Solar System Lesson 1

DO NOW: Why do scientists spend so much time and money studying the Sun?

LEARNING TARGET: I can describe the composition of the sun's internal and atmospheric levels.

SUCCESS CRITERIA: Complete all the review questions and, if you have internet access, watch the Explore More media and answer the questions.

SCIENCE STANDARD: DCI ESS1.B The solar system consists of the sun and a collection of objects, the planets, their moons, and asteroids that are held in orbit around the sun because of its gravitational pull on them. (MS-ESS1-2), (MS-ESS1-3)

ACTIVITY 1: Read Why Is the Summer Warmer Than the Winter?, decide which student has the best idea, and explain your thinking.

### Why Is the Summer Warmer Than the Winter?

Six friends were talking. They each had different ideas about why it is warmer in the summer than in the winter. This is what they said:

Werner: “It’s because the winter clouds block the heat from the sun.”

Ava: “It’s because the sun gives off more heat in the summer than in the winter.”

Raul: “It’s because Earth’s tilt changes the angle of sunlight hitting the Earth.”

Fernando: “It’s because Earth orbits closer to the sun in the summer than in the winter”

Shakira: “It’s because one side of the Earth faces the sun and the other side faces away.”

Susan: “It’s because the Northern Hemisphere is closer to the sun in the summer.”

Which student do you think has the best idea? ________________________

Explain your thinking and describe any evidence that supports your answer.
ACTIVITY 2: Grade 8 Space Systems Supplement

The supplement is available online on the Tacoma Public Schools home page. Click on Grades PK-12 Resources, then click on Middle School, and then click 8th Grade under April 2020. You can also pick up the learning packet at FCMS starting on Tuesday, April 14 and Thursday, April 16. Please call the school and make other arrangements if this does not work for you.

Read the first four chapters of the Grade 8 Space Systems Supplement, 1.1 – 1.4, and answer the review questions at the end of each one. If you have access to the internet do the Explore More section at the end of each chapter also.

ACTIVITY 3: Vocabulary

sun
plasma
core
radiative zone
photons
convection zone
photosphere
chromosphere
corona
sunspots
solar flares
solar prominences

Create a Frayer model to define each vocabulary word. Remember to identify some of the characteristics and attributes of the word, give some examples, illustrate the word, and use the word in a sentence.

ACTIVITY 4: Read the informational text *Our Sun* and *Regions of the Sun* then answer the questions on a separate piece of paper or print out the worksheet and answer on your copy.

ACTIVITY 5: Read Chapter 1.5 *Our Solar System* and Chapter 1.6 *Planet Orbits in the Solar System* as a preview to next week’s lessons.
OUR SUN

Our sun is the keeper of life as we know it. The sun is the beginning of most food chains. It provides the energy needed for plants to produce food. These plants may then become food for other life forms. The sun also provides heat and light. Without the sun, life would not be possible on Earth. Let’s find out more about this very important member of our solar system.

The sun is a star. It is not solid, like Earth, but is a body of hot gases. The sun is made of many elements which may also be found on earth. Approximately 75% of the sun is hydrogen gas. Some of the other important elements of the sun are helium, calcium, sodium, magnesium, and iron.

Compared to other members of the solar system, the sun is huge. It is, in fact, the largest member of the solar system, and it contains 99 percent of all the matter in the system. The diameter of the sun is approximately 109 times greater than the earth’s diameter. Astronomers believe the sun’s diameter is 1,392,000 kilometers, or 864,000 miles. If the sun were the size of a large orange, the earth would be a tiny seed. You would need about 1.33 million earths to fill the area of the sun.

Compared to other stars in the galaxy, the sun is just average sized. There are many stars which are much larger but also many that are smaller. Our sun seems different, and larger, because it is so close to us.

The sun is thought to be middle-aged. Astronomers believe the sun was formed about 4.6 billion years ago. They also believe the sun has enough energy to continue actively sustaining life for another few billion years. The sun will begin losing energy at that time, but it will take trillions of years before it cools completely.

The sun’s energy is produced by nuclear fusion. In the sun’s core, four hydrogen atoms join, or fuse, to form one helium atom. When this fusion occurs, energy is released in two forms: light and heat.

Astronomers have discovered stars of different colors. White and blue stars are very hot and send out lots of heat. Yellow stars are average in temperature, while red and orange stars are cooler. Our sun is classified as a yellow star. As it becomes older and loses its ability to produce energy, it may swell and become a red star, engulfing the earth.

The sun travels around the center of the Milky Way, much as the earth travels around the sun. It takes the sun approximately 250,000,000 years to complete one orbit. The sun is traveling in space at about 135 miles per second. That’s nearly half a million miles per hour!

As the sun travels around the Milky Way, it also rotates on its axis. Remember the sun is not a solid body. The gases rotate around the axis of the sun. At different levels, or latitudes, the gases may rotate at different times and speeds.

The sun has its own special place in the universe. Astronomers have measured distances from the sun to various space objects. They believe the sun is 149.6 kilometers from earth. Remember this is an average. They believe the sun is also 30,000 light years from the center of our galaxy, 4.3 light years to the closest star, and 150,000 light years from the nearest galaxy.
DIRECTIONS: Answer the questions below with complete sentences.

1. Why might the sun be considered the keeper of life?

2. Besides energy, what else does the sun provide?

3. What is the most common element found in the sun?

4. What other elements does the sun contain?

5. What is the size of the sun compared to the earth?

6. How does the sun compare in size to other stars in our galaxy?

7. How old is the sun and about how much longer will it last?

8. Where does the sun get its energy?

9. How does the sun make helium?

10. What are the colors of stars and how does this relate to temperature?

11. How do gases in the sun rotate on an axis?

12. How close is the nearest star, other than our own sun?
REGIONS of the SUN

Our sun is made of several different layers, or regions. The innermost layer is known as the core. This is also called the nuclear reaction zone. In the central part of our sun, energy is created by thermonuclear reactions. Four hydrogen atoms join, or fuse, to form one helium atom. As this fusion takes place, tremendous amounts of energy are released in the form of heat and light. These reactions occur under conditions of extremely great pressure. The matter is so densely packed in the sun's core, it is 340 trillion times the pressure found at sea level on the earth. If matter from the sun's core were packed into an area the size of a walnut, it would outweigh a large watermelon. Astronomers estimate that the temperature of the sun's core is as high as 15,000,000 degrees Celsius or 27,000,000 degrees Fahrenheit. This is the hottest region of the sun.

Moving out from the core, the next region of the sun is the radiative, or radiation zone. Many astronomers believe this is the thickest of the sun's layers. In this zone, energy is transferred from atom to atom by the process of radiation. The energy moves much like a wave. It takes centuries for the energy to be transmitted from the core through the radiation zone and on to the next region of the sun.

The third region has been called the convective zone. Hot gases leave the radiation zone and enter the convection zone, which consists of a cooler layer of gas. Astronomers believe this layer may be 80,000 kilometers deep and extends to within 160 kilometers of the surface of the sun. The hot gases entering this zone rise rapidly towards the surface. As they rise, the gases begin to cool. They then fall back towards the bottom of this zone. The cycle of heating, rising, cooling, and falling is repeated over and over. The end result is that the convection zone consists of continuously moving convection currents. It may take the sun's energy millions of years to travel from the core and through the radiation and convection zones before it can finally reach the surface.

Next to the convection zone is the first of three zones that make up the sun's atmosphere, the photosphere. This is the bright, shiny disk of the sun that we can see from earth. Most of the light that reaches earth comes from this layer. This layer is believed to be 400 kilometers deep, and astronomers have figured temperatures in the photosphere to be about 5600 degrees Celsius. This is considerably cooler than the temperatures found deep within the sun.

The middle layer of the sun's atmosphere is called the chromosphere. This portion of the sun's atmosphere is estimated to be between 14,000 kilometers and 9,500 kilometers deep. Temperatures range from 4,000 degrees Celsius at the bottom to 50,000 degree Celsius at the top. This layer appears bright red in color, but can only be seen from earth during a total solar eclipse. Normally the light is blocked by the much brighter chromosphere.

The final, outermost layer of the sun's atmosphere is called the corona. Once again, this region is only visible during a total solar eclipse or with an instrument called a coronagraph. The corona may vary in color from white to yellow to pale green. The temperature of the corona is difficult to determine because the gas particles are widely dispersed. Temperatures may be as high as 2,000 000 degrees Celsius, but the overall heating effect of the corona is much lower. As the gas particles continue to disperse, the corona gradually fades off into space.
DIRECTIONS: Answer the questions below with complete sentences.

1. What is the first layer of the sun called and where is it located?

2. How and where is energy created in the sun?

3. What is formed when four hydrogen atoms are joined or fuse?

4. What is released as a result of nuclear fusion?

5. What is the second region of the sun called?

6. How is energy transferred and how does it move?

7. What is the third region of the sun called?

8. What happens to the gases in this region as they are heated and cooled?

9. What is the name of this process?

10. How many zones make up the sun's atmosphere and what are they called?

11. When can the chromosphere be seen?

12. What happens to the sun's gas particles as they continue to disperse?