The Star of the System

Name: _____

Earth is just one small part of a huge solar system filled with numerous objects—planets, moons, comets, asteroids, rocks, dust, and gas. At the center of it all is a giant star that we call the Sun. The Romans called the sun *Sol*, and that is where the term *solar system* comes from.

By far, the Sun is the most massive object in the solar system. In fact, of all of the material in the solar system, the Sun contains about 99.8% of it! Because of the Sun's great mass, its gravity attracts all other objects in the solar system toward it. Its gravitational force causes the planets to orbit around it.

There are eight major planets, which can be divided into two categories: Inner Planets and Outer Planets. In order from the Sun, the Inner Planets are Mercury, Venus, Earth, and Mars. These planets have solid, rocky surfaces and are nearest to the Sun. In order from the Sun, the Outer Planets are Jupiter, Saturn, Uranus, and Neptune. These planets are called "gas giants" because their surfaces are made of gas, not solid rock. They are also much larger than the Inner Planets and much further away from the Sun.

There are also millions of minor planets in our solar system. Many of these are called asteroids, some of which are as large as 500 miles across. The majority of asteroids can be found in the asteroid belt. This enormous collection of asteroids orbits within the spacebetween the furthest Inner Planet (Mars) and the nearest Outer Planet (Jupiter).

What Did You Learn ?

1. Which of these is **not** an Outer Planet?

Ⓐ Jupiter
Ⓑ Venus
Ⓒ Saturn
Ⓓ Neptune

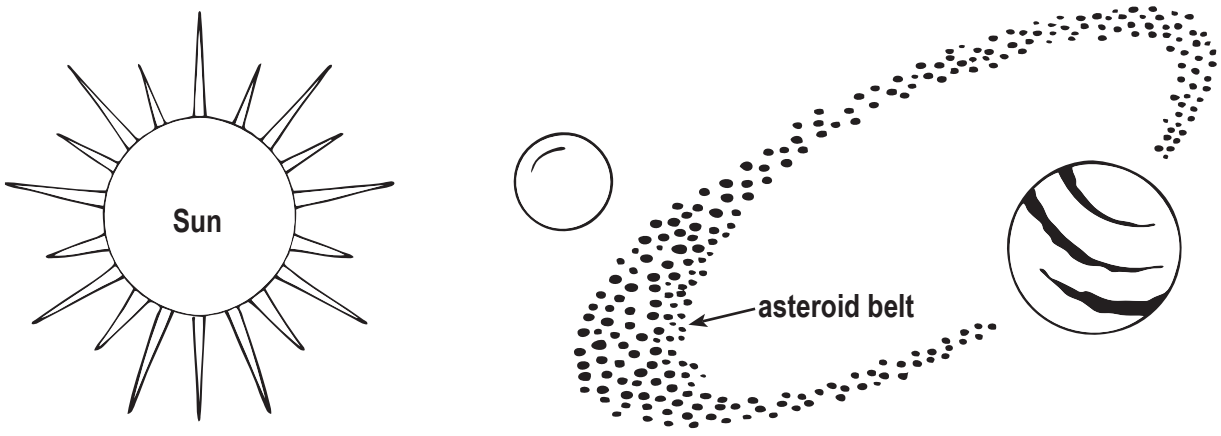
2. From the information given, you can infer that all of the material on Earth equals _____ of the material in the solar system.

Ⓐ about 2%
Ⓑ about 1%
Ⓒ about 0.2%
Ⓓ much less than 0.2%

3. The title of this page is "The Star of the System." To what object does this title refer?

Ⓐ Earth
Ⓑ Sun
Ⓒ Jupiter
Ⓓ asteroid belt

4. Look at the diagram below. Label the two planets shown in the diagram.



The Order of the Eight Planets

Name: _____

Other than the Sun, the eight planets are the largest objects in our solar system. The chart below gives information about these eight planets.

Planet Name	Order from Sun	Distance from Sun	Average Temperature
Mercury	1	36 million miles	333°F
Venus	2	67 million miles	867°F
Earth	3	93 million miles	59°F
Mars	4	141.6 million miles	-81°F
Jupiter	5	483.7 million miles	-162°F
Saturn	6	886 million miles	-218°F
Uranus	7	1.8 billion miles	-323°F
Neptune	8	2.79 billion miles	-330°F

1. Judging only by the information given in the chart, which one planet other than Earth would be a candidate for human survival? Explain your answer.

_____

_____

2. Earth's two planetary next-door neighbors are Venus and Mars. Determine which neighbor is closest to Earth.

- ➤ Venus is _____ million miles from Earth.
- ➤ Mars is _____ million miles from Earth.

3. One way in which people remember the order of the planets is by using a mnemonic. A *mnemonic* is a device that people use to remember things. In the instance below, the mnemonic helps people remember the order of the planets by memorizing a phrase. The first letters in the words in the phrase correspond to the first letters in the names of the planets. Here is one popular mnemonic:

My	**V**ery	**E**ducated	**M**other	**J**ust	**S**erved	**U**s	**N**achos
↑	↑	↑	↑	↑	↑	↑	↑
Mercury	**V**enus	**E**arth	**M**ars	**J**upiter	**S**aturn	**U**ranus	**N**eptune

Now create a mnemonic of your own that will help you remember the order of the planets. Your mnemonic must contain at least five different words than the one shown above.

_____

_____

Your Weight on Jupiter

Name: _____

The surface gravity of each planet is different, and that affects how much you would weigh on that planet. The surface gravity on Earth is listed at 1, and so the weight of a 100-pound person on Earth is computed as 1 × 100. If the surface gravity of the planet is different, the force of gravity holding that person on the planet is different. The surface gravity on Earth's moon is about 17%, which is 0.17 of the Earth's gravity. Therefore, a person weighing 100 pounds on Earth would weigh only 17 pounds on the moon because 0.17 × 100 = 17.

Directions:

- ➤ Study the chart below, and then compute the surface gravity of a 100-pound person on all eight planets.
- ➤ Compute the weight of a 150-pound person on each planet. The first one has been done for you.
- ➤ Answer the questions below.

Planet	Surface Gravity	Weight (100-pound person)	Weight (150-pound person)
Mercury	38%	38 pounds	57 pounds
Venus		90 pounds	
Earth		100 pounds	
Mars		38 pounds	
Jupiter		214 pounds	
Saturn		91 pounds	
Uranus		86 pounds	
Neptune		114 pounds	

1. Which planet(s) has the highest surface gravity? _____

2. Which planet(s) has the lowest surface gravity? _____

3. On which planet(s) would a person weigh the least? _____

4. On which planet(s) would a person weigh the most? _____

5. In which place would a 150-pound person weigh about 25 pounds?

Ⓐ Mercury
Ⓑ Mars
Ⓒ Jupiter
Ⓓ Earth's moon

6. Show the formula you used to answer #5.

Math on the Moons

Name: _____

A moon is a satellite. This means that it is an object that orbits a planet in space. For us Earthlings, there is one moon to gaze upon in dark night sky. But not all planets have moons, and some planets have a large number of them.

The chart below shows the number of moons for each planet. These numbers reflect the current number, but new moons are occasionally discovered. In fact, Neptune's 14th moon was discovered as recently as 2013.

Inner Planets				Outer Planets			
Mercury	Venus	Earth	Mars	Jupiter	Saturn	Uranus	Neptune
0	0	1	2	67	62	27	14

Directions: Use the chart above to complete the following math problems.

1. _____ **–** _____ **=** _____
[moons of Jupiter] [moons of Uranus]

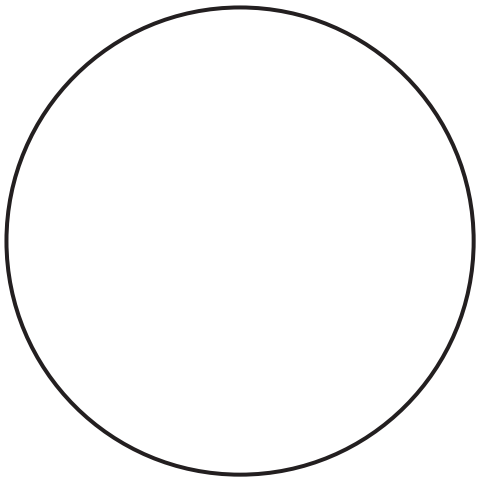
2. (_____ **+** _____) **×** _____ **=** _____
[moons of Earth] [moons of Neptune] [moons of Mars]

3. _____ **×** _____ **×** _____ **=** _____
[moons of Jupiter] [moons of Saturn] [moons of Venus]

4. If six more moons were discovered around Jupiter and two more were discovered around Saturn, what would be the total number of moons those two planets would have altogether? Show the equation used to find this answer.

_____

5. Imagine that a pie chart is created to show the number of moons in the Inner Planets vs. the number of moons in the Outer Planets. What would that pie chart look like? Divide the circle on the right into two sections to show this. Label one section "Inner Planets" and the other section "Outer Planets."



A Planet Unlike Earth

Name: _____

Mercury is the planet closest to the Sun. It was so named by the Romans because of its rapid movement across the night sky. In Roman myths, Mercury was the messenger of the gods who flew from place to place to deliver messages.

Of the eight planets in our solar system, Mercury is the smallest. Its diameter is only 3,032 miles. (Diameter is the distance across the middle of a circle or sphere.) By contrast, Earth's diameter is nearly 8,000 miles. If Earth were the size of a baseball, Mercury would only be the size of a golf ball.

Mercury is less than 38 million miles from the Sun. By comparison, Earth is about 93 million miles from the Sun. Because Mercury is very near to the Sun, its daytime temperatures can reach as high as 800°F. This is about four times the temperature of boiling water. Night temperatures, on the other hand, can fall to a very cold -300°F. This is more than 330°F below the freezing point of water.

At one time, Mercury had active volcanoes. On its surface, there are large plains that were formed long ago by lava flows. Mercury also has many rough, sharp-edged craters. These have been caused by meteors smashing into its surface. The craters and other rocky surfaces are not worn down. This is because Mercury has almost no atmosphere and no water.

Mercury's year is only 88 Earth days long, less than a quarter of an Earth year. Though Mercury revolves around the Sun quickly, it spins around on its axis very slowly. One day on Mercury equals about 59 Earth days. This means that there are fewer than two days in a Mercury year. Mercury has almost no tilt on its axis, and seasons do not exist.

Directions: The passage above shows the contrasts between Mercury and Earth. In your own words, summarize the information given in the passage. You must use complete sentences, and your summary must fit in the box below. Be sure to mention planet size, temperature, and day length.

Read Between the Lines

From the information given in the first paragraph, what you can infer about the Roman messenger of the gods?

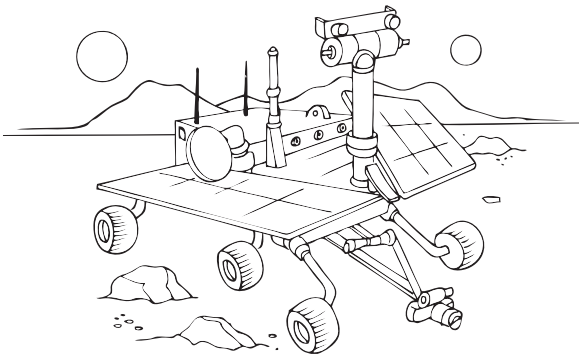
Ⓐ He was the most powerful god.
Ⓑ He flew swiftly and rapidly.
Ⓒ He flew closest to the Sun.
Ⓓ He was the smallest of the gods.

The Red Planet Next Door

Warm-Up 157

Name: _____

As the fourth planet from the Sun, Mars is one of Earth's nearest neighbors. Along with Mercury, Venus, and Earth, Mars is one of the Inner Planets of our solar system. Due to its reddish-orange landscape, it is often called "The Red Planet," and it can be seen from Earth by the naked eye. However, powerful telescopes are needed to observe the planet's features. And to get an even more detailed look at Mars, we have sent unmanned rovers to its surface. By collecting information in these various ways, we have learned many things about our planetary neighbor.



Mars' surface is littered with rocks and covered with a soil that has a high concentration of iron. It is the site of numerous storms that for weeks blow dust across its surface. In the past, Mars was home to large, active volcanoes; and it also appears to have flood plains that were formed from ancient water flows. Mars appears to have water in the form of vapor and ice.

With a diameter of 4,221 miles, Mars is about half the size of Earth. However, its volume is only about 15 percent of the volume of Earth. Diameter is the measurement of a straight line from one side to the other through the center of a circle or sphere. Volume refers to the amount of space in an object. Mars takes about 687 Earth days to make one complete orbit around the Sun. This means that a year on Mars is nearly equal to two years on Earth.

Mars has two moons. They are named Phobos and Deimos. The diameter of Phobos is less than 14 miles, while Deimos's diameter is less than 8 miles. In contrast, the diameter of Earth's moon is about 2,160 miles. Both of Mars' moons are believed to be asteroids that were trapped in the planet's orbit millions of years ago.

What Did You Learn ?

1. On the lines below, write down four features that can be found on the surface of Mars.

_____

_____

_____

_____

2. If a year on Mars equals about two on Earth, then about how many birthdays would you have had on Mars?

- ➤ Number of birthdays you have had on Earth: _____
- ➤ Number of birthdays you have had on Mars: _____

3. Of the three moons in the Inner Planets, name the one that is the smallest. Write it in the box.

The Little Planet that Once Was

Name: _____

Prior to 2006, students who studied our solar system learned about the Sun, the stars, and of course, the nine planets. Wait, *nine* planets? Aren't there only eight?

In 1930, a planet-like object was discovered beyond Neptune. While this object was quite a bit smaller than the other planets — in fact, it is 1/6 the size of our moon — it was decided that this object would be called a planet. The next task was to name the new planet. Three finalists were chosen: Minerva, Cronus, and Pluto. On May 1, 1930, the name Pluto was chosen. This name had been nominated by an 11-year-old English girl named Venetia Burney. Because Pluto was such a cold and dark place, Venetia chose to name it after the Greek god of the underworld.

Pluto's reign as a planet lasted 76 years. In 2005 an object larger than Pluto was discovered. This led scientists to formally define what it means to be a planet. It was decided that a planet must do the following three things:

1. It must orbit around the Sun.
2. It must be big enough to hold a round shape.
3. It must a have a gravitational pull that is strong enough to clear out objects in its area.

Pluto did not meet this third requirement. In 2006, its status was downgraded from "planet" to "dwarf planet." As one result of that decision, students now learn about the *eight* planets in our solar system.

Directions: Imagine a new planet has been discovered. It is up to you to decide on the characteristics of this new planet. Is it cold and dark? Is it warm and full of life? Describe the planet, and then name it. Finally, explain why you chose that name.

Planet Description: _____

_____

_____

_____

_____

_____

Planet Name: _____

Why?: _____

_____

_____

The Long-Haired Space Travelers

Name: _____

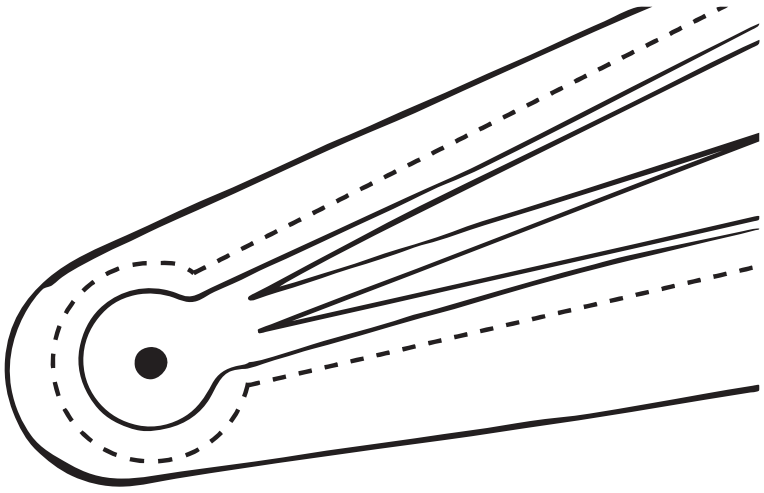
Comets are natural objects in space. The word *comet* means "long-haired," a name these objects were given by the Greek philosopher Aristotle. He thought comets looked like stars with hair.

Why do comets look this way? First, a comet is composed of three main ingredients: ice, dust, and rocks. The central part of the comet is called the *nucleus*. The nucleus is a bit like a very large, very dirty snowball flying through space. (A comet's nucleus may be several miles across.) As the comet passes close to the Sun, it begins to melt. Solar winds—or winds from the sun—blow the melted comet parts away from the Sun. These melted parts form a *coma* (the hazy atmosphere around the nucleus) and a *tail* (the long part that trails off from the nucleus). Since the solar wind creates the tail, the tail does not always trail behind the comet. If the comet is moving away from the Sun, then the tail would actually be at the front of the comet.

Some comets are periodic, which means they make regular passes by Earth. A famous such comet is called Halley's Comet, and it can be observed from Earth every 75 years or so. The list to the right shows the years since 1500 CE in which the comet could be observed from Earth. The exact dates given show when the comet came the closest to the Sun in its orbit.

August 26, 1531
October 27, 1607
September 15, 1682
March 13, 1759
November 16, 1835
April 20, 1910
February 9, 1986
July 28, 2061*
** predicted date*

Directions: Look at the picture below. Label the following parts: **nucleus**, **coma**, and **tail**. Then—either to the left or the right of the comet—draw the Sun. The location of the tail should tell you where the Sun needs to be drawn.



Extension: How old will you be when Halley's comet can next be observed from Earth? Answer this question on a separate piece of paper, and write a paragraph explaining why you would or would not be interested in seeing Halley's Comet as it passes by.

Word Study (page 142)
Accept appropriate responses.

Unit 25

Waterways Through the Continents (page 143)

1. A
2. D
3. C
4. A

How Do Rivers Form? (page 144)
Accept appropriate responses.

The Great Rivers of the World (page 145)

1. in order: Nile, Amazon, Yangtze, Mississippi
2. Africa: Congo, Nile; Asia: Ganges, Yangtze; North America: Mississippi; South America: Amazon
3. 3,902 – 1,569 = 2,333 miles

River Math (page 146)

1. 156 miles
2. 507 miles
3. 5,499 miles
4. Nile River
5. 1,240 miles
6. 1,201 miles
7. 12,072 miles
8. The answer is B, because B is represented by the second-shortest line and the Yellow River is the second-shortest of these four rivers.

Word Study (page 147)
Accept appropriate responses.

Unit 26

How Does Weather Happen? (page 148)

1. A
2. A
3. B
4. C

What Am I?: precipitation

The Weather Engine (page 149)

1. heat, air movement, precipitation
2. Warmed water vapor rises up and then cools.

Think About It!: Accept appropriate responses, such as using heaters and air conditioners, wearing warmer or cooler clothing, using umbrellas, wearing sunscreen, etc.

Let's Talk About the Weather (page 150)
Accept appropriate responses.

Your Personal Weather Log (page 151)
Accept appropriate responses.

The Tools to Measure Weather (page 152)

1. barometer
2. rain gauge
3. thermometer
4. anemometer
5. hygrometer

Two Ways to Express Temperature (page 153)

1. 77°F
2. 41°F
3. 32°F
4. 52°F
5. 93°F
6. 66°F

The Storms That Have Names (page 154)

1. C
2. B
3. D
4. C
5. Oscar is the only name that can be correct. Hurricane names never begin with X, so Xavier cannot be correct. Hurricanes named Sandy and Katrina have caused a lot of damage, so their names have been removed from the list.

Hurricanes of the 21st Century (page 155)

1. Hurricane Jeanne
2. August and September
3. total cost of 7 other hurricanes ($107.7 billion) < cost of Hurricane Katrina ($108 billion)
4. $\frac{3}{10}$
5. Accept appropriate responses.

Weather to the Extreme (page 156)

1. North America
2. Antarctica
3. 262.6°
4. Australia
5. Asia
6. Accept appropriate responses.
7. Accept appropriate responses.

Word Study (page 157)
Accept appropriate responses.

Unit 27

The Star of the System (page 158)

1. B
2. D
3. B
4. Mars, Jupiter

The Order of the Eight Planets (page 159)

1. Mars; its temperature is the closest to Earth's
2. Venus = 26 million miles from Earth
   Mars = 48.6 million miles from Earth
3. Accept appropriate responses.

Your Weight on Jupiter (page 160)

Planet	Surface Gravity	Weight (100-pound person)	Weight (150-pound person)
Mercury	38%	38	57
Venus	90%	90	135
Earth	100%	100	150
Mars	38%	38	57
Jupiter	214%	214	321
Saturn	91%	91	136.5
Uranus	86%	86	129
Neptune	114%	114	171

1. Jupiter
2. Mercury and Mars
3. Mercury and Mars
4. Jupiter
5. D
6. .17 × 150 = 25.5

Math on the Moons (page 161)

1. 67 – 27 = 40
2. (1 + 14) × 2 = 30
3. 67 × 62 × 0 = 0
4. (67 + 6) + (62 + 2) = 137
5. The section labeled "Outer Planets" should take up almost the entire circle.

A Planet Unlike Earth (page 162)

Accept appropriate responses.

Read Between the Lines: B

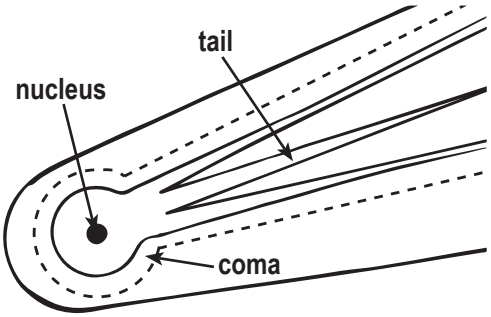
The Red Planet Next Door (page 163)

1. Correct answers will include reddish-orange landscape, littered with rocks, covered with soil, flood plains, dust storms, etc.
2. Students will have had about half the number of birthdays on Mars.
3. Deimos

The Little Planet that Once Was (page 164)

Accept appropriate responses.

The Long-Haired Space Travelers (page 165)



In students' drawings, the comet's tail should be furthest from the Sun.

Extension: Accept appropriate responses.

Word Study (page 166)

Accept appropriate responses.