

Utah	Astronomy Standards	The Cosmic Perspective 10e Page Reference
Standard ASTR.1.1	Develop and use models to evaluate the relationship between the relative positions of the Earth, Sun, and Moon and the phenomena caused by the relationship as observed from Earth. Emphasize how the location of the Earth, Sun, and Moon cause the phenomena. Examples of observable phenomena may include the day/night cycle, seasons, equinoxes and solstices, moon phases, eclipses, or tides.	pp. 14-17 Chapter 1, Section 3: Spaceship Earth - Earth, Sun, Moon, rotation and orbit for day/night; pp. 32-45 Chapter 2, Section 2.2 The Reason for Seasons - seasons, equinoxes, solstices; 2.3 The Moon, Our Constant Companion - Moon, phases, eclipses, tides
Standard ASTR.1.2	Plan and carry out an investigation using the celestial sphere to explain how latitude and time of year affect the visibility of constellations, planets, and other celestial objects.	pp. 26-31 Chapter 2 - the celestial sphere, latitude, direction, distance; pp. 91-98 Chapter S1 - coordinates of celestial objects
Standard ASTR.1.3	Obtain, evaluate, and communicate information about how patterns in ancient structures, instruments, philosophies, and civilizations influenced the study of astronomy. Examples of philosophies could include astronomical models (e.g., geocentric, heliocentric), Aristotelian physics, or Ptolemaic models with epicycles.	pp. 54-63 Chapter 3 Section 3.1 The Ancient Roots of Science - Aristotle, Ptolemy, geocentric
Standard ASTR.1.4	Plan and carry out an investigation to analyze patterns in telescopic data of various electromagnetic spectra to explain astronomical phenomena. Emphasize evaluating the uses and advantages of data to explain phenomena. Examples of data of various electromagnetic spectra could include absorption, redshift/ blueshift, emission spectra, or blackbody curves.	pp. 150-160 Chapter 5 Section 5.4 Learning from Light - electromagnetic spectra, absorption, redshift, blueshift, emission lines, blackbody radiation; pp. 168-175 Chapter 6 Section 6.2 Telescopes: Giant Eyes - telescopic data
Standard ASTR.1.5	Construct an argument based on evidence for the significance of historical and future space exploration as they relate to affecting leaps in technology, cultural cooperation, knowledge, and inspiration. Emphasize that historical space exploration began with Sputnik and continues to the present day.	

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Standard ASTR.2.1	Ask questions to investigate and communicate the structure and properties of objects in our solar system and the zones they inhabit. Emphasize grouping the objects found in the solar system into different categories based on their major properties. Examples of objects in the solar system could include planets, dwarf planets, major moons, asteroids, or comets. Examples of zones could include asteroid belt, Kuiper belt, or the Oort cloud.	pp. 46-48 Chapter 2 Section 2.4 - planets, solar system; pp. 193-209 Chapter 7 Section 7.1 - solar system, sun, planets, moons, asteroids, comets; pp. 220-230 Chapter 8 Section 8.2 - solar system, planets
Standard ASTR.2.2	Develop and use models, based on evidence, to explain the formation of the solar system and the different proportions of matter and energy within regions of the system. Emphasize the cause of observed patterns of matter distribution in the solar system. Examples of matter distribution could include low amounts of ice found inside the frost line or the location of gas planets.	pp. 218-219 Chapter 8 Section 8.1 - solar system origin; pp. 230-232 Chapter 8 Section 8.3 - matter mathematics/equations, radiometric dating
Standard ASTR.2.3	Use computational thinking to model gravitational force at varying scale and proportion that explain motion and interaction of objects in the solar system. Emphasize that these forces are also at play throughout the universe. Examples of models could be conceptual, comparing force and motion of different objects in space, and do not require that students solve for the force of gravity acting on an object.	pp. 111-117 Chapter 4 Section 4.1 - gravity, motion, velocity, acceleration, force
Standard ASTR.2.4	Design a solution (plan) for a functioning human colony on an object in the solar system other than Earth. Define the problem, identify criteria and constraints, develop possible solutions using models, analyze data to make improvements from iteratively testing solutions, and optimize the solution. Emphasize analyzing which planet/world of the solar system would have the best chance for a successful colony based on specific criteria. Examples of planets/ worlds of the solar system could include Mars or moons of the Jovian planets. Examples of specific criteria could include distance from Earth, available energy sources, amounts of water or solvent, protection from solar radiation, or amount of resources/building materials.	p. 316 Chapter 10 exercises - Group Activity: Moon Colony
Standard ASTR.3.1	Develop and use models to explain stability and change during the process of stellar evolution from birth to death of a star. Emphasize the causes for the changes during stellar evolution and the evidence that supports current understanding.	pp. 531-560 Chapter 16, Section 16.2 - star birth, newborn stars; Chapter 17: Star Stuff - life, death, evolution, changes

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Standard ASTR.3.2	Construct an argument based on evidence from the Hertzsprung-Russell diagram to investigate properties (structure) of stars. Examples of properties of stars could include density, luminosity, temperature, rates of fusion, absolute magnitude, or spectral class.	pp. 507-514 Chapter 15 Section 15.2 - star patterns and properties, density, temperature, fusion, spectral types
Standard ASTR.3.3	Ask questions to evaluate evidence that predicts the stability and change of a star during its lifespan and its final stage of stellar evolution based on mass. Emphasize stellar remnants and events such as white dwarfs, neutron stars, pulsars, black holes, and supernovae.	pp. 531-560 Chapter 16, Section 16.2 - star birth, newborn stars; Chapter 17: Star Stuff - life, death, evolution, changes, white dwarfs, black holes, supernova
Standard ASTR.4.1	Construct an argument from evidence to explain the patterns that describe the formation of the universe. Emphasize the scientific theory of the Big Bang and evidence that supports it. Examples of evidence for the Big Bang could include the cosmological principle, cosmic microwave background radiation, Hubble's Law, observed galactic redshift, and time-space expansion.	pp. 11-14 Chapter 1 Section 1.2 - history and origins of the universe, big bang; pp. 628-632 Chapter 20 Section 20.3 - Hubble's law, cosmological principle, redshift, expansion
Standard ASTR.4.2	Use models to describe the conditions of the early universe that led the formation and evolution of matter including the birth of the first stars and galaxies.	pp. 593-603 Chapter 19 Section 19.2 gas/universe recycling, birth of stars and galaxies; pp. 638-640 Chapter 21 Section 21.1 galaxy formation
Standard ASTR.4.3	Construct an explanation using evidence to support the existence of dark matter and dark energy. Emphasize indirect evidence to support their existence.	pp. 681-700 Chapter 23 Section 23.1 dark matter, dark energy
Standard ASTR.4.4	Develop and use models to relate the cause for how galactic evolution occurs. Emphasize the processes of mergers and collisions.	pp. 640-643 Chapter 21 Section 21.2 - mergers and collisions, galaxy evolution