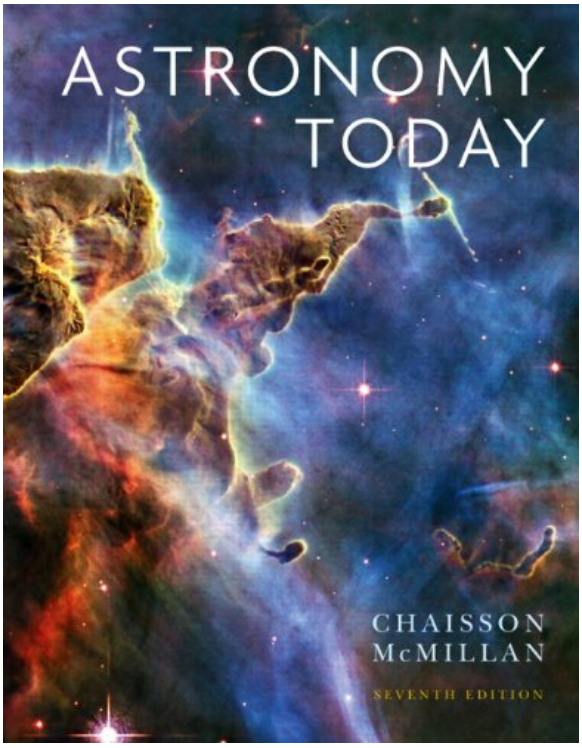
A Correlation of

Astronomy Today

Chaisson, McMillan

7th Edition ©2011



To the

Texas

Essential Knowledge and Skills

For Astronomy

ALWAYS LEARNING PEARSON

A Correlation of
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to the
Texas Essential Knowledge and Skills (TEKS) for Astronomy

INTRODUCTION

This document demonstrates how Pearson's **Chaisson, Astronomy Today, 7th Edition ©2011** supports the Texas Essential Knowledge and Skills (TEKS) for Astronomy. Correlation page references are to the Student Edition.

Astronomy Today emphasizes critical thinking and visualization, and it focuses on the process of scientific discovery, making "how we know what we know" an integral part of the text. The revised edition has been thoroughly updated with the latest astronomical discoveries and theories, and it has been streamlined to keep students focused on the essentials and to develop an understanding of the "big picture."

Features and Benefits

- **The Process of Science and The Process of Discovery** are both emphasized throughout the text with end-of-chapter Process of Science questions and coverage of the historical development of the discipline, which provides insight into how scientists approach the field. Additionally, the authors have added **Process of Science Check** questions throughout every chapter, prompting students to consider how astronomers use various aspects of the process of science in their discoveries.
- **Concept Checks** are critical thinking questions throughout each chapter that prompt students to reconsider some of the material just presented and to test their mastery of key concepts.
- **Concept Link Icons** refer students back to previous sections in the text to help students understand how concepts are related and allow them to more easily see the "big picture."
- **Discovery Boxes** explore a wide variety of interesting supplementary topics, providing students with insight into how scientific knowledge evolves and emphasizing the process of science.
- **Spectrum Icons** accompany each photo in the text, identifying the wavelength used to capture the image and reinforcing for students how light influences the way we see things.
- **Compound Art** employs multiple-part images to capture all aspects of a complex subject wherever possible, including images from various wavelengths, interpretive line drawings paired with astronomical photographs, and breakouts that zoom in to or out from astronomical objects and phenomena.
- **MasteringAstronomy®** is the most powerful astronomy tutorial and assessment system ever built, providing both instructor-assigned homework as well as a self-study area for students. Along with an outstanding diagnostic and grading capability, it includes a library of study assets, such as Self-Guided Tutorials, Interactive Figures and Photos™, new WorldWide Telescope tours, Animations and Videos, quizzes, RSS news feeds that provide up-to-date articles from major astronomy news sources, and more.

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Texas Essential Knowledge and Skills for Astronomy	Astronomy Today 7th Edition, ©2011
Subject **Chapter 112. Science**	
Course Title **§112.33. Astronomy, Beginning with School Year 2010-2011 (One Credit).**	
TEKS (Knowledge and Skills) Student Expectation Breakout	
(a) General requirements. Students shall be awarded one credit for successful completion of this course. Suggested prerequisite: one unit of high school science. This course is recommended for students in Grade 11 or 12.	
(b) Introduction.	
(1) Astronomy. In Astronomy, students conduct laboratory and field investigations, use scientific methods, and make informed decisions using critical thinking and scientific problem solving. Students study the following topics: astronomy in civilization, patterns and objects in the sky, our place in space, the moon, reasons for the seasons, planets, the sun, stars, galaxies, cosmology, and space exploration. Students who successfully complete Astronomy will acquire knowledge within a conceptual framework, conduct observations of the sky, work collaboratively, and develop critical-thinking skills.	
(2) Nature of science. Science, as defined by the National Academy of Sciences, is the "use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process." This vast body of changing and increasing knowledge is described by physical, mathematical, and conceptual models. Students should know that some questions are outside the realm of science because they deal with phenomena that are not scientifically testable.	
(3) Scientific inquiry. Scientific inquiry is the planned and deliberate investigation of the natural world. Scientific methods of investigation can be experimental, descriptive, or comparative. The method chosen should be appropriate to the question being asked.	
(4) Science and social ethics. Scientific decision making is a way of answering questions about the natural world. Students should be able to distinguish between scientific decision-making methods and ethical and social decisions that involve the application of scientific information.	
(5) Scientific systems. A system is a collection of cycles, structures, and processes that interact. All systems have basic properties that can be described in terms of 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. 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.	

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(C) Knowledge and skills.	
(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:	
(A) demonstrate safe practices during laboratory and field investigations	
(i) demonstrate safe practices during laboratory investigations	*Astronomy Today* presents the fundamentals of astronomy with a focus on critical thinking and visualization; streamlined for students to develop an understanding of the "big picture." This objective falls outside of the program scope.
(ii) demonstrate safe practices during field investigations	*Astronomy Today* presents the fundamentals of astronomy with a focus on critical thinking and visualization; streamlined for students to develop an understanding of the "big picture." This objective falls outside of the program scope.
(B) demonstrate an understanding of the use and conservation of resources and the proper disposal or recycling of materials	
(i) demonstrate an understanding of the use of resources	*Astronomy Today* presents the fundamentals of astronomy with a focus on critical thinking and visualization; streamlined for students to develop an understanding of the "big picture." This objective falls outside of the program scope.
(ii) demonstrate an understanding of the conservation of resources	*Astronomy Today* presents the fundamentals of astronomy with a focus on critical thinking and visualization; streamlined for students to develop an understanding of the "big picture." This objective falls outside of the program scope.
(iii) demonstrate an understanding of the proper disposal or recycling of materials	*Astronomy Today* presents the fundamentals of astronomy with a focus on critical thinking and visualization; streamlined for students to develop an understanding of the "big picture." This objective falls outside of the program scope.

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(2) Scientific processes. The student uses scientific methods during laboratory and field investigations. The student is expected to:	
(A) know the definition of science and understand that it has limitations, as specified in subsection (b)(2) of this section	
(i) know the definition of science, as specified in subsection (b)(2) [above]	For related content, please see: **SE:** 6-8
(ii) understand that [science] has limitations, as specified in subsection (b)(2) [above]	This objective can be developed from the following: **SE:** 6-8
(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	
(i) know that scientific hypotheses are tentative statements that must be capable of being supported or not supported by observational evidence	**SE:** 8
(ii) know that scientific hypotheses are testable statements that must be capable of being supported or not supported by observational evidence	**SE:** 8
(iii) [know that] hypotheses of durable explanatory power which have been tested over a wide variety of conditions are incorporated into theories	**SE:** 6-7, 54
(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	
(i) know that scientific theories are based on natural and physical phenomena	**SE:** 6-7, 54
(ii) know that scientific theories are capable of being tested by multiple independent researchers	For related content, please see: **SE:** 6-7
(iii) [know that], unlike hypotheses, scientific theories are well-established explanations	**SE:** 6-7, 54

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(iv) [know that], unlike hypotheses, scientific theories are highly-reliable explanations	**SE:** 6-7, 54
(v) [know that] scientific theories may be subject to change as new areas of science are developed	For related content, please see: **SE:** 6-7
(vi) [know that] scientific theories may be subject to change as new technologies are developed	For related content, please see: **SE:** 6-7
(D) distinguish between scientific hypotheses and scientific theories	For related content, please see: **SE:** 6-7, 8, 54
(E) plan and implement investigative procedures, including making observations, asking questions, formulating testable hypotheses, and selecting equipment and technology	
(i) plan investigative procedures, including making observations	*Astronomy Today* presents the fundamentals of astronomy with a focus on critical thinking and visualization; streamlined for students to develop an understanding of the "big picture." This objective falls outside of the program scope.
(ii) plan investigative procedures, including asking questions	*Astronomy Today* presents the fundamentals of astronomy with a focus on critical thinking and visualization; streamlined for students to develop an understanding of the "big picture." This objective falls outside of the program scope.
(iii) plan investigative procedures, including formulating testable hypotheses	*Astronomy Today* presents the fundamentals of astronomy with a focus on critical thinking and visualization; streamlined for students to develop an understanding of the "big picture." This objective falls outside of the program scope.

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(iv) plan investigative procedures, including selecting equipment	*Astronomy Today* presents the fundamentals of astronomy with a focus on critical thinking and visualization; streamlined for students to develop an understanding of the "big picture." This objective falls outside of the program scope.
(v) plan investigative procedures, including selecting technology	*Astronomy Today* presents the fundamentals of astronomy with a focus on critical thinking and visualization; streamlined for students to develop an understanding of the "big picture." This objective falls outside of the program scope.
(vi) implement investigative procedures, including making observations	*Astronomy Today* presents the fundamentals of astronomy with a focus on critical thinking and visualization; streamlined for students to develop an understanding of the "big picture." This objective falls outside of the program scope.
(vii) implement investigative procedures, including asking questions	*Astronomy Today* presents the fundamentals of astronomy with a focus on critical thinking and visualization; streamlined for students to develop an understanding of the "big picture." This objective falls outside of the program scope.
(viii) implement investigative procedures, including formulating testable hypotheses	*Astronomy Today* presents the fundamentals of astronomy with a focus on critical thinking and visualization; streamlined for students to develop an understanding of the "big picture." This objective falls outside of the program scope.

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(ix) implement investigative procedures, including selecting equipment	*Astronomy Today* presents the fundamentals of astronomy with a focus on critical thinking and visualization; streamlined for students to develop an understanding of the "big picture." This objective falls outside of the program scope.
(x) implement investigative procedures, including selecting technology	This objective can be developed from the following: **SE:** 13, 59, 145, 195, 235, 296, 338, 371, 418, 431, 502, 562, 612, 636
(F) collect data and make measurements with accuracy and precision	
(i) collect data with accuracy	*Astronomy Today* presents the fundamentals of astronomy with a focus on critical thinking and visualization; streamlined for students to develop an understanding of the "big picture." This objective falls outside of the program scope.
(ii) collect data with precision	*Astronomy Today* presents the fundamentals of astronomy with a focus on critical thinking and visualization; streamlined for students to develop an understanding of the "big picture." This objective falls outside of the program scope.
(iii) make measurements with accuracy	This objective can be developed from the following: **SE:** 29, 75, 129, 209, 257, 311, 381, 463, 515, 569, 633, 681, 727
(iv) make measurements with precision	This objective can be developed from the following: **SE:** 55, 95, 153, 181, 229, 283, 359, 443, 489, 537, 601, 659, 705

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(G) organize, analyze, evaluate, make inferences, and predict trends from data, including making new revised hypotheses when appropriate	
(i) organize data, including making new revised hypotheses when appropriate	*Astronomy Today* presents the fundamentals of astronomy with a focus on critical thinking and visualization; streamlined for students to develop an understanding of the "big picture." This objective falls outside of the program scope.
(ii) analyze data, including making new revised hypotheses when appropriate	*Astronomy Today* presents the fundamentals of astronomy with a focus on critical thinking and visualization; streamlined for students to develop an understanding of the "big picture." This objective falls outside of the program scope.
(iii) evaluate data, including making new revised hypotheses when appropriate	*Astronomy Today* presents the fundamentals of astronomy with a focus on critical thinking and visualization; streamlined for students to develop an understanding of the "big picture." This objective falls outside of the program scope.
(iv) make inferences from data, including making new revised hypotheses when appropriate	*Astronomy Today* presents the fundamentals of astronomy with a focus on critical thinking and visualization; streamlined for students to develop an understanding of the "big picture." This objective falls outside of the program scope.
(v) predict trends from data, including making new revised hypotheses when appropriate	*Astronomy Today* presents the fundamentals of astronomy with a focus on critical thinking and visualization; streamlined for students to develop an understanding of the "big picture." This objective falls outside of the program scope.

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(H) communicate valid conclusions in writing, oral presentations, and through collaborative projects	
(i) communicate valid conclusions in writing	*Astronomy Today* presents the fundamentals of astronomy with a focus on critical thinking and visualization; streamlined for students to develop an understanding of the "big picture." This objective falls outside of the program scope.
(ii) communicate valid conclusions in oral presentations	*Astronomy Today* presents the fundamentals of astronomy with a focus on critical thinking and visualization; streamlined for students to develop an understanding of the "big picture." This objective falls outside of the program scope.
(iii) communicate valid conclusions through collaborative projects	*Astronomy Today* presents the fundamentals of astronomy with a focus on critical thinking and visualization; streamlined for students to develop an understanding of the "big picture." This objective falls outside of the program scope.
(I) use astronomical technology such as telescopes, binoculars, sextants, computers, and software	This objective can be developed from the following: **SE:** 16, 64, 145, 172, 235, 346, 418, 472, 502, 550, 624, 702 *Mastering Astronomy-Interactive
(i) use astronomical technology	This objective can be developed from the following: **SE:** 37, 80, 150, 189, 263, 371, 432, 485, 520, 581, 654, 667 *Mastering Astronomy-Interactive

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(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:	
(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	
(i) in all fields of science, analyze scientific explanations by using empirical evidence	For related content, please see: **SE:** 54-55, 153, 208, 256, 310, 380, 488, 514, 600, 632
(ii) in all fields of science, analyze scientific explanations by using logical reasoning	For related content, please see: **SE:** 28, 75, 152, 208, 282, 310, 488, 514, 568, 600, 658, 726
(iii) in all fields of science, analyze scientific explanations by using experimental testing	*Astronomy Today* presents the fundamentals of astronomy with a focus on critical thinking and visualization; streamlined for students to develop an understanding of the "big picture." This objective falls outside of the program scope.
(iv) in all fields of science, analyze scientific explanations by using observational testing	*Astronomy Today* presents the fundamentals of astronomy with a focus on critical thinking and visualization; streamlined for students to develop an understanding of the "big picture." This objective falls outside of the program scope.
(v) in all fields of science, analyze scientific explanations, including examining all sides of scientific evidence of those scientific explanations	*Astronomy Today* presents the fundamentals of astronomy with a focus on critical thinking and visualization; streamlined for students to develop an understanding of the "big picture." This objective falls outside of the program scope.
(vi) in all fields of science, evaluate scientific explanations by using empirical evidence	For related content, please see: **SE:** 75, 94-95, 228-229, 282, 536, 658, 680
(vii) in all fields of science, evaluate scientific explanations by using logical reasoning	For related content, please see: **SE:** 54-55, 94-95, 128, 180, 228-229, 380, 536, 632, 680, 725

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(viii) in all fields of science, evaluate scientific explanations by using experimental testing	*Astronomy Today* presents the fundamentals of astronomy with a focus on critical thinking and visualization; streamlined for students to develop an understanding of the "big picture." This objective falls outside of the program scope.
(ix) in all fields of science, evaluate scientific explanations by using observational testing	*Astronomy Today* presents the fundamentals of astronomy with a focus on critical thinking and visualization; streamlined for students to develop an understanding of the "big picture." This objective falls outside of the program scope.
(x) in all fields of science, evaluate scientific explanations, including examining all sides of scientific evidence of those scientific explanations	*Astronomy Today* presents the fundamentals of astronomy with a focus on critical thinking and visualization; streamlined for students to develop an understanding of the "big picture." This objective falls outside of the program scope.
(xi) in all fields of science, critique scientific explanations by using empirical evidence	For related content, please see: **SE:** 75, 153, 208, 228-229, 310, 488, 514, 600, 658, 680
(xii) in all fields of science, critique scientific explanations by using logical reasoning	For related content, please see: **SE:** 54-55, 94-95, 128, 208, 380, 488, 536, 632, 658, 725
(xiii) in all fields of science, critique scientific explanations by using experimental testing	*Astronomy Today* presents the fundamentals of astronomy with a focus on critical thinking and visualization; streamlined for students to develop an understanding of the "big picture." This objective falls outside of the program scope.

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(xiv) in all fields of science, critique scientific explanations by using observational testing	*Astronomy Today* presents the fundamentals of astronomy with a focus on critical thinking and visualization; streamlined for students to develop an understanding of the "big picture." This objective falls outside of the program scope.
(xv) in all fields of science, critique scientific explanations, including examining all sides of scientific evidence of those scientific explanations	*Astronomy Today* presents the fundamentals of astronomy with a focus on critical thinking and visualization; streamlined for students to develop an understanding of the "big picture." This objective falls outside of the program scope.
(B) communicate and apply scientific information extracted from various sources such as current events, news reports, published journal articles, and marketing materials	
(i) communicate scientific information extracted from various sources	*Astronomy Today* presents the fundamentals of astronomy with a focus on critical thinking and visualization; streamlined for students to develop an understanding of the "big picture." This objective falls outside of the program scope.
(ii) apply scientific information extracted from various sources	*Astronomy Today* presents the fundamentals of astronomy with a focus on critical thinking and visualization; streamlined for students to develop an understanding of the "big picture." This objective falls outside of the program scope.
(C) draw inferences based on data related to promotional materials for products and services	
(i) draw inferences based on data related to promotional materials for products	*Astronomy Today* presents the fundamentals of astronomy with a focus on critical thinking and visualization; streamlined for students to develop an understanding of the "big picture." This objective falls outside of the program scope.

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(ii) draw inferences based on data related to promotional materials for services	*Astronomy Today* presents the fundamentals of astronomy with a focus on critical thinking and visualization; streamlined for students to develop an understanding of the "big picture." This objective falls outside of the program scope.
(D) evaluate the impact of research on scientific thought, society, and the environment	
(i) evaluate the impact of research on scientific thought	For related content, please see: **SE:** 54-55, 268-269, 270, 338-339, 391, 467, 475, 486, 503, 524-525, 555, 653, 676
(ii) evaluate the impact of research on society	For related content, please see: **SE:** 190-191, 248-249, 709
(iii) evaluate the impact of research on the environment	For related content, please see: **SE:** 161, 404
(E) describe the connection between astronomy and future careers	*Astronomy Today* presents the fundamentals of astronomy with a focus on critical thinking and visualization; streamlined for students to develop an understanding of the "big picture." This objective falls outside of the program scope.
(4) Science concepts. The student recognizes the importance and uses of astronomy in civilization. The student is expected to:	
(A) research and describe the use of astronomy in ancient civilizations such as the Egyptians, Mayans, Aztecs, Europeans, and the native Americans	
(i) research the use of astronomy in ancient civilizations	For related content, please see: **SE:** 32-34
(ii) describe the use of astronomy in ancient civilizations	**SE:** 54
(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	
(i) research the contributions of scientists to our changing understanding of astronomy, including Ptolemy	For related content, please see: **SE:** 36-37

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(ii) research the contributions of scientists to our changing understanding of astronomy, including Copernicus	For related content, please see: **SE:** 37-38, 40-41, 53, 54
(iii) research the contributions of scientists to our changing understanding of astronomy, including Tycho Brahe	For related content, please see: **SE:** 42, 55
(iv) research the contributions of scientists to our changing understanding of astronomy, including Kepler	For related content, please see: **SE:** 43-45, 51-53, 55
(v) research the contributions of scientists to our changing understanding of astronomy, including Galileo	For related content, please see: **SE:** 39-40, 134, 292, 396
(vi) research the contributions of scientists to our changing understanding of astronomy, including Newton	For related content, please see: **SE:** 47-53, 55
(vii) research the contributions of scientists to our changing understanding of astronomy, including Einstein	For related content, please see: **SE:** 553-554, 556
(viii) research the contributions of scientists to our changing understanding of astronomy, including Hubble	For related content, please see: **SE:** 102, 128, 571, 604-610, 615-616
(ix) research the contributions of scientists to our changing understanding of astronomy, including the contribution of women astronomers, including Maria Mitchell	*Astronomy Today* presents the fundamentals of astronomy with a focus on critical thinking and visualization; streamlined for students to develop an understanding of the "big picture." This objective falls outside of the program scope.
(x) research the contributions of scientists to our changing understanding of astronomy, including the contribution of women astronomers, including Henrietta Swan Leavitt	For related content, please see: **SE:** 579, 580
(xi) describe the contributions of scientists to our changing understanding of astronomy, including Ptolemy	For related content, please see: **SE:** 36, 54

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(xii) describe the contributions of scientists to our changing understanding of astronomy, including Copernicus	**SE:** 54
(xiii) describe the contributions of scientists to our changing understanding of astronomy, including Tycho Brahe	**SE:** 55
(xiv) describe the contributions of scientists to our changing understanding of astronomy, including Kepler	**SE:** 55
(xv) describe the contributions of scientists to our changing understanding of astronomy, including Galileo	**SE:** 55
(xvi) describe the contributions of scientists to our changing understanding of astronomy, including Newton	**SE:** 55
(xvii) describe the contributions of scientists to our changing understanding of astronomy, including Einstein	For related content, please see: **SE:** 553-554, 556
(xviii) describe the contributions of scientists to our changing understanding of astronomy, including Hubble	**SE:** 128
(xix) describe the contributions of scientists to our changing understanding of astronomy, including the contribution of women astronomers, including Maria Mitchell	*Astronomy Today* presents the fundamentals of astronomy with a focus on critical thinking and visualization; streamlined for students to develop an understanding of the "big picture." This objective falls outside of the program scope.
(xx) describe the contributions of scientists to our changing understanding of astronomy, including the contribution of women astronomers, including Henrietta Swan Leavitt	For related content, please see: **SE:** 579, 580

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(C) describe and explain the historical origins of the perceived patterns of constellations and the role of constellations in ancient and modern navigation	
(i) describe the historical origins of the perceived patterns of constellations	For related content, please see: **SE:** 8-10, 28
(ii) describe the role of constellations in ancient navigation	For related content, please see: **SE:** 9, 28
(iii) describe the role of constellations in modern navigation	This objective can be developed from the following: **SE:** 9, 28
(iv) explain the historical origins of the perceived patterns of constellations	For related content, please see: **SE:** 8-10, 28
(v) explain the role of constellations in ancient navigation	For related content, please see: **SE:** 9, 28
(vi) explain the role of constellations in modern navigation	This objective can be developed from the following: **SE:** 9, 28
(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	
(i) explain the contributions of modern astronomy to today's society, including the identification of potential asteroid/comet impact hazards	For related content, please see: **SE:** 337-340, 358
(ii) explain the contributions of modern astronomy to today's society, including the Sun's effects on communication	*Astronomy Today* presents the fundamentals of astronomy with a focus on critical thinking and visualization; streamlined for students to develop an understanding of the "big picture." This objective falls outside of the program scope.
(iii) explain the contributions of modern astronomy to today's society, including the Sun's effects on navigation	*Astronomy Today* presents the fundamentals of astronomy with a focus on critical thinking and visualization; streamlined for students to develop an understanding of the "big picture." This objective falls outside of the program scope.

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(iv) explain the contributions of modern astronomy to today's society, including the Sun's effects on high-tech devices	For related content, please see: **SE:** 404
(5) Science concepts. The student develops a familiarity with the sky. The student is expected to:	
(A) observe and record the apparent movement of the Sun and Moon during the day	
(i) observe the apparent movement of the Sun during the day	For related content, please see: **SE:** 12, 28, 208
(ii) observe the apparent movement of the Moon during the day	For related content, please see: **SE:** 16-18, 28, 189-190, 208
(iii) record the apparent movement of the Sun during the day	For related content, please see: **SE:** 12, 28, 208
(iv) record the apparent movement of the Moon during the day	For related content, please see: **SE:** 16-18, 28, 189-190, 208
(B) observe and record the apparent movement of the Moon, planets, and stars in the nighttime sky	
(i) observe the apparent movement of the Moon in the nighttime sky	For related content, please see: **SE:** 16-22, 28, 189-190, 208
(ii) observe the apparent movement of the planets in the nighttime sky	For related content, please see: **SE:** 34-35
(iii) observe the apparent movement of the stars in the nighttime sky	For related content, please see: **SE:** 420-421, 442
(iv) record the apparent movement of the Moon in the nighttime sky	For related content, please see: **SE:** 16-22, 28, 189-190, 208
(v) record the apparent movement of the planets in the nighttime sky	For related content, please see: **SE:** 34-35
(vi) record the apparent movement of the stars in the nighttime sky	For related content, please see: **SE:** 420-421, 442
(C) recognize and identify constellations such as Ursa Major, Ursa Minor, Orion, Cassiopeia, and constellations of the zodiac	
(i) recognize constellations	For related content, please see: **SE:** 8-10, 13-14
(ii) identify constellations	For related content, please see: **SE:** 8-10, 13-14

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(6) Science concepts. The student knows our place in space. The student is expected to:	
(A) compare and contrast the scale, size, and distance of the Sun, Earth, and Moon system through the use of data and modeling	
(i) compare the scale of the Sun, Earth, and Moon system through the use of data	**SE:** 28, 414
(ii) compare the size of the Sun, Earth, and Moon system through the use of data	**SE:** 28, 414
(iii) compare the distance of the Sun, Earth, and Moon system through the use of data	For related content, please see: **SE:** 184, 385
(iv) contrast the scale of the Sun, Earth, and Moon system through the use of data	**SE:** 28, 414
(v) contrast the size of the Sun, Earth, and Moon system through the use of data	**SE:** 28, 414
(vi) contrast the distance of the Sun, Earth, and Moon system through the use of data	For related content, please see: **SE:** 184, 385
(vii) compare the scale of the Sun, Earth, and Moon system through the use of modeling	For related content, please see: **SE:** 28, 414
(viii) compare the size of the Sun, Earth, and Moon system through the use of modeling	For related content, please see: **SE:** 28, 414
(ix) compare the distance of the Sun, Earth, and Moon system through the use of modeling	This objective can be developed from the following: **SE:** 184, 385
(x) contrast the scale of the Sun, Earth, and Moon system through the use of modeling	For related content, please see: **SE:** 28, 414
(xi) contrast the size of the Sun, Earth, and Moon system through the use of modeling	For related content, please see: **SE:** 28, 414
(xii) contrast the distance of the Sun, Earth, and Moon system through the use of modeling	This objective can be developed from the following: **SE:** 184, 385

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(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	
(i) compare the scale of objects in the solar system	For related content, please see: **SE:** 136-137, 140, 152, 387
(ii) compare the size of objects in the solar system	For related content, please see: **SE:** 136-137, 140, 152, 387
(iii) compare the distance of objects in the solar system	For related content, please see: **SE:** 136, 140, 152, 387
(iv) contrast the scale of objects in the solar system	For related content, please see: **SE:** 136-137, 140, 152, 387
(v) contrast the size of objects in the solar system	For related content, please see: **SE:** 136-137, 140, 152, 387
(vi) contrast the distance of objects in the solar system	For related content, please see: **SE:** 136, 140, 152, 387
(C) examine the scale, size, and distance of the stars, Milky Way, and other galaxies through the use of data and modeling	
(i) examine the scale of the stars through the use of data	For related content, please see: **SE:** 428-430
(ii) examine the scale of the Milky Way through the use of data	For related content, please see: **SE:** 579, 581, 582
(iii) examine the scale of the other galaxies through the use of data	For related content, please see: **SE:** 636-637
(iv) examine the size of the stars through the use of data	For related content, please see: **SE:** 428-430
(v) examine the size of the Milky Way through the use of data	For related content, please see: **SE:** 579, 581, 582
(vi) examine the size of other galaxies through the use of data	For related content, please see: **SE:** 636-637
(vii) examine the distance of the stars through the use of data	For related content, please see: **SE:** 418-420
(viii) examine the distance of the Milky Way through the use of data	For related content, please see: **SE:** 578-579

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(ix) examine the distance of other galaxies through the use of data	For related content, please see: **SE:** 611-614
(x) examine the scale of the stars through the use of modeling	This objective can be developed from the following: **SE:** 428-430
(xi) examine the scale of the Milky Way through the use of modeling	This objective can be developed from the following: **SE:** 579, 581, 582
(xii) examine the scale of the other galaxies through the use of modeling	This objective can be developed from the following: **SE:** 636-637
(xiii) examine the size the stars through the use of modeling	This objective can be developed from the following: **SE:** 428-430
(xiv) examine the size of the Milky Way through the use of modeling	This objective can be developed from the following: **SE:** 579, 581, 582
(xv) examine the size of other galaxies through the use of modeling	This objective can be developed from the following: **SE:** 636-637
(xvi) examine the distance of the stars through the use of modeling	This objective can be developed from the following: **SE:** 418-420
(xvii) examine the distance of the Milky Way through the use of modeling	This objective can be developed from the following: **SE:** 578-579
(xviii) examine the distance of other galaxies through the use of modeling	This objective can be developed from the following: **SE:** 611-614
(D) relate apparent versus absolute magnitude to the distances of celestial objects	For related content, please see: **SE:** 422, 423, 425

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(E) demonstrate the use of units of measurement in astronomy, including Astronomical Units and light years	
(i) demonstrate the use of units of measurement in astronomy, including Astronomical Units	**SE:** 55, 153, 359, 381, 515, 569, 726
(ii) demonstrate the use of units of measurement in astronomy, including light years	**SE:** 29
(7) Science concepts. The student knows the role of the Moon in the Sun, Earth, and Moon system. The student is expected to:	
(A) observe and record data about lunar phases and use that information to model the Sun, Earth, and Moon system	
(i) observe data about lunar phases	For related content, please see: **SE:** 16-18, 28
(ii) record data about lunar phases	For related content, please see: **SE:** 16-18, 28
(iii) use [data about lunar phases] to model the Sun, Earth, and Moon system	This objective can be developed from the following: **SE:** 16-18, 28
(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	
(i) illustrate the cause of lunar phases by showing positions of the Moon relative to Earth and the Sun for each phase, including new moon	For related content, please see: **SE:** 16, 17, 18
(ii) illustrate the cause of lunar phases by showing positions of the Moon relative to Earth and the Sun for each phase, including waxing crescent	For related content, please see: **SE:** 16, 17
(iii) illustrate the cause of lunar phases by showing positions of the Moon relative to Earth and the Sun for each phase, including first quarter	For related content, please see: **SE:** 16, 17
(iv) illustrate the cause of lunar phases by showing positions of the Moon relative to Earth and the Sun for each phase, including waxing gibbous	For related content, please see: **SE:** 16, 17

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(v) illustrate the cause of lunar phases by showing positions of the Moon relative to Earth and the Sun for each phase, including full moon	For related content, please see: **SE:** 16, 17, 186, 188
(vi) illustrate the cause of lunar phases by showing positions of the Moon relative to Earth and the Sun for each phase, including waning gibbous	For related content, please see: **SE:** 16, 17
(vii) illustrate the cause of lunar phases by showing positions of the Moon relative to Earth and the Sun for each phase, including third quarter	For related content, please see: **SE:** 16, 17
(viii) illustrate the cause of lunar phases by showing positions of the Moon relative to Earth and the Sun for each phase, including waning crescent	For related content, please see: **SE:** 16, 17
(C) identify and differentiate the causes of lunar and solar eclipses, including differentiating between lunar phases and eclipses	
(i) identify the cause of lunar eclipses	**SE:** 28
(ii) differentiate the causes of lunar and solar eclipses, including differentiating between lunar phases and eclipses	For related content, please see: **SE:** 16-22, 28
(iii) identify the cause of solar eclipses	**SE:** 28
(D) identify the effects of the Moon on tides	**SE:** 180
(8) Science concepts. The student knows the reasons for the seasons. The student is expected to:	
(A) recognize that seasons are caused by the tilt of Earth's axis	**SE:** 15, 28
(B) explain how latitudinal position affects the length of day and night throughout the year	For related content, please see: **SE:** 12, 14, 15, 28
(C) recognize that the angle of incidence of sunlight determines the concentration of solar energy received on Earth at a particular location	This objective can be developed from the following: **SE:** 406-409

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(D) examine the relationship of the seasons to equinoxes, solstices, the tropics, and the equator	
(i) examine the relationship of the seasons to equinoxes	**SE:** 14, 15
(ii) examine the relationship of the seasons to solstices	**SE:** 14, 15
(iii) examine the relationship of the seasons to the tropics	**SE:** 15, 16
(iv) examine the relationship of the seasons to the equator	For related content, please see: **SE:** 12-15
(9) Science concepts. The student knows that planets of different size, composition, and surface features orbit around the Sun. The student is expected to:	
(A) compare and contrast the factors essential to life on Earth such as temperature, water, mass, and gases to conditions on other planets	
(i) compare the factors essential to life on Earth	For related content, please see: **SE:** 713, 714-715, 726
(ii) contrast the factors essential to life on Earth	For related content, please see: **SE:** 713, 714-715, 726
(B) compare the planets in terms of orbit, size, composition, rotation, atmosphere, natural satellites, and geological activity	
(i) compare the planets in terms of orbit	**SE:** 136, 138-139
(ii) compare the planets in terms of size	**SE:** 136, 137, 138-139, 152
(iii) compare the planets in terms of composition	**SE:** 138-139, 152
(iv) compare the planets in terms of rotation	**SE:** 136, 137, 139
(v) compare the planets in terms of atmosphere	**SE:** 139, 152
(vi) compare the planets in terms of natural satellites	**SE:** 136
(vii) compare the planets in terms of geological activity	**SE:** 138-140, 152

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(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	
(i) relate the role of Newton's law of universal gravitation to the motion of the planets around the Sun	**SE:** 50-51, 53
(ii) relate the role of Newton's law of universal gravitation to the motion of natural satellites around the planets	For related content, please see: **SE:** 52-53
(iii) relate the role of Newton's law of universal gravitation to the motion of artificial satellites around the planets	For related content, please see: **SE:** 52-53
(D) explore the origins and significance of small solar system bodies, including asteroids, comets, and Kuiper belt objects	
(i) explore the origins of small solar system bodies, including asteroids	For related content, please see: **SE:** 334-335
(ii) explore the origins of small solar system bodies, including comets	For related content, please see: **SE:** 268-269, 340-343, 711-712
(iii) explore the origins of small solar system bodies, including Kuiper belt objects	For related content, please see: **SE:** 348-352
(iv) explore the significance of small solar system bodies, including asteroids	For related content, please see: **SE:** 334-335
(v) explore the significance of small solar system bodies, including comets	For related content, please see: **SE:** 268-269, 340-343, 711-712
(vi) explore the significance of small solar system bodies, including Kuiper belt objects	For related content, please see: **SE:** 348-352
(10) Science concepts. The student knows the role of the Sun as the star in our solar system. The student is expected to:	
(A) identify the approximate mass, size, motion, temperature, structure, and composition of the Sun	
(i) identify the approximate mass of the Sun	**SE:** 386-387, 414
(ii) identify the approximate size of the Sun	**SE:** 386-387
(iii) identify the approximate motion of the Sun	**SE:** 386, 389-390, 399, 414

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(iv) identify the approximate temperature of the Sun	**SE:** 386-387, 389-390, 394, 396, 397
(v) identify the approximate structure of the Sun	**SE:** 386-387
(vi) identify the approximate composition of the Sun	**SE:** 393
(B) distinguish between nuclear fusion and nuclear fission, and identify the source of energy within the Sun as nuclear fusion of hydrogen to helium	
(i) distinguish between nuclear fusion and nuclear fission	For related content, please see: **SE:** 407, 408-409, 412, 414
(ii) identify the source of energy within the Sun as nuclear fusion of hydrogen to helium	**SE:** 408-409, 412
(C) describe the eleven-year solar cycle and the significance of sunspots	
(i) describe the eleven-year solar cycle	For related content, please see: **SE:** 399-401, 404, 414
(ii) describe the significance of sunspots	**SE:** 414
(D) analyze solar magnetic storm activity, including coronal mass ejections, prominences, flares, and sunspots	
(i) analyze solar magnetic storm activity, including coronal mass ejections	For related content, please see: **SE:** 402, 403, 414
(ii) analyze solar magnetic storm activity, including prominences	For related content, please see: **SE:** 401, 402, 414
(iii) analyze solar magnetic storm activity, including flares	For related content, please see: **SE:** 401-402, 403, 414
(iv) analyze solar magnetic storm activity, including sunspots	For related content, please see: **SE:** 396-401, 414
(11) Science concepts. The student knows the characteristics and life cycle of stars. The student is expected to:	
(A) identify the characteristics of main sequence stars, including surface temperature, age, relative size, and composition	
(i) identify the characteristics of main sequence stars, including surface temperature	**SE:** 431, 472

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(ii) identify the characteristics of main sequence stars, including age	For related content, please see: **SE:** 472, 473
(iii) identify the characteristics of main sequence stars, including relative size	**SE:** 431
(iv) identify the characteristics of main sequence stars, including composition	This objective can be developed from the following: **SE:** 468-473
(B) characterize star formation in stellar nurseries from giant molecular clouds, to protostars, to the development of main sequence stars	For related content, please see: **SE:** 468-473, 480-481, 488
(C) evaluate the relationship between mass and fusion on the dying process and properties of stars	
(i) evaluate the relationship between mass and fusion on the dying process of stars	For related content, please see: **SE:** 436-440, 442, 492-508, 520
(ii) evaluate the relationship between mass and fusion on the properties of stars	For related content, please see: **SE:** 438-440
(D) differentiate among the end states of stars, including white dwarfs, neutron stars, and black holes	For related content, please see: **SE:** 432-433, 442, 501-502, 514, 518-519, 540-541, 551-552, 568
(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	For related content, please see: **SE:** 431-432, 501-502, 514, 540-541, 551-552
(F) relate the use of spectroscopy in obtaining physical data on celestial objects such as temperature, chemical composition, and relative motion	
(i) relate the use of spectroscopy in obtaining physical data on celestial objects	**SE:** 94
(G) use the Hertzsprung-Russell diagram to plot and examine the life cycle of stars from birth to death	
(i) use the Hertzsprung-Russell diagram to plot the life cycle of stars from birth to death	For related content, please see: **SE:** 471, 472, 473, 488
(ii) use the Hertzsprung-Russell diagram to examine the life cycle of stars from birth to death	For related content, please see: **SE:** 471, 472, 473, 488

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(12) Science concepts. The student knows the variety and properties of galaxies. The student is expected to:	
(A) describe characteristics of galaxies	**SE:** 574, 610, 632
(B) recognize the type, structure, and components of our Milky Way galaxy and location of our solar system within it	
(i) recognize the type of our Milky Way galaxy	**SE:** 574-575, 604-605
(ii) recognize the structure of our Milky Way galaxy	**SE:** 582-585, 588-591
(iii) recognize the components of our Milky Way galaxy	For related content, please see: **SE:** 574-575, 583-585
(iv) recognize the location of our solar system within [the Milky Way Galaxy]	For related content, please see: **SE:** 134-138, 418-420
(C) compare and contrast the different types of galaxies, including spiral, elliptical, irregular, and dwarf	
(i) compare the different types of galaxies, including spiral, elliptical, irregular, and dwarf	For related content, please see: **SE:** 604-609, 610, 632
(ii) contrast the different types of galaxies, including spiral, elliptical, irregular, and dwarf	For related content, please see: **SE:** 604-609, 610, 632
(13) Science concepts. The student knows the scientific theories of cosmology. The student is expected to:	
(A) research and describe the historical development of the Big Bang Theory, including red shift, cosmic microwave background radiation, and other supporting evidence	
(i) research the historical development of the Big Bang Theory, including red shift	For related content, please see: **SE:** 667, 680
(ii) research the historical development of the Big Bang Theory, including cosmic microwave background radiation	For related content, please see: **SE:** 677-679, 680, 701-702
(iii) research the historical development of the Big Bang Theory, including other supporting evidence	For related content, please see: **SE:** 665-667, 675-679, 680
(iv) describe the historical development of the Big Bang Theory, including red shift	**SE:** 680

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(v) describe the historical development of the Big Bang Theory, including cosmic microwave background radiation	**SE:** 680
(vi) describe the historical development of the Big Bang Theory, including other supporting evidence	**SE:** 680
(B) research and describe current theories of the evolution of the universe, including estimates for the age of the universe	
(i) research current theories of the evolution of the universe, including estimates for the age of the universe	For related content, please see: **SE:** 665, 675-677, 680
(ii) describe current theories of the evolution of the universe, including estimates for the age of the universe	For related content, please see: **SE:** 665, 675-677, 680
(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	
(i) research scientific hypotheses of the fate of the universe, including open universes	For related content, please see: **SE:** 671
(ii) research scientific hypotheses of the fate of the universe, including closed universes	For related content, please see: **SE:** 670
(iii) research scientific hypotheses of the fate of the universe, including the role of dark matter	For related content, please see: **SE:** 672, 680
(iv) research scientific hypotheses of the fate of the universe, including the role of dark energy	For related content, please see: **SE:** 674, 675-677
(v) describe scientific hypotheses of the fate of the universe, including open universes	For related content, please see: **SE:** 671
(vi) describe scientific hypotheses of the fate of the universe, including closed universes	For related content, please see: **SE:** 670
(vii) describe scientific hypotheses of the fate of the universe, including the role of dark matter	**SE:** 680

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(viii) describe scientific hypotheses of the fate of the universe, including the role of dark energy	For related content, please see: **SE:** 674-677
(14) Science concepts. The student recognizes the benefits and challenges of space exploration to the study of the universe. The student is expected to:	
(A) identify and explain the contributions of human space flight and future plans and challenges	
(i) identify the contributions of human space flight	**SE:** 190-191
(ii) identify future [human space flight] plans	**SE:** 190-191
(iii) identify [human space flight] challenges	**SE:** 190-191
(iv) explain the contributions of human space flight	For related content, please see: **SE:** 190-191
(v) explain [human space flight] future plans	For related content, please see: **SE:** 190-191
(vi) explain [human space flight] challenges	For related content, please see: **SE:** 190-191
(B) recognize the advancement of knowledge in astronomy through robotic space flight	**SE:** 141-146, 152
(C) analyze the importance of ground-based technology in astronomical studies	For related content, please see: **SE:** 98-120, 128, 389
(D) recognize the importance of space telescopes to the collection of astronomical data across the electromagnetic spectrum	For related content, please see: **SE:** 126
(E) demonstrate an awareness of new developments and discoveries in astronomy	
(i) demonstrate an awareness of new developments in astronomy	For related content, please see: **SE:** 144-145, 391, 503, 524-525, 555, 580, 590, 653, 676
(ii) demonstrate an awareness of new discoveries in astronomy	For related content, please see: **SE:** 161, 190-191, 248-249, 268-269, 270, 301, 338-339, 404, 475, 486, 507, 566

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