

Disciplinary Core Ideas

ESS1.A: The Universe and Its Stars

- Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe.

ESS1.B: Earth and the Solar System

- The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them.
- The solar system appears to have formed from a disk of dust and gas, drawn together by gravity.

Plan for the day:

- 1) **LATE:** Turn in completed **Scaling the Solar System** handout if you have not already done so.
- 2) **FINISH** correcting your responses to **Lesson 3: The Sun.**
- 3) **START** Lesson 4: The Terrestrial Planets answering **ALL 23** questions as you read.
- 4) Answer the **12** Lesson Review questions.
- 5) Make a foldable highlighting **DIFFERENCES** among the terrestrial planets.

Sep 25-6:22 AM

Active Reading

3 **Synthesize** You can often define an unknown word if you know the meaning of its word parts. Use the word parts and sentences below to make an educated guess about the meaning of the word photosphere.

Word Part	Meaning
photo-	light
-sphere	ball

Example sentence:
Energy is transferred to the sun's photosphere by convection cells.

photosphere:
Variations on: Layer of the sun (a sphere)
from which light escapes into space.

I used different shades of GREEN to circle in the reading.

Vocabulary Terms

- nuclear fusion
- solar flare
- sunspot
- prominence

4 Apply This list contains the key terms you'll learn in this section. As you read, circle the definition of each term.

DONE LAST CLASS

Sep 25-6:22 AM



Think Outside the Book

8 Discussion Einstein's equation $E = mc^2$ is probably the most famous equation in the world. With your classmates, discuss the kinds of technologies that rely on the conversion of matter to energy.

In your every day life:

batteries solar panels

In the production of electricity:

nuclear power plants

In the military, for defense:

nuclear weapons

DONE LAST CLASS

Visualize It!
Identify Fill in the circles to label the particles in the diagrams.

Three Steps of Nuclear Fusion in the Sun

Step 1: Deuterium Two hydrogen nuclei (protons) collide. One proton emits particles and energy and then becomes a neutron. The proton and neutron combine to produce a heavy form of hydrogen called **deuterium**.

Step 2: Helium-3 Deuterium combines with another hydrogen nucleus to form a variety of helium called **helium-3**. More energy, including gamma rays, is released.

Step 3: Helium-4 Two helium-3 nuclei combine to form helium-4, which releases more energy and a pair of hydrogen nuclei (protons).

78 Unit 4 The Solar System

Lesson 3 The Sun 79

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By the Fusion of Hydrogen into Helium

The most common elements in the sun are hydrogen and helium. Under the crushing force of gravity, these gases are compressed and heated in the sun's core, where temperatures reach 15,000,000 °C. In the sun's core, hydrogen nuclei sometimes fuse to form a helium nucleus. This process takes three steps to complete. This three-step process is illustrated below.

Most of the time, when protons are on a collision course with other protons, their positive charges instantly repel them. The protons do not collide. But sometimes one proton will encounter another proton and, at that exact moment, turn into a neutron and eject an electron. This collision forms a nucleus that contains one proton and one neutron. This nucleus is an isotope of hydrogen called *deuterium*. The deuterium nucleus collides with another proton and forms a variety of helium called *helium-3*. Then, two helium-3 nuclei collide and form a helium-4 nucleus that has two protons and two neutrons. The remaining two protons are released back into the sun's core.

The entire chain of fusion reactions requires six hydrogen nuclei and results in one helium nucleus and two hydrogen nuclei. There are approximately 10³⁸ collisions between hydrogen nuclei taking place in the sun's core every second, which keeps the sun shining.

Active Reading

10 Identify As you read the text, underline the steps in the nuclear fusion process in the sun.

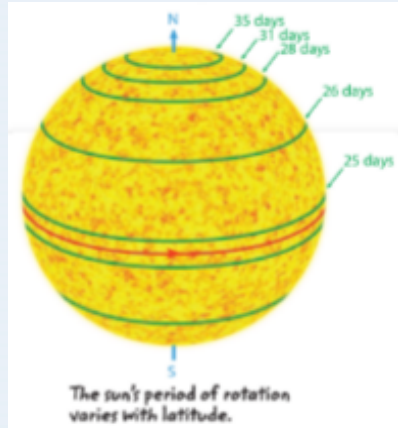


DONE LAST CLASS

Sep 14-7:04 AM

22 Compare How is energy transferred from the sun's core to the sun's surface in the radiative zone and in the convective zone?

Radiative zone	Convective zone
energy transferred by electromagnetic waves;	energy transferred by movement of matter;
electromagnetic waves don't travel directly through the radiative zone but are absorbed and re-emitted	energy transferred to sun's surface by convection cells;
	hot gases rise to the surface, cool then sink back to the CZ.



23 Define In your own words, define the term differential rotation.

Rotation of a non-solid body; different periods of rotation occur at different latitudes.

Sep 14-7:04 AM

What is solar activity?

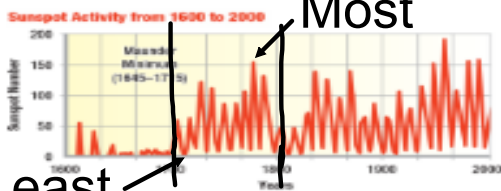
Solar activity refers to variations in the appearance or energy output of the sun. Solar activity includes dark areas that occur on the sun's surface known as sunspots. Solar activity also includes sudden explosive events on the sun's surface, which are called solar flares. Prominences are another form of solar activity. Prominences are vast loops of gases that extend into the sun's outer atmosphere.

Sunspots

Dark areas that form on the surface of the sun are called sunspots. They are about 1,500 °C cooler than the areas that surround them. Sunspots are places where hot, convecting gases are prevented from reaching the sun's surface.

Sunspots can appear for periods of a few hours or a few months. Some sunspots are only a few hundred kilometers across. Others have widths that are 10 to 15 times the diameter of Earth.

Sunspot activity occurs on average in 11-year cycles. When a cycle begins, the number of sunspots is at a minimum. The number of sunspots then increases until it reaches a maximum. The number then begins to decrease. A new sunspot cycle begins when the sunspot number reaches a minimum again.



Do the Math You Try It

23 Analyze The sunspot range is the difference between the maximum number of sunspots and the minimum number of sunspots for a certain period of time. To find this range, subtract the minimum number of sunspots from the maximum number of sunspots. What is the range of sunspot activity between 1700 and 1800?

Least: 0; Most: 150 to 160: So, 0-150 or 0-160

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Solar flares

Solar flares appear as very bright spots on the sun's photosphere. A solar flare is an explosive release of energy that can extend outward as far as the sun's outer atmosphere. During a solar flare, enormous numbers of high-energy particles are ejected at near the speed of light. Radiation is released across the entire electromagnetic spectrum, from radio waves to x-rays and gamma rays. Temperatures within solar flares reach millions of degrees Celsius.

Prominences

Huge loops of relatively cool gas that extend outward from the photosphere thousands of kilometers into the outer atmosphere are called prominences. Several objects the size of Earth could fit inside a loop of a prominence. The gases in prominences are cooler than the surrounding atmosphere.

Prominences generally last from several hours to a day. However, some prominences can last for as long as several months.

14. Compare Use the Venn diagram below to compare solar flares and prominences.

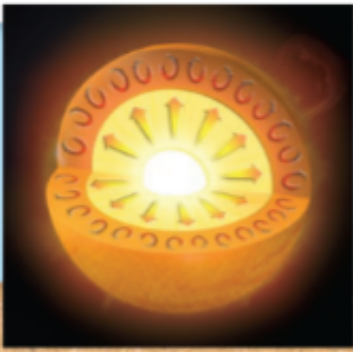
Sep 14-7:04 AM

Properties of the Sun

The sun is composed of layers.

15 Identify the six layers of the sun, beginning with the innermost layer.

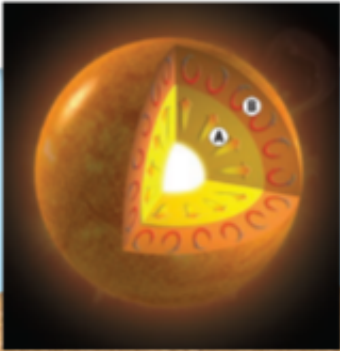
core, radiative zone, convective zone, photosphere, chromosphere, corona



Energy is transferred from the sun's core to the photosphere.

16 By what process is the sun's energy transported in layer A? **radiation**

By what process is the sun's energy transported in layer B? **convection**



16 Layer A: radiation, Layer B: convection
the photosphere, the chromosphere, and the corona.

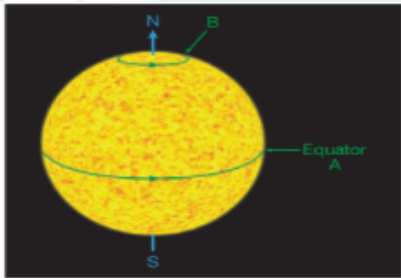
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Lesson Review

Vocabulary

Fill in the blank with the term that best completes the following sentences.

- The process by which two or more low-mass atomic nuclei fuse to form another, heavier nucleus is called nuclear fusion.
- A sunspot is a dark area on the surface of the sun that is cooler than the surrounding areas.
- A prominence is a loop of relatively cool gas that extends above the photosphere.



- Determine** How many days does it take for the sun to spin once on its axis at location A? How many days does it take for the sun to spin once on its axis at location B?
A: 25 days; B: 35 days

Key Concepts

In the following table, write the name of the correct layer next to the definition.

Definition	Layer
4 Identify What is the layer of the sun from which energy escapes into space?	photosphere
5 Identify What is the layer of the sun in which energy is produced?	core
6 Identify What is the layer of the sun through which energy is transferred away from the core by radiation?	radiative zone

7 Identify What is the composition of the sun?
74% hydrogen; 25% helium; 1% other elements

8 Explain What is the sunspot cycle?

Sunspot cycle is about 11 years. In that cycle, sunspots go from the minimum to maximum and back to minimum.

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- Compare** How is the rotation of the sun different from the rotation of Earth?

The sun has different rotation periods at different latitudes.

- Explain** In your own words, explain how energy is transported from the core to the surface of the sun by radiation and by convection.

Radiation: energy transferred through the radiative zone as electromagnetic waves. Electromagnetic waves do not travel directly through the RZ but are absorbed and re-emitted by particles until they reach the top of the RZ

Convection: energy transported to the sun's surface, cools, sinks back into the CZ

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Now that you know expectations, you will continue with Lesson 4 The Terrestrial Planets (pg: 86-99).

Answer ALL questions within the reading.

There are 23! (23 points)

Answer ALL questions in the Lesson Review

There are 12! (12 points)

Next class meeting, you will make a 'foldable'

Sep 16-8:05 AM

Chart the Planets Foldable

PRODUCT GRADE!

Make a Four Corner FoldNote detailing the DIFFERENCES between the rocky planets.

Include a drawing of each planet.

Use your text to gather information.

Hint: look at the questions the text asked you to answer.

Sep 16-8:05 AM

Attachments



Scale of Earth and Sun.mp4



Scale of Solar System.mp4