Astronomy Side-by-Side

2021 Knowledge and Skill Statement/Student Expectation	2021 Text	2017 Knowledge and Skill Statement/Student Expectation	2017 Text	Notes from TEA Staff
SCIENCE.ASTRO.1	Scientific and engineering practices. The student, for at least 40% of instructional time, asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models. The student is expected to:	ASTRO.1	Scientific ~~processes~~. The student, for at least 40% of instructional time, conducts laboratory and field investigations ~~using~~ safe, ~~environmentally appropriate, and ethical practices~~. The student is expected to:	
		ASTRO.2	Scientific ~~processes. The student uses~~ scientific ~~methods during~~ laboratory and field investigations. The student is expected to:	
		~~ASTRO. 1.B~~	~~demonstrate an understanding of the use and conservation of resources and the proper disposal or recycling of materials.~~	The use and conservation of resources are covered in elementary and middle school science.
SCIENCE.ASTRO.1.A	ask questions and define problems based on observations or information from text, phenomena, models, or investigations;	ASTRO.2.E	plan ~~and implement~~ investigative ~~procedures, including~~ asking questions, ~~formulating testable hypotheses, and selecting, handling, and maintaining appropriate equipment and technology;~~	
SCIENCE.ASTRO.1.B	apply scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems;			
SCIENCE.ASTRO.1.C	use appropriate safety equipment and practices during laboratory, classroom, and field investigations as outlined in Texas Education Agency-approved safety standards;	ASTRO.1.A	~~demonstrate~~ safe practices during laboratory and field investigations; and	
SCIENCE.ASTRO.1.D	use appropriate tools such as gnomons; sundials; Planisphere; star charts; globe of the Earth; diffraction gratings; spectroscopes; color filters; lenses of multiple focal lengths; concave, plane, and convex mirrors; binoculars; telescopes; celestial sphere; online astronomical databases; and online access to observatories;	ASTRO.2.I	~~use astronomical technology~~ such as telescopes, binoculars, ~~sextants, computers, and software~~.	
SCIENCE.ASTRO.1.E	collect quantitative data using the International System of Units (SI) and qualitative data as evidence;	ASTRO.2.F	collect data ~~and make measurements with accuracy and precision;~~	
SCIENCE.ASTRO.1.F	organize quantitative and qualitative data using probeware, spreadsheets, lab notebooks or journals, models, diagrams, graphs paper, computers, or cellphone applications;			
SCIENCE.ASTRO.1.G	develop and use models to represent phenomena, systems, processes, or solutions to engineering problems; and			
SCIENCE.ASTRO.1.H	distinguish between scientific hypotheses, theories, and laws.	ASTRO.2.D	distinguish between scientific hypotheses and scientific theories;	
		ASTRO.2.B	~~know that scientific~~ hypotheses ~~are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power which have been tested over a wide variety of conditions are incorporated into theories;~~	
		ASTRO.2.C	~~know that scientific~~ theories ~~are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly reliable explanations, but may be subject to change as new areas of science and new technologies are developed;~~	
		~~ASTRO.2.A~~	~~know the definition of science and understand that it has limitations, as specified in subsection (b)(2) of this section;~~	

SCIENCE.ASTRO.2	Scientific and engineering practices. The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs. The student is expected to:			
SCIENCE.ASTRO.2.A	identify advantages and limitations of models such as their size, scale, properties, and materials;			
SCIENCE.ASTRO.2.B	analyze data by identifying significant statistical features, patterns, sources of error, and limitations;	**ASTRO.2.G**	~~organize~~, analyze, ~~evaluate, make inferences, and predict trends from~~ data, ~~including making new revised hypotheses when appropriate~~;	
SCIENCE.ASTRO.2.C	use mathematical calculations to assess quantitative relationships in data; and			
SCIENCE.ASTRO.2.D	evaluate experimental and engineering designs.			
SCIENCE.ASTRO.3	Scientific and engineering practices. The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions. The student is expected to:	~~Astro 3~~	~~Scientific processes. The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:~~	
SCIENCE.ASTRO.3.A	develop explanations and propose solutions supported by data and models consistent with scientific ideas, principles, and theories;	**ASTRO. 3.C**	~~draw inferences based on~~ data ~~related to promotional materials for products and services;~~	
SCIENCE.ASTRO.3.B	communicate explanations and solutions individually and collaboratively in a variety of settings and formats; and	**ASTRO.2.H**	communicate ~~valid conclusions in writing, oral presentations, and through collaborative projects; and~~	Students are now being asked to communicate not only as scientists but also as engineers.
		~~ASTRO.3.B~~	communicate ~~and apply scientific information extracted from various sources such as current events, news reports, published journal articles, and marketing materials;~~	
SCIENCE.ASTRO.3.C	engage respectfully in scientific argumentation using applied scientific explanations and empirical evidence.			
SCIENCE.ASTRO.4	Scientific and engineering practices. The student knows the contributions of scientists and recognizes the importance of scientific research and innovation on society. The student is expected to:			
SCIENCE.ASTRO.4.A	analyze, evaluate, and critique scientific explanations and solutions by using empirical evidence, logical reasoning, and experimental and observational testing, so as to encourage critical thinking by the student;	**ASTRO.3.A**	~~in all fields of science,~~ analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, ~~including examining all sides of scientific evidence of those scientific explanations~~, so as to encourage critical thinking by the student;	
SCIENCE.ASTRO.4.B	relate the impact of past and current research on scientific thought and society, including research methodology, cost-benefit analysis, and contributions of diverse scientists as related to the content; and	**ASTRO.3.D**	~~evaluate~~ the impact of research on scientific thought, society, ~~and the environment; and~~	
SCIENCE.ASTRO.4.C	research and explore resources such as museums, planetariums, observatories, libraries, professional organizations, private companies, online platforms, and mentors employed in a science, technology, engineering, and mathematics (STEM) field in order to investigate STEM careers.	**ASTRO.3.E**	~~describe the connection between astronomy and future~~ careers.	
		~~ASTRO.4.D~~	~~explain the contributions of modern astronomy to today's society, including the identification of potential asteroid/comet impact hazards and the Sun's effects on communication, navigation, and high-tech devices.~~	
SCIENCE.ASTRO.5	Science concepts. The student understands how astronomy influenced and advanced civilizations. The student is expected to:	**ASTRO.4**	Science concepts. The student ~~recognizes the importance and uses of~~ astronomy ~~in~~ civilization. The student is expected to:	

SCIENCE.ASTRO.5.A	evaluate and communicate how ancient civilizations developed models of the universe using astronomical structures, instruments, and tools such as the astrolabe, gnomons, and charts and how those models influenced society, time keeping, and navigation;	**ASTRO.4.A**	~~research and describe the use of astronomy in~~ ancient civilizations ~~such as the Egyptians, Mayans, Aztecs, Europeans, and the native Americans;~~	
SCIENCE.ASTRO.5.B	research and evaluate the contributions of scientists, including Ptolemy, Copernicus, Tycho Brahe, Kepler, Galileo, and Newton, as astronomy progressed from a geocentric model to a heliocentric model; and	**ASTRO.4.B**	research and ~~describe~~ the contributions of scientists ~~to our changing understanding of astronomy~~, including Ptolemy, Copernicus, Tycho Brahe, Kepler, Galileo, Newton, ~~Einstein, and Hubble, and the contribution of women astronomers, including Maria Mitchell and Henrietta Swan Leavitt~~;	
SCIENCE.ASTRO.5.C	describe and explain the historical origins of the perceived patterns of constellations and the role of constellations in ancient and modern navigation.	**ASTRO.4C**	describe and explain the historical origins of the perceived patterns of constellations and the role of constellations in ancient and modern navigation; and	
SCIENCE.ASTRO.6	Science concepts. The student conducts and explains astronomical observations made from the point of reference of Earth. The student is expected to:	~~**ASTRO.5**~~	~~Science concepts. The student develops a familiarity with the sky. The student is expected to:~~	
SCIENCE.ASTRO.6.A	observe, record, and analyze the apparent movement of the Sun, Moon, and stars and predict sunrise and sunset;	**ASTRO.5.A**	observe and record the apparent movement of the Sun and Moon ~~during the day;~~	
SCIENCE.ASTRO.6.B	observe the movement of planets throughout the year and measure how their positions change relative to the constellations;	**ASTRO.5.B**	observe ~~and record the apparent~~ movement of ~~the Moon~~, planets, ~~and stars in the nighttime sky; and~~	
SCIENCE.ASTRO.6.C	identify constellations such as Ursa Major, Ursa Minor, Orion, Cassiopeia, and constellations along the ecliptic and describe their importance; and	**ASTRO.5.C**	~~recognize and~~ identify constellations such as Ursa Major, Ursa Minor, Orion, Cassiopeia, and ~~constellations of the zodiac~~.	The Zodiac and astrology were moved to Student Expectation ASTRO.6.D.
SCIENCE.ASTRO.6.D	understand the difference between astronomy and astrology, the reasons for their historical conflation, and their eventual separation.			
SCIENCE.ASTRO.7	Science concepts. The student knows our relative place in the solar system. The student is expected to:	**ASTRO.6**	Science concepts. The student knows our place in ~~space~~. The student is expected to:	
SCIENCE.ASTRO.7.A	demonstrate the use of units of measurement in astronomy, including astronomical units and light years, minutes, and seconds;	**ASTRO.6.E**	demonstrate the use of units of measurement in astronomy, including Astronomical Units and light years.	
		~~**ASTRO.6.D**~~	~~relate apparent versus absolute magnitude to the distances of celestial objects; and~~	The difference between apparent and absolute magnitude was deleted from Astronomy.
SCIENCE.ASTRO.7.B	model the scale, size, and distances of the Sun, Earth, and Moon system and identify the limitations of physical models; and	**ASTRO.6.A**	~~compare and contrast~~ the scale, size, and distance of the Sun, Earth, and Moon system ~~through the use of data and~~ modeling;	
SCIENCE.ASTRO.7.C	model the scale, sizes, and distances of the Sun and the planets in our solar system and identify the limitations of physical models.	**ASTRO.6.B**	~~compare and contrast~~ the scale, size, and distance of ~~objects~~ in the solar system ~~such as~~ the Sun and planets ~~through the use of data and~~ modeling;	
		~~**ASTRO.6C**~~	~~examine the scale, size, and distance of the stars, Milky Way, and other galaxies through the use of data and modeling;~~	The scale, size, and distance of the Milky Way and other galaxies have been deleted from Astronomy.
SCIENCE.ASTRO.8	Science concepts. The student observes and models the interactions within the Sun, Earth, and Moon system. The student is expected to:	**ASTRO.7**	Science concepts. The student knows the ~~role of the Moon~~ in the Sun, Earth, and Moon system. The student is expected to:	
SCIENCE.ASTRO.8.A	model how the orbit and relative position of the Moon cause lunar phases and predict the timing of moonrise and moonset during each phase;	**ASTRO.7.A**	~~observe and record data about~~ lunar phases ~~and use that information to~~ model ~~the Sun, Earth, and~~ Moon ~~system~~;	
		ASTRO.7.B	~~illustrate the~~ cause of lunar phases ~~by showing~~ positions of the Moon relative ~~to Earth and the Sun for each~~ phase, ~~including new moon, waxing crescent, first quarter, waxing gibbous, full moon, waning gibbous, third quarter, and waning crescent;~~	
SCIENCE.ASTRO.8.B	model how the orbit and relative position of the Moon cause lunar and solar eclipses; and	**ASTRO.7.C**	~~identify and differentiate the~~ causes of lunar and solar eclipses, ~~including differentiating between lunar phases and eclipses; and~~	

SCIENCE.ASTRO.8.C	examine and investigate the dynamics of tides using the Sun, Earth, and Moon model.	**ASTRO.7.D**	~~identify the effects of the~~ Moon ~~on~~ tides.	
SCIENCE.ASTRO.9	Science concepts. The student models the cause of planetary seasons. The student is expected to:	**ASTRO.8**	Science concepts. The student ~~knows the reasons for the~~ seasons. The student is expected to:	
SCIENCE.ASTRO.9.A	examine the relationship of a planet's axial tilt to its potential seasons;	**ASTRO.8.A**	~~recognize that~~ seasons ~~are caused by the~~ tilt ~~of Earth's~~ axis;	
SCIENCE.ASTRO.9.B	predict how changing latitudinal position affects the length of day and night throughout a planet's orbital year;	**ASTRO.8.B**	~~explain how~~ latitudinal position affects the length of day and night throughout ~~the~~ year;	
SCIENCE.ASTRO.9.C	investigate the relationship between a planet's axial tilt, angle of incidence of sunlight, and concentration of solar energy; and	**ASTRO.8.C**	~~recognize that~~ the angle of incidence of sunlight ~~determines~~ the concentration of solar energy ~~received on Earth at a particular location~~; and	
SCIENCE.ASTRO.9.D	explain the significance of Earth's solstices and equinoxes.	**ASTRO.8.D**	~~examine the relationship of the seasons to~~ equinoxes, solstices, ~~the tropics, and the equator~~.	
SCIENCE.ASTRO.10	Science concepts. The student knows how astronomical tools collect and record information about celestial objects. The student is expected to:			
SCIENCE.ASTRO.10.A	investigate the use of black body radiation curves and emission, absorption, and continuous spectra in the identification and classification of celestial objects;			
SCIENCE.ASTRO.10.B	calculate the relative light-gathering power of different-sized telescopes to compare telescopes for different applications;			
SCIENCE.ASTRO.10.C	analyze the importance and limitations of optical, infrared, and radio telescopes, gravitational wave detectors, and other ground-based technology; and	**ASTRO.14.C**	analyze the importance of ground-based technology ~~in astronomical studies;~~	
SCIENCE.ASTRO.10.D	analyze the importance and limitations of space telescopes in the collection of astronomical data across the electromagnetic spectrum.	**ASTRO.14.D**	~~recognize~~ the importance of space telescopes ~~to~~ the collection of astronomical data across the electromagnetic spectrum; and	
SCIENCE.ASTRO.11	Science concepts. The student uses models to explain the formation, development, organization, and significance of solar system bodies. The student is expected to:	~~**ASTRO.9**~~	~~Science concepts. The student knows that planets of different size, composition, and surface features orbit around the Sun. The student is expected to:~~	
SCIENCE.ASTRO.11.A	relate Newton's law of universal gravitation and Kepler's laws of planetary motion to the formation and motion of the planets and their satellites;	**ASTRO.9.C**	relate ~~the role of~~ Newton's law of universal gravitation to the motion of the planets ~~around the Sun and~~ to the motion of ~~natural and artificial~~ satellites ~~around~~ the planets; and	
SCIENCE.ASTRO.11.B	explore and communicate the origins and significance of planets, planetary rings, satellites, asteroids, comets, Oort cloud, and Kuiper belt objects;	**ASTRO.9.D**	explore the origins and significance ~~of small solar system bodies, including~~ asteroids, comets, and Kuiper belt objects.	
SCIENCE.ASTRO.11.C	compare the planets in terms of orbit, size, composition, rotation, atmosphere, natural satellites, magnetic fields, and geological activity; and	**ASTRO.9.B**	compare the planets in terms of orbit, size, composition, rotation, atmosphere, natural satellites, and geological activity;	
SCIENCE.ASTRO.11.D	compare the factors essential to life on Earth such as temperature, water, gases, and gravitational and magnetic fields to conditions on other planets and their satellites.	**ASTRO.9.A**	compare ~~and contrast~~ the factors essential to life on Earth such as temperature, water, ~~mass~~, and gases to conditions on other planets;	
SCIENCE.ASTRO.12	Science concepts. The student knows that our Sun serves as a model for stellar activity. The student is expected to:	**ASTRO.10**	Science concepts. The student knows the ~~role of the~~ Sun as ~~the star in our solar system~~. The student is expected to:	
SCIENCE.ASTRO.12.A	identify the approximate mass, size, motion, temperature, structure, and composition of the Sun;	**ASTRO.10.A**	identify the approximate mass, size, motion, temperature, structure, and composition of the Sun;	
SCIENCE.ASTRO.12.B	distinguish between nuclear fusion and nuclear fission and identify the source of energy within the Sun as nuclear fusion of hydrogen to helium;	**ASTRO.10.B**	distinguish between nuclear fusion and nuclear fission, and identify the source of energy within the Sun as nuclear fusion of hydrogen to helium;	
SCIENCE.ASTRO.12.C	describe the eleven-year solar cycle and the significance of sunspots; and	**ASTRO.10.C**	describe the eleven-year solar cycle and the significance of sunspots; and	
SCIENCE.ASTRO.12.D	analyze the origins and effects of space weather, including the solar wind, coronal mass ejections, prominences, flares, and sunspots.	**ASTRO.10.D**	analyze ~~solar magnetic storm activity,~~ including coronal mass ejections, prominences, flares, and sunspots.	

SCIENCE.ASTRO.13	Science concepts. The student understands the characteristics and life cycle of stars. The student is expected to:	**ASTRO.11**	Science concepts. The student ~~knows~~ the characteristics and life cycle of stars. The student is expected to:	
SCIENCE.ASTRO.13.A	identify the characteristics of main sequence stars, including surface temperature, age, relative size, and composition;	**ASTRO.11.A**	identify the characteristics of main sequence stars, including surface temperature, age, relative size, and composition;	
SCIENCE.ASTRO.13.B	describe and communicate star formation from nebulae to protostars to the development of main sequence stars;	**ASTRO.11.B**	~~characterize~~ star formation ~~in stellar nurseries from giant molecular clouds~~, to protostars, to the development of main sequence stars;	
SCIENCE.ASTRO.13.C	evaluate the relationship between mass and fusion on stellar evolution;	**ASTRO.11.C**	evaluate the relationship between mass and fusion on ~~the dying process and properties of stars~~;	
SCIENCE.ASTRO.13.D	compare how the mass of a main sequence star will determine its end state as a white dwarf, neutron star, or black hole;	**ASTRO.11.E**	compare how the mass ~~and gravity~~ of a main sequence star will determine its end state as a white dwarf, neutron star, or black hole;	
		ASTRO.11.D	~~differentiate among~~ the end states of ~~stars, including~~ white dwarfs, neutron stars, and black holes;	
SCIENCE.ASTRO.13.E	describe the use of spectroscopy in obtaining physical data on celestial objects such as temperature, chemical composition, and relative motion;	**ASTRO.11.F**	~~relate~~ the use of spectroscopy in obtaining physical data on celestial objects such as temperature, chemical composition, and relative motion; and	
SCIENCE.ASTRO.13.F	use the Hertzsprung-Russell diagram to classify stars and plot and examine the life cycle of stars from birth to death;	**ASTRO.11.G**	use the Hertzsprung-Russell diagram to plot and examine the life cycle of stars from birth to death.	
SCIENCE.ASTRO.13.G	illustrate how astronomers use geometric parallax to determine stellar distances and intrinsic luminosities; and			
SCIENCE.ASTRO.13.H	describe how stellar distances are determined by comparing apparent brightness and intrinsic luminosity when using spectroscopic parallax and the Leavitt relation for variable stars.			
SCIENCE.ASTRO.14	Science concepts. The student knows the structure of the universe and our relative place in it. The student is expected to:	~~**ASTRO.12**~~	~~Science concepts. The student knows the variety and properties of galaxies. The student is expected to:~~	
SCIENCE.ASTRO.14.A	illustrate the structure and components of our Milky Way galaxy and model the size, location, and movement of our solar system within it;	**ASTRO.12.B**	~~recognize the type~~, structure, and components of our Milky Way galaxy and location of our solar system within it; and	
SCIENCE.ASTRO.14.B	compare spiral, elliptical, irregular, dwarf, and active galaxies;	**ASTRO.12.C**	compare ~~and contrast the different types of~~ galaxies, ~~including~~ spiral, elliptical, irregular, and dwarf.	The characteristics of galaxies are used to compare the galaxies in Student Expectation Astro.14.B.
		~~**ASTRO.12.A**~~	~~describe characteristics of galaxies;~~	
SCIENCE.ASTRO.14.C	develop and use models to explain how galactic evolution occurs through mergers and collisions;			
SCIENCE.ASTRO.14.D	describe the Local Group and its relation to larger-scale structures in the universe; and			
SCIENCE.ASTRO.14.E	evaluate the indirect evidence for the existence of dark matter.			
SCIENCE.ASTRO.15	Science concepts. The student knows the scientific theories of cosmology. The student is expected to:	**ASTRO.13**	Science concepts. The student knows the scientific theories of cosmology. The student is expected to:	
SCIENCE.ASTRO.15.A	describe and evaluate the historical development of evidence supporting the Big Bang Theory;	**ASTRO.13.A**	~~research and~~ describe the historical development of the Big Bang Theory, ~~including red shift, cosmic microwave background radiation, and~~ other supporting evidence;	
SCIENCE.ASTRO.15.B	evaluate the limits of observational astronomy methods used to formulate the distance ladder;			
SCIENCE.ASTRO.15.C	evaluate the indirect evidence for the existence of dark energy;	**ASTRO.13.C**	~~research and describe scientific hypotheses of the fate of the universe, including open and closed universes and the role of dark matter and~~ dark energy.	Information related to the fate of the universe is in Student Expectation ASTRO.15.E, and dark matter is in ASTRO.14.E.
SCIENCE.ASTRO.15.D	describe the current scientific understanding of the evolution of the universe, including estimates for the age of the universe; and	**ASTRO.13.B**	~~research and~~ describe current ~~theories~~ of the evolution of the universe, including estimates for the age of the universe; and	
SCIENCE.ASTRO.15.E	describe current scientific hypotheses about the fate of the universe, including open and closed universes.	**ASTRO.13.C**	research and ~~describe~~ scientific hypotheses ~~of~~ the fate of the universe, including open and closed universes ~~and the role of dark matter and dark energy.~~	Dark matter is covered in Student Expectation ASTRO.14.E and dark energy is in ASTRO.15.C

SCIENCE.ASTRO.16	Science concepts. The student understands the benefits and challenges of expanding our knowledge of the universe. The student is expected to:	**ASTRO.14**	Science concepts. The student ~~recognizes~~ the benefits and challenges of ~~space exploration to the study~~ of the universe. The student is expected to:	
SCIENCE.ASTRO.16.A	describe and communicate the historical development of human space flight and its challenges;	**ASTRO.14.A**	~~identify and explain the contributions~~ of human space flight and ~~future plans~~ and challenges;	
SCIENCE.ASTRO.16.B	describe and communicate the uses and challenges of robotic space flight;	**ASTRO.14.B**	~~recognize the advancement of knowledge in astronomy through~~ robotic space flight;	
SCIENCE.ASTRO.16.C	evaluate the evidence of the existence of habitable zones and potentially habitable planetary bodies in extrasolar planetary systems;			
SCIENCE.ASTRO.16.D	evaluate the impact on astronomy from light pollution, radio interference, and space debris;			
SCIENCE.ASTRO.16.E	examine and describe current developments and discoveries in astronomy; and	**ASTRO.14.E**	~~demonstrate an awareness of new~~ developments and discoveries in astronomy.	
SCIENCE.ASTRO.16.F	explore and explain careers that involve astronomy, space exploration, and the technologies developed through them.			
KEY	**Blue double underline: indicates content new to the grade level**		**~~Orange strike through: indicates content was deleted~~**	