

## SCIENCE 2 THE SUN

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The sun is a star. It is a quite ordinary star compared to others but is very special to the earth. The earth receives over 99% of its energy from the sun. (The other energy comes from the heat of the earth's interior).

### The Sun's Properties

The sun is about 150 million kilometers (about 93 million miles) from the earth. A fighter plane flying at twice the speed of sound would take over 3.5 years to travel that far. The distance is so large that even the light coming from the sun takes over eight minutes to get to the earth!

The sun is also very large. Its diameter, 1,380,000 kilometers, is about 110 times that of the earth's. Over one million earths could fit inside the sun. The sun's mass is greater than 700 times that of all of the planets put together.

The temperature on the surface of the sun is about 5500 °C; this is about as hot as an electric arc used to melt iron. The temperature in the interior of the sun is estimated to be 15,000,000 °C.

### Structure of the Sun

The sun's atmosphere consists of three parts. The surface of the sun is called the **photosphere**. It looks to be bright yellow and is 400 kilometers thick. Extending thousands of kilometers above the photosphere is the **chromosphere**. The chromosphere is much less dense than the photosphere and has a temperature of about 100,000 °C. It glows red but is rarely seen except during eclipses because of the brightness of the photosphere. The upper atmosphere of the sun is called the **corona**. The corona consists of very little gas extending for about a million kilometers above the sun. The corona is very hot, over 2,000,000 °C, and, like the chromosphere can only be seen with the naked eye during an eclipse. When visible the corona looks white.

**Solar prominences** are flamelike arches that occur in the corona. They are huge and may extend for millions of kilometers. **Sunspots** which appear as dark spots on the sun are cooler regions on the photosphere. These come and go but periods with lots of sunspots seem to have an eleven year cycle. No one knows why but there may be a link between drought on earth and sun spot cycles.

### The Sun's Energy

The sun gets its energy from nuclear fusion. This process happens in the center, or **core**, of the sun. The temperature has to be very high for fusion to occur and the core has a temperature of about 15,000,000 °C.

In this process, lighter hydrogen atoms are fused, or joined together, to make heavier helium atoms. After fusing, the resulting helium has less mass than the hydrogen. This apparent loss of mass is released as energy by Einstein famous equation  $E=mc^2$ . The amount of energy produced by this process is incredible. If you were to take 4.030 kg (about 9 pounds) of hydrogen and convert it completely to helium, you would get 4.003 kg of helium. This loss of 0.027 kg is equivalent to 2.4 million billion joules of energy. That is more energy than is required to lift every man, woman and child in the United States 10 kilometers off of the ground! The sun converts 564 million metric tons of hydrogen into helium every second! Even at this rate the sun should have enough fuel to go on for another 5 billion years.



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