Name: _____ Teacher: _____ Pd. ___ Date: _____

STAAR Science Tutorial 35
TEK 8.8B: The Sun

TEK 8.8B: Recognize that the Sun is a medium-sized star near the edge of a disc-shaped galaxy of stars and that the Sun is many thousands of times closer to Earth than any other star.

Our Sun is a star, much like all of the other stars that are visible in the night sky. What makes our Sun different than other stars in the sky is that it is so much closer to Earth, and thus so much brighter. The next nearest star to Earth (other than our Sun) is Proxima Centauri, which is about 4.2 light years away from Earth. This is 263,000 times further away from Earth than our Sun. (Our Sun is 0.000016 light-years away from Earth.) While there are 11 stars within 10 light-years of Earth, most of the other stars visible in the night sky are many thousands of times further away. With a telescope, stars many millions of times further away from Earth are visible. See *Tutorial 36: Light-Years* for a detailed discussion of distance measurement in space, and the distances between Earth and other objects in the Universe.

Compared with the other stars in our galaxy, the Sun is a medium-sized star. Typical main-sequence stars in our galaxy vary in size from 0.1 times less massive than our Sun, to about 40 times more massive, with a radius range of 0.1 to 18 times that of the Sun. The luminosity or absolute brightness of main-sequence stars in our galaxy varies from 0.0008 times as bright to 500,000 times brighter. Giant and supergiant stars near the end of their life can become much, much larger in diameter and brightness.

The surface temperature of our Sun, 5,500°C, is about average when compared with other stars. About half of the stars in our galaxy are cooler, and about half are hotter. The surface temperature of stars ranges from 3000°C to 30,000°C, though very few stars are over 10,000 C. The color of our Sun, yellow, is at about the middle of the star spectrum, with red at the cool end and blue-white at the hot end.

One characteristic of our Sun that is a bit unusual is that our Sun is not part of a binary (double) or multiple-star system. Our Sun has no star partner.

Our Sun is expected to have a total life span of about 10 billion years. It is currently about 4.6 billion years old, in the middle of its "main sequence" phase of life. During this phase, it fuses hydrogen into helium in its core, with a temperature of about 15 million degrees Celsius. When all of its hydrogen has been fused into helium, the fusion process will temporarily stop, and the Sun will begin to collapse under the force of gravity. This compression at the core will increase the temperature. When the core temperature reaches about 100 million degrees Celsius, the fusion of helium will begin, and the Sun will expand to become a red giant. Once all of the helium has been fused to carbon, the Sun will collapse into a white dwarf, a very hot glowing ball of carbon. Eventually, the Sun will finally cool into a black dwarf. See *Tutorial 34:*

Stars, Galaxies, Universe for a detailed discussion of the life cycle of stars and the H-R Diagram, which is a graph showing the brightness and temperature of all stars.

The Sun is located in the Milky Way Galaxy, which is shaped like a flat disk with outwardly spiraling arms. The overall diameter of the Milky Way Galaxy is about 100,000 light-years. Our Sun and solar system is about 27,000 light-years from the center, in one of the spiral arms. There are about 200 to 400 billion stars in the Milky Way. They are seen from Earth as a milky white band of stars (hence the name) crossing the sky, but is visible only on very clear, dark nights away from city lights.

Practice Questions

1. Our Sun is so much brighter than the other stars visible in the sky because it is so _____ to the Earth. The next closest star to Earth is _____ times further away than the Sun.
2. The size of the Sun is _____, compared to the size of other main-sequence stars.
3. The surface temperature of our Sun is _____ degrees Celsius, which gives a surface color of _____. Stars range in surface temperature from _____ to _____°C.
4. The one thing about our Sun that is not average is that it is not part of a _____ or _____ star system.
5. Our Sun is currently about _____ billion years old, and is expected to have a total life span of about _____ billion years.
6. During the main-sequence of a star's life, it fuses _____ into _____ and has a core temperature of _____ degrees Celsius. In the beginning of the giant or supergiant phase, a star fuses _____ into _____, and has a core temperature of _____ degrees Celsius.
7. Our Sun is located in the _____ _____ Galaxy, which has a diameter of _____ light-years. Our Sun is located about _____ light-years from the center of the galaxy.