

<p>Important Concepts</p> <p>Solar System and Universe</p> <p>9-12 Level</p>	<p>Alaska Science Content Standards D3 Students develop an understanding of the cyclical changes controlled by energy from the sun and by Earth's position and motion in our solar system. (partially addressed)</p> <p>D4 Students develop an understanding of the theories regarding the evolution of the universe.</p>
--	---

Grade Level Expectations:

The student demonstrates an understanding of cycles influenced by energy from the sun and by Earth's position and motion in our solar system by:

[9] **SD3.1** recognizing the effect of the moon and sun on tides

[9] **SD3.2** explaining the phenomena of the aurora

[11] **SD3.2** exploring causes and effects related to phenomena (e.g., the aurora, solar winds, Coriolis Effect) (L)

The student demonstrates an understanding of the theories regarding the origin and evolution of the universe by:

[9] **SD4.1** recognizing that a star changes over time

[9] **SD4.2** explaining that the position of stars changes in the expanding universe

[9] **SD4.4** identifying the Big Bang Theory

[10] **SD 4.1** recognizing phenomena in the universe (i.e., black holes, nebula)

[10] **SD 4.2** explaining that the position of stars changes in the expanding universe

[10] **SD 4.4** describing the Big Bang Theory

[11] **SD4.1** describing phenomena in the universe (i.e., black holes, nebula)

[11] **SD4.2** using evidence to explain how the position of stars changes in the expanding universe

[11] **SD4.4** describing the Big Bang Theory and exploring the evidence that supports it (L)

According to AAAS's Benchmarks for Science Literacy*, some of the things that students should know and understand by the end of twelfth grade are:

- Life is adapted to conditions on the earth, including the force of gravity that enables the planet to retain an adequate atmosphere, and an intensity of electromagnetic waves from the sun that allows water to be present in the liquid state.
- Because the earth turns daily on an axis that is tilted relative to the plane of the earth's yearly orbit around the sun, sunlight falls more intensely on different parts of the earth during the year. The difference in intensity of sunlight and the resulting warming of the earth's surface produces the seasonal variations in temperature.
- The stars differ from each other in size, temperature, and age, but they appear to be made up of the same elements found on earth and behave according to the same physical principles.
- On the basis of scientific evidence, the universe is estimated to be over ten billion years old. The current theory is that its entire contents expanded explosively from a hot, dense, chaotic mass.

*Project 2061, American Association for the Advancement of Science, Benchmarks for Science Literacy. New York: Oxford University Press, 1993.

- Stars condensed by gravity out of clouds of molecules of the lightest elements until nuclear fusion of the light elements into heavier ones began to occur. Fusion released great amounts of energy over millions of years.
- Eventually, some stars exploded, producing clouds containing heavy elements from which other stars and planets orbiting them could later condense. The process of star formation and destruction continues.
- Increasingly sophisticated technology is used to learn about the universe. Visual, radio and X-ray telescopes collect information from across the entire spectrum of electromagnetic waves; computers handle data and complicated computations to interpret them; space probes send back data and materials from remote parts of the solar system; and accelerators give subatomic particles energies that simulate conditions in the stars and in the early history of the universe before stars formed.
- Mathematical models and computer simulations are used in studying evidence from many sources in order to form a scientific account of the universe.
- Our solar system coalesced out of a giant cloud of gas and debris left in the wake of exploding stars about five billion years ago. Everything in and on the earth, including living organisms, is made of this material.