**eDynamic Learning Course Title: Astronomy 1a / 1b**

**State: TX**
**State Course Title: Astronomy**
**State Course Code: 112.48**
**State Standards: Science**
**Date of Standards: 2021**

| Standards | Course Title (a or b), if applicable, e.g. Game Design 1a | Unit Name(s) | Lesson(s) Numbers |
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| **(3) Scientific hypotheses and theories.** | | | |
| (A) hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power that have been tested over a wide variety of conditions are incorporated into theories; and | Astronomy 1a: Introduction | Unit 2: Techniques and Tools of the Trade: Studying the Universe | Lessons 2, 3 |
| (B) 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 they may be subject to change as new areas of science and new technologies are developed. | Astronomy 1a: Introduction | Unit 2: Techniques and Tools of the Trade: Studying the Universe | Lesson 3 |
| **(4) Scientific inquiry. Scientific inquiry is the planned and deliberate investigation of the natural world using scientific and engineering practices. Scientific methods of investigation are descriptive, comparative, or experimental. The method chosen should be appropriate to the question being asked. Student learning for different types of investigations include descriptive investigations, which involve collecting data and recording observations without making comparisons; comparative investigations, which involve collecting data with variables that are manipulated to compare results; and experimental investigations, which involve processes similar to comparative investigations but in which a control is identified.** | | | |
| (A) Scientific practices. Students should be able to ask questions, plan and conduct investigations to answer questions, and explain phenomena using appropriate tools and models. | Astronomy 1a: Introduction | Unit 3: The Earth, Moon, and Sun Systems | Activity |
| (B) Engineering practices. Students should be able to identify problems and design solutions using appropriate tools and models. | Astronomy 1b: Exploring the Universe | Unit 8: The Future of Space Travel | Lab |
| (5) Science and social ethics. Scientific decision making is a way of answering questions about the natural world involving its own set of ethical standards about how the process of science should be carried out. Students should be able to distinguish between scientific decision-making methods (scientific methods) and ethical and social decisions that involve science (the application of scientific information). | Astronomy 1a: Introduction | Unit 2: Techniques and Tools of the Trade: Studying the Universe | Lesson 1 |
| (6) Science consists of recurring themes and making connections between overarching concepts. Recurring themes include systems, models, and patterns. All systems have basic properties that can be described in space, time, energy, and matter. Change and constancy occur in systems as patterns and can be observed, measured, and modeled. These patterns help to make predictions that can be scientifically tested, while models allow for boundary specification and provide tools for understanding the ideas presented. Students should analyze a system in terms of its components and how these components relate to each other, to the whole, and to the external environment. | Astronomy 1a: Introduction | Unit 3: The Earth, Moon, and Sun Systems | All Lessons Associated |
| **(c) Knowledge and skills.**<br><br>**(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 explain phenomena or design solutions using appropriate tools and models.** | | | |

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| (A) ask questions and define problems based on observations or information from text, phenomena, models, or investigations; | Astronomy 1a: Introduction | Unit 2: Techniques and Tools of the Trade: Studying the Universe | Discussion 2 |
| (B) apply scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems; | Astronomy 1a: Introduction | Unit 2: Techniques and Tools of the Trade: Studying the Universe | Lesson 3 |
| (C) use appropriate safety equipment and practices during laboratory, classroom, and field investigations as outlined in Texas Education Agency-approved safety standards; | Astronomy 1a: Introduction | Unit 2: Techniques and Tools of the Trade: Studying the Universe | Lesson 5 |
| (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; | Astronomy 1a: Introduction | Unit 2: Techniques and Tools of the Trade: Studying the Universe | Lesson 5, Activity |
| (E) collect quantitative data using the International System of Units (SI) and qualitative data as evidence; | Astronomy 1a: Introduction | Unit 3: The Earth, Moon, and Sun Systems | Activity |
| (F) organize quantitative and qualitative data using graphs, charts, spreadsheets, and computer software; | Astronomy 1a: Introduction | Unit 3: The Earth, Moon, and Sun Systems | Activity |
| (G) develop and use models to represent phenomena, systems, processes, or solutions to engineering problems; and | Astronomy 1a: Introduction | Unit 6: The Milky Way | Activity 2 |
| (H) distinguish between scientific hypotheses, theories, and laws. | Astronomy 1a: Introduction | Unit 2: Techniques and Tools of the Trade: Studying the Universe | Lessons 2, 3 |
| **(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.** | | | |
| (A) identify advantages and limitations of models such as their size, scale, properties, and materials; | | | |
| (B) analyze data by identifying significant statistical features, patterns, sources of error, and limitations; | | | |
| (C) use mathematical calculations to assess quantitative relationships in data; and | Astronomy 1a: Introduction | Unit 4: Stars | Activity 1, 2 |
| (D) evaluate experimental and engineering designs. | Astronomy 1a: Introduction | Unit 2: Techniques and Tools of the Trade: Studying the Universe | Lab |
| **(3) Scientific and engineering practices. The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions.** | | | |
| (A) develop explanations and propose solutions supported by data and models consistent with scientific ideas, principles, and theories; | Astronomy 1b: Exploring the Universe | Unit 4: Outer Planets: Uranus, Neptune, and the Dwarf Planets | Lab |
| (B) communicate explanations and solutions individually and collaboratively in a variety of settings and formats; and | Astronomy 1b: Exploring the Universe | Unit 4: Outer Planets: Uranus, Neptune, and the Dwarf Planets | Lab |
| (C) engage respectfully in scientific argumentation using applied scientific explanations and empirical evidence. | Astronomy 1b: Exploring the Universe | Unit 5: The Sun | Activity |
| **(4) Scientific and engineering practices. The student knows the contributions of scientists and recognizes the importance of scientific research and innovation on society.** | | | |
| (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; | Astronomy 1b: Exploring the Universe | Unit 2: Inner Planets | Activity |
| (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 | Astronomy 1b: Exploring the Universe | Unit 1: Space Explorers | All Lessons Associated |

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| (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. | Astronomy 1a: Introduction | Unit 8: Becoming a Space Professional | Lab |
| **(5) Science concepts. The student understands how astronomy influenced and advanced civilizations.** | | | |
| (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; | Astronomy 1b: Exploring the Universe | Unit 1: Space Explorers | Lessons 1, 2 |
| (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 | Astronomy 1b: Exploring the Universe | Unit 1: Space Explorers | Lessons 1, 3 |
| (C) describe and explain the historical origins of the perceived patterns of constellations and the role of constellations in ancient and modern navigation. | Astronomy 1a: Introduction | Unit 4: Stars | Lesson 2 |
| **(6) Science concepts. The student conducts and explains astronomical observations made from the point of reference of Earth.** | | | |
| (A) observe, record, and analyze the apparent movement of the Sun, Moon, and stars and predict sunrise and sunset; | Astronomy 1a: Introduction | Unit 3: The Earth, Moon, and Sun Systems | Activity |
| (B) observe the movement of planets throughout the year and measure how their positions change relative to the constellations; | Astronomy 1b: Exploring the Universe | Unit 2: Inner Planets | Activity |
| (C) identify constellations such as Ursa Major, Ursa Minor, Orion, Cassiopeia, and constellations along the ecliptic and describe their importance; and | Astronomy 1a: Introduction | Unit 4: Stars | Lesson 2 |
| (D) understand the difference between astronomy and astrology, the reasons for their historical conflation, and their eventual separation. | Astronomy 1a: Introduction | Unit 1: The Universe | Lesson 2 |
| **(7) Science concepts. The student knows our relative place in the solar system.** | | | |
| (A) demonstrate the use of units of measurement in astronomy, including astronomical units and light years, minutes, and seconds; | Astronomy 1a: Introduction | Unit 6: The Milky Way | Activity 1 |
| | Astronomy 1a: Introduction | Unit 4: Stars | Lesson 4 |
| (B) model the scale, size, and distances of the Sun, Earth, and Moon system and identify the limitations of physical models; and | Astronomy 1a: Introduction | Unit 3: The Earth, Moon, and Sun Systems | Lesson 4 |
| (C) model the scale, sizes, and distances of the Sun and the planets in our solar system and identify the limitations of physical models. | Astronomy 1a: Introduction | Unit 6: The Milky Way | Activity 1 |
| **(8) Science concepts. The student observes and models the interactions within the Sun, Earth, and Moon system.** | | | |
| (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; | Astronomy 1a: Introduction | Unit 3: The Earth, Moon, and Sun Systems | Lesson 4 |
| (B) model how the orbit and relative position of the Moon cause lunar and solar eclipses; and | Astronomy 1a: Introduction | Unit 3: The Earth, Moon, and Sun Systems | Lesson 5 |
| (C) examine and investigate the dynamics of tides using the Sun, Earth, and Moon model. | Astronomy 1a: Introduction | Unit 3: The Earth, Moon, and Sun Systems | Lesson 4 |
| **(9) Science concepts. The student models the cause of planetary seasons.** | | | |
| (A) examine the relationship of a planet's axial tilt to its potential seasons; | Astronomy 1a: Introduction | Unit 3: The Earth, Moon, and Sun Systems | Lesson 2 |
| (B) predict how changing latitudinal position affects the length of day and night throughout a planet's orbital year; | Astronomy 1a: Introduction | Unit 3: The Earth, Moon, and Sun Systems | Lesson 2 |

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| (C) investigate the relationship between a planet's axial tilt, angle of incidence of sunlight, and concentration of solar energy; and | Astronomy 1a: Introduction | Unit 3: The Earth, Moon, and Sun Systems | Lesson 2 |
| (D) explain the significance of Earth's solstices and equinoxes. | Astronomy 1a: Introduction | Unit 3: The Earth, Moon, and Sun Systems | Lesson 3 |
| **(10) Science concepts. The student knows how astronomical tools collect and record information about celestial objects.** | | | |
| (A) investigate the use of black body radiation curves and emission, absorption, and continuous spectra in the identification and classification of celestial objects; | Astronomy 1a: Introduction | Unit 4: Stars | Lesson 3 |
| (B) calculate the relative light-gathering power of different-sized telescopes to compare telescopes for different applications; | Astronomy 1a: Introduction | Unit 2: Techniques and Tools of the Trade: Studying the Universe | Lesson 4 |
| (C) analyze the importance and limitations of optical, infrared, and radio telescopes, gravitational wave detectors, and other ground-based technology; and | Astronomy 1a: Introduction | Unit 2: Techniques and Tools of the Trade: Studying the Universe | Lesson 4 |
| (D) analyze the importance and limitations of space telescopes in the collection of astronomical data across the electromagnetic spectrum. | Astronomy 1a: Introduction | Unit 2: Techniques and Tools of the Trade: Studying the Universe | Lesson 4 |
| **(11) Science concepts. The student uses models to explain the formation, development, organization, and significance of solar system bodies.** | | | |
| (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; | Astronomy 1b: Exploring the Universe | Unit 2: Inner Planets | Lesson 1 |
| (B) explore and communicate the origins and significance of planets, planetary rings, satellites, asteroids, comets, Oort cloud, and Kuiper belt objects; | Astronomy 1b: Exploring the Universe | Unit 2: Inner Planets | Lesson 1 |
| | Astronomy 1b: Exploring the Universe | Unit 6: Comets, Asteroids, and Meteors | All Lessons Associated |
| (C) compare the planets in terms of orbit, size, composition, rotation, atmosphere, natural satellites, magnetic fields, and geological activity; and | Astronomy 1b: Exploring the Universe | Unit 2: Inner Planets | Lessons 2-5 |
| | Astronomy 1b: Exploring the Universe | Unit 3: Outer Planets | All Lessons Associated |
| | Astronomy 1b: Exploring the Universe | Unit 4: Outer Planets: Uranus, Neptune, and the Dwarf Planets | All Lessons Associated |
| (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. | Astronomy 1b: Exploring the Universe | Unit 2: Inner Planets | Lesson 4 |
| **(12) Science concepts. The student knows that our Sun serves as a model for stellar activity.** | | | |
| (A) identify the approximate mass, size, motion, temperature, structure, and composition of the Sun; | Astronomy 1b: Exploring the Universe | Unit 5: The Sun | Lesson 2 |
| (B) distinguish between nuclear fusion and nuclear fission and identify the source of energy within the Sun as nuclear fusion of hydrogen to helium; | Astronomy 1b: Exploring the Universe | Unit 5: The Sun | Lesson 3 |
| (C) describe the eleven-year solar cycle and the significance of sunspots; and | Astronomy 1b: Exploring the Universe | Unit 5: The Sun | Lesson 4 |
| (D) analyze the origins and effects of space weather, including the solar wind, coronal mass ejections, prominences, flares, and sunspots. | Astronomy 1b: Exploring the Universe | Unit 5: The Sun | Lesson 5 |
| **(13) Science concepts. The student understands the characteristics and life cycle of stars.** | | | |
| (A) identify the characteristics of main sequence stars, including surface temperature, age, relative size, and composition; | Astronomy 1a: Introduction | Unit 4: Stars | Lessons 3, 5 |
| (B) describe and communicate star formation from nebulae to protostars to the development of main sequence stars; | Astronomy 1a: Introduction | Unit 4: Stars | Lesson 5 |
| (C) evaluate the relationship between mass and fusion on stellar evolution; | Astronomy 1a: Introduction | Unit 4: Stars | Lesson 5 |

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| (D) compare how the mass of a main sequence star will determine its end state as a white dwarf, neutron star, or black hole; | Astronomy 1a: Introduction | Unit 4: Stars | Lesson 5 |
| (E) describe the use of spectroscopy in obtaining physical data on celestial objects such as temperature, chemical composition, and relative motion; | Astronomy 1a: Introduction | Unit 4: Stars | Lesson 4 |
| (F) use the Hertzsprung-Russell diagram to classify stars and plot and examine the life cycle of stars from birth to death; | Astronomy 1a: Introduction | Unit 4: Stars | Lesson 4 |
| (G) illustrate how astronomers use geometric parallax to determine stellar distances and intrinsic luminosities; and | Astronomy 1a: Introduction | Unit 6: The Milky Way | Lesson 3 |
| (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. | | | |
| **(14) Science concepts. The student knows the structure of the universe and our relative place in it.** | | | |
| (A) illustrate the structure and components of our Milky Way galaxy and model the size, location, and movement of our solar system within it; | Astronomy 1a: Introduction | Unit 6: The Milky Way | Lessons 3, 4 |
| (B) compare spiral, elliptical, irregular, dwarf, and active galaxies; | Astronomy 1a: Introduction | Unit 5: Galaxies | Lessons 2-4 |
| (C) develop and use models to explain how galactic evolution occurs through mergers and collisions; | Astronomy 1a: Introduction | Unit 5: Galaxies | Lesson 5 |
| (D) describe the Local Group and its relation to larger-scale structures in the universe; and | Astronomy 1a: Introduction | Unit 5: Galaxies | Lesson 3 |
| (E) evaluate the indirect evidence for the existence of dark matter. | Astronomy 1a: Introduction | Unit 5: Galaxies | Lesson 5 |
| **(15) Science concepts. The student knows the scientific theories of cosmology.** | | | |
| (A) describe and evaluate the historical development of evidence supporting the Big Bang Theory; | Astronomy 1a: Introduction | Unit 1: The Universe | Lesson 2 |
| (B) evaluate the limits of observational astronomy methods used to formulate the distance ladder; | | | |
| (C) evaluate the indirect evidence for the existence of dark energy; | Astronomy 1a: Introduction | Unit 1: The Universe | Lesson 3 |
| (D) describe the current scientific understanding of the evolution of the universe, including estimates for the age of the universe; and | Astronomy 1a: Introduction | Unit 1: The Universe | Lessons 3, 4 |
| (E) describe current scientific hypotheses about the fate of the universe, including open and closed universes. | Astronomy 1a: Introduction | Unit 1: The Universe | Lesson 4 |
| **(16) Science concepts. The student understands the benefits and challenges of expanding our knowledge of the universe.** | | | |
| (A) describe and communicate the historical development of human space flight and its challenges; | Astronomy 1b: Exploring the Universe | Unit 1: Space Explorers | Lessons 3, 4 |
| (B) describe and communicate the uses and challenges of robotic space flight; | Astronomy 1b: Exploring the Universe | Unit 1: Space Explorers | Lesson 3 |
| (C) evaluate the evidence of the existence of habitable zones and potentially habitable planetary bodies in extrasolar planetary systems; | Astronomy 1a: Introduction | Unit 6: The Milky Way | Lesson 4 |
| | Astronomy 1b: Exploring the Universe | Unit 3: Outer Planets | Lab |
| (D) evaluate the impact on astronomy from light pollution, radio interference, and space debris; | | | |
| (E) examine and describe current developments and discoveries in astronomy; and | Astronomy 1a: Introduction | Unit 6: The Milky Way | Lab |

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| (F) explore and explain careers that involve astronomy, space exploration, and the technologies developed through them. | Astronomy 1a: Introduction | Unit 8: Becoming a Space Professional | Lessons 1, 2 |