

Our Amazing Sun

Name _____

There are billions of stars in the universe. But there is only one star that scientists have been able to study in great detail. It is our Sun.

Imagine feeling the effects of an explosion 93 million miles away from its source. One November afternoon in 1960, astronomers noted a brilliant explosion on the sun. Six hours later, a huge "cloud" of electrical energy from the explosion hit the earth at a speed of about 4,000 miles a second. The cloud was ten million miles across and still trailing almost halfway back to the sun.

This collision between the cloud and the earth could not be heard or seen. But it started a great electrical storm on and around the earth. For hours radio was blacked out. Overhead, sheets of flaming-red northern lights flashed in the night sky. Electric lights flickered as in a thunderstorm, although the air and sky were clear and silent.

For more than a week these unusual conditions continued. They were the result of that explosion 93 million miles away! Yet such a storm is no more than a tiny ripple in the usual flow of the sun's energy. And explosions like these are actually very common!

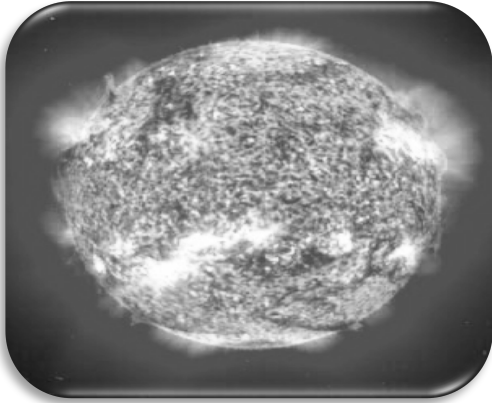
The sun's power is almost beyond imagination. In one *second*, this star of ours gives off more energy than man has used since civilization began. The sun delivers to us in a few days as much heat and light as would be produced by burning all the oil, coal, and wood on earth at once. Yet earth receives only one half of one billionth of the energy of the sun's rays.

What makes the sun shine so brilliantly? The answer that scientists now accept as correct is *atomic energy*. The sun may be considered as a hydrogen bomb that produces so much energy because it is so large.

Until the twentieth century, the study of the sun was limited by the earth's envelope of murky air. Particles in our atmosphere distort light beams and blot out many of the sun's rays. But, since 1946, satellites have carried instruments above the earth's atmosphere.

Now these satellites point instruments steadily at the sun. Huge radar transmitters bounce beams off the atmosphere of the sun and probe its structure and movement. Another kind of instrument- a spectroscope – lets scientists analyze the light coming from 93 million miles away. This tells what the sun is made of.

Astronomers know the size of the sun. Its diameter is 864,000 miles. That of the earth is 8,000 miles. The sun could hold 1,300,000 earths!



What is the sun made of? Did you guess that it consists mostly of hydrogen? You are correct.

The sun is *gaseous*. That is, the atoms in it are free to move about, as in a gas. They are not fixed in a regular pattern, like the atoms in solid matter.

Spots on the sun show us that it rotates from east to west and in a very peculiar way. Different parts spin at various speeds. A spot close to the equator, for example, may complete a rotation in 25 days. But a spot at the polar zone may take 34 days.

Through a solar telescope the edge of the sun looks sharp. But the sun really has no definite surface. What looks like the surface is in fact a layer of gas about 200 miles thick. From this layer comes most of the light we get. The layer is called the photosphere. (*Photo* means "light.")

The other layers of gas lie outside the photosphere. One is a reddish-colored layer where bursts of gas burn in great flames. It is called the chromosphere. (*Chromo* means "color.") The third layer, called the corona, or crown, extends outward without definite limits. All that scientists know about what is inside the sun they must learn from observing these three outside layers.

How hot is the sun's center? One scientist says that the heat from a pinhead of material as hot as the sun's core would kill a human 100 miles away!

You may have seen an eclipse of the sun. It is caused by the moon passing between the sun and the earth and blocking out the brilliant disk. Most of what scientists know of the sun's outer atmosphere comes from studies of solar eclipses, for at that time the corona and chromosphere are visible.

Pictures of the sun's rim show tongues and streamers of bright gas springing above the sun's surface. They rise up thousands of miles and then fall back.

But these thrilling activities are mild when compared with the explosion called a solar flare. A large flare from the sun may have the force of a billion hydrogen bombs! It was such a flare that happened in November, 1960.

Does it surprise you to learn that in spite of its activity our sun is a very ordinary star? It is a yellow star, midway in size between the largest and smallest stars. In temperature, it is midway between the hottest blue stars and the coolest red stars. (Young stars are blue; older stars are red.) To us, it seems brighter than any other star. But a star called Rigel (RYE-jel) is 15,000 times brighter than our sun! And 36 million suns could be put into a red giant known as Antares (an-TAIR-eez).

The sun is our bridge to the universe. It is the only star we can study in fine detail. As scientists have developed new tools to observe the sun, we have learned more about the earth's main source of energy – and about the stars beyond.

Exercise 1: Underline the choice that completes each statement according to the article. (RI.4.1)

- 1) The sun's distance from the earth is about (864,000, 93 million, 155 thousand) miles.
- 2) The effects of a solar explosion reach the earth in about (60 seconds, ten days, six hours).
- 3) The source of the sun's light and heat is (its rapid rotation, the northern lights, atomic energy).
- 4) Man-made satellites are important for studying the sun because they carry instruments (within, into, above) the earth's atmosphere.
- 5) Scientists analyze sunlight with spectrosopes to find out (the size of the sun, what the sun is made of, the movement of the sun).

- 6) When matter is in gaseous form, its atoms (are fixed in a pattern, move about, spin at the same speed).
- 7) The sun's inner layer of gas, from which most of our light comes, is the (corona, chromosphere, photosphere).
- 8) A good time to study the sun's atmosphere is during a solar eclipse because the corona and chromosphere are then (active, visible, quiet).
- 9) A solar flare is a huge (spot, light, explosion) on the sun.
- 10) The sun is one of the (smallest, middle-sized, largest) stars.

Exercise 2: How does the writer of the article help you imagine the huge size and energy of the sun and other stars? Think about some of the comparisons he makes in the text. Write three of the best examples below. (RI.4.5)

Exercise 3: Humans once believed the earth to be the center of the universe. Think about the earth and the sun. Why is this not surprising? Explain below. (RI.5.3)

ANSWERS

Exercise A:

- | | | |
|---------------|----------------------------|------------------|
| 1) 93 million | 2) six hours | 3) atomic energy |
| 4) above | 5) what the sun is made of | |
| 6) move about | 7) photosphere | |
| 8) visible | 9) explosion | 10) middle-sized |

Exercise B:

Answers will vary. Students have a number of comparisons they can choose for their examples using any of the text below. Examples include:

"In one second, this star of ours gives off more energy than man has used since civilization began. The sun delivers to us in a few days as much heat and light as would be produced by burning at once all oil, coal, and wood on earth. Yet earth receives only one half of one billionth of the energy of the sun's rays."

"Its (the sun) diameter is 864,000 miles. That of the earth is 8,000 miles. The sun could hold 1,300,000 earths!"

"One scientist says that the heat from a pinhead of material as hot as the sun's core would kill a human 100 miles away!"

"A large flare may have the force of a billion hydrogen bombs!"

"But a star called Rigel (RYE-jel) is 15,000 times brighter than our sun! And 36 million suns could be put into a red giant known as Antares (an-TAIR-eez)."

Exercise C:

Answers will vary. Accept reasonable responses. Most students will recognize that the movement of the sun across the sky during the day gave the impression that the sun was revolving around the earth and that we were the center of the solar system (or universe). The change in location of the moon at different times also contributed to the feeling that the earth is the center of the solar system or universe.

I hope you find this FREE product useful with your classes! This is another example of over 100+ passages and assessments I offer for Grades 3-9, both in individual format and in value-priced grade-level bundles. Help your students practice close reading skills and informational text standards with engaging texts and rigorous questioning!

Simply type **Mark Aaron** in the search function on the TpT homepage to view any of my 200+ products or to visit my TpT Store. And please consider becoming a follower of my store to receive automatic notifications of new releases, as I am working hard to add great new freebies and informational texts with assessments each month!



©Mark Aaron. All rights reserved. This work is bound by copyright laws and the redistributing, editing, selling, or posting of this item (or any part thereof) on the Internet are all strictly prohibited without first gaining permission from the author. Violations are subject to the penalties of the Digital Millennium Copyright Act.

Any claims of correlation or alignment to the Common Core State Standards are solely those of Mark Aaron and have not been evaluated or endorsed by the NGA. Mark Aaron is the sole creator of this product and does not claim endorsement or association with the creators of the CCSS.