meteorites are meteoroid-size when they enter the atmosphere, and some of their mass burns up as they speed toward the ground.

   Larger bodies—asteroids and comets—do collide with Earth on rare occasions and can devastate the planet. Earth's geologic record preserves evidence that suggests one such collision may have occurred at the end of the Mesozoic era. Many scientists theorize that this impact killed the dinosaurs and many other groups of organisms in a mass extinction.

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