PLANNED INSTRUCTION

A PLANNED COURSE FOR:

Astronomy

Curriculum writing committee:

Robert E. Curtis, Jr. P.E.

Grade Level:

10, 11, & 12

Date of Board Approval: ____2021_____

Course Weighting: Astronomy

Major Assessments (Tests, Common Assessments)	45 % (4-5 per marking period)
Skills Application (Labs)	30 % (4-5 per marking period)
Skills Practice (Activities, Homework)	20 % (16-18 per marking period)
Participation	5 %
Total	100 %

Curriculum Map

Overview:
Astronomy is a one semester, ½ credit, introductory astronomy course for grades 10,11, and 12. The course introduces astronomy with a concentration on the makeup of our solar system and the methods and tools of astronomical investigation. Emphasis will be on the motions, make-up, evolution, and properties of the Sun, the Moon, and the planets, and historical development of astronomy as a human endeavor. Studies telescopes, astronomical instruments, light and the electromagnetic spectrum. Addresses asteroids, comets, and meteoroids, and ideas in stellar evolution, galaxy configurations, and modern cosmology. One or more observing nights will be held, weather permitting. College credit available through Keystone College.

Goals:
Astronomy is the branch of science dedicated to the study of everything in the universe on size scales from the incredibly tiny to the unimaginably large. The main goal of this course is to provide students with an introductory overview of astronomy to spark a continuing interest in astronomy and encourage further study of astronomy on a college level or individual basis. Other goals of the course include having students develop an understanding and appreciation for how astronomers gather and interpret data from celestial bodies through the use of telescopes and probes sent to these bodies, acquire an understanding of current thought on explaining astronomical phenomena, appreciate that astronomy is a vibrant field with new discoveries happening every day, and be able to perform basic astronomical observations themselves. Specifically, the course will address the charting of the heavens, ancient astronomy to the Copernican revolution, the modern study of radiation from objects in space – spectroscopy -, the tools of astronomy, planets, and the Sun. In addition, we will study our solar system, as well as the possibility of planetary systems beyond our own. To a lesser extent, interstellar medium, stars and stellar evolution, galaxies, dark matter, cosmology, and the possibility of life in the universe will also be considered.

Specifically, the concepts to be covered by marking period are as follows:

MP1/3: Charting the Heavens, The Copernican Revolution, Radiation, Spectroscopy, Telescopes

MP2/4: The Solar System, Planetology, Stars and Stellar Evolution, Galaxies and Cosmology

Big Ideas:

BIG IDEA 1: Matter can be understood in terms of the types of atoms present and the interactions both between and within atoms.

BIG IDEA 2: Interactions between any two objects can cause changes in one or both of them.

BIG IDEA 3: Interactions of objects or systems of objects can be predicted and explained using the concept of energy transfer and conservation.

BIG IDEA 4: Waves are a repeating pattern of motion that transfers energy from place to place without overall displacement of matter.

Textbook and Supplemental Resources:

Chaisson, McMillan (2014). Astronomy Today. 8th Edition. New York, NY: Pearson.

Pearson. "Personalize the Teaching and Learning Experience." *Pearson*, www.pearsonmylabandmastering.com/masteringastronomy/.

PhET Interactive Physics Simulations, University of Colorado Boulder. https://phet.colorado.edu/en/simulations/category/physics

Stellarium Astronomy Software. stellarium.org

NASA's Eyes Software. https://eyes.nasa.gov/

Activities in Planetary Geology for the Physical and Earth Sciences. https://www.nasa.gov/stem-ed-resources/planetary-geology.html

Curriculum Plan

Unit 1: Charting the Heavens: The Foundations of Astronomy Time/Days (14 days)

Standards (by number): 3.2.P.B2, 3.2.10.B6, 3.2.P.B6, 3.2.12.B6, 3.2.7.B7, 3.2.P.B7, 3.2.12.B7, 3.3.10.B1, 3.3.12.B1, 3.3.10.B2, CC.3.5.9-10.A., CC 3.5.11-12.A, CC.3.5.9-10.B, CC.3.5.11-12.B, CC.3.5.9-10.C, CC.3.5.11-12.C, CC.3.5.9-10.D, CC3.5.11-12.D, CC.3.5.9-10.E, CC.3.5.11-12.E.

Anchors: A1.1.1.1, A1.1.1.3

Eligible Content: Chapter 1 of textbook: Charting the Heavens: Our Place in Space, Scientific Theory and the Scientific Method, The "Obvious" View, Earth's Orbital Motion, The Motion of the Moon, The Measurement of Distance.

Objectives: Students shall:

- Arrange the basic levels of structure in the universe in order of increasing size. (DOK level 1)
- Distinguish among scientific theories, hypotheses, and observations, and describe how scientists combine observation, theory, and testing in their study of the universe. (DOK level 2)
- Describe the celestial sphere and explain how astronomers use constellations and angular measurement to locate objects in the sky. (DOK level 2)
- Describe how and why the Sun and the stars appear to change their positions from night to night and from month to month. (DOK level 3)
- Explain how Earth's axial tilt causes the seasons, and why the seasons change over time. (DOK level 3)
- Account for the changing appearance of the Moon, and explain how the relative motions of Earth, the Sun, and the Moon lead to eclipses. (DOK level 3)
- Give an example of how simple geometric reasoning can be used to measure the distances and sizes of otherwise inaccessible objects. (DOK level 4)

Core Activities and Corresponding Instructional Methods:

- "Scale of Universe" Activity
- Reading of Chapter 1 in Textbook
- Direct Instruction (lecture with fill-in note pages for student completion)
- Online Chapter 1 Independent Practice and Review through the Pearson Mastering Astronomy website
- "Introduction to Stellarium" Activity and "Angular Size", "Lunar and Solar Eclipses", "Moon Phases: Modeling and Testing", "Northern Sky, Southern Sky: Navigation by Stars", and "Seasonal Stars: What Stars are Visible Each Night through the Seasons?" Stellarium Labs on the Pearson Mastering Astronomy website
- "Modeling Moon's Motion" Lab
- "Angle of Insolation" Activity

Assessments:

- Diagnostic: Teacher observations and questioning
- Formative: student responses to independent practice, labs, and activities
- Summative: Unit 1 Test; Lab

Unit 2: The Copernican Revolution: The Birth of Modern Science Time/Days (8 days)

Standards (by number): 3.2.10.B1, 3.2.10.B6, 3.2.P.B6, 3.2.12.B6, 3.2.7.B7, 3.2.P.B7, 3.2.12.B7, 3.3.10.B1, 3.3.12.B1, 3.3.10.B2, CC.3.5.9-10.A., CC 3.5.11-12.A, CC.3.5.9-10.B, CC.3.5.11-12.B, CC.3.5.9-10.C, CC.3.5.11-12.C, CC.3.5.9-10.D, CC3.5.11-12.D, CC.3.5.9-10.E, CC.3.5.11-12.E.

Anchors: A1.1.1.1, A1.1.1.3, A1.2.1.1

Eligible Content: Chapter 2 of textbook: Ancient Astronomy, The Geocentric Universe, The Heliocentric Model of the Solar System, The Birth of Modern Astronomy, The Laws of Planetary Motion, The Dimensions of the Solar System, Newton's Laws, Newtonian Mechanics

Objectives: Students shall:

- Describe how some ancient civilizations attempted to explain the heavens in terms of Earth-centered models of the Universe. (DOK Level 1)
- Explain how the observed motions of the planets led to our modern view of the Sun-centered solar system. (DOK Level 3)
- Describe the major contributions of Galileo and Kepler to our understanding of the solar system. (DOK Level 1)
- State Kepler's Laws of planetary motion. (DOK Level 1)
- Explain how astronomers have measured the true size of the solar system. (DOK Level 2)
- State Newton's laws of motion and universal gravitation and explain how they account for Kepler's Laws. (DOK Levels 1 & 3)
- Explain how the law of gravitation enables us to measure the masses of astronomical bodies. (DOK Level 4)

Core Activities and Corresponding Instructional Methods:

- "Ellipses and Eccentricity" Activity
- Reading of Chapter 2 in Textbook
- Direct Instruction (lecture with fill-in note pages for student completion)
- Online Chapter 2 Independent Practice and Review through the Pearson Mastering Astronomy website
- "Retrograde Mars", "Retrograde Motion", "Transit of Venus", and "Kepler's Second Law" Stellarium Labs on the Pearson Mastering Astronomy website
- "Gravity and Orbits" Lab

Assessments:

- Diagnostic: Teacher observations and questioning
- Formative: student responses to independent practice, labs, and activities
- Summative: Unit 2 Test; Lab

Unit 3: Radiation: Information from the Cosmos Time/Days (8 days)

Standards (by number): 3.2.10.B5, 3.2.P.B5, 3.2.10.B6, 3.2.P.B6, 3.2.12.B6, 3.2.7.B7, 3.2.P.B7, 3.2.12.B7, 3.3.10.B2, CC.3.5.9-10.A., CC 3.5.11-12.A, CC.3.5.9-10.B, CC.3.5.11-12.B, CC.3.5.9-10.C, CC.3.5.11-12.C, CC.3.5.9-10.D, CC3.5.11-12.D, CC.3.5.9-10.E, CC.3.5.11-12.E.

Anchors: A1.1.1.1, A1.1.1.3

Eligible Content: Chapter 3 of textbook: Information from the Stars, Waves in What? Electromagnetic Spectrum, Thermal Radiation, The Doppler Effect

Objectives: Students shall:

- Outline the basic properties of wave motion. (DOK Level 1)
- Tell how electromagnetic radiation transfers energy and information through interstellar space. (DOK Level 3)
- Describe the major regions of the electromagnetic spectrum and explain how Earth's atmosphere affects our ability to make astronomical observations at different wavelengths. (DOK Levels 1 & 2)
- Explain what is meant by the term "blackbody radiation" and describe the basic properties of such radiation. (DOK Levels 1 & 2)
- Tell how we can determine the temperature of an object by observing the radiation it emits. (DOK Level 2)
- Describe how the relative motion between a source of radiation and its observer can change the perceived wavelength of radiation and explain the importance of this phenomenon to astronomy. (DOK Level 3)

Core Activities and Corresponding Instructional Methods:

- "Blackbody Spectrum" Activity
- Reading of Chapter 3 in Textbook
- Direct Instruction (lecture with fill-in note pages for student completion)
- Online Chapter 3 Independent Practice and Review through the Pearson Mastering Astronomy website
- "Star Velocity Lab" on the Pearson Mastering Astronomy website
- "Exploring Light and Temperature" Lab

Assessments:

- Diagnostic: Teacher observations and questioning
- Formative: student responses to independent practice, labs, and activities
- Summative: Unit 3 Test; Lab

Unit 4: Spectroscopy: The Inner Workings of Atoms Time/Days (10 days)

Standards (by number): 3.2.10.B5, 3.2.P.B5, 3.2.10.B6, 3.2.P.B6, 3.2.12.B6, 3.2.7.B7, 3.2.P.B7, 3.2.12.B7, 3.3.10.B2, CC.3.5.9-10.A., CC 3.5.11-12.A, CC.3.5.9-10.B, CC.3.5.11-12.B, CC.3.5.9-10.C, CC.3.5.11-12.C, CC.3.5.9-10.D, CC3.5.11-12.D, CC.3.5.9-10.E, CC.3.5.11-12.E.

Anchors: A1.1.1.1, A1.1.1.3

Eligible Content: Chapter 4 of textbook: Spectral Lines, Atoms and Radiation, The Formation of Spectral Lines, Molecules, Spectral-Line Analysis.

Objectives: Students shall:

- Describe the characteristics of continuous, emission, and absorption spectra and the conditions under which each is produced. (DOK Level 1)
- Explain the relation between emission and absorption lines and say what we can learn from those lines. (DOK Level 3)
- Specify the basic components of the atom and describe our modern conception of its structure. (DOK Levels 1 & 3)
- Outline the observations that led scientists to conclude that light has particle as well as wave properties. (DOK Level 2)
- Explain how electron transitions within atoms produce unique emission and absorption features in the spectra of those atoms. (DOK Level 3)
- Describe the general features of spectra produced by these molecules. (DOK Level 2)
- List and explain the kinds of information that can be obtained by analyzing the spectra of astronomical objects. (DOK Level 4)

Core Activities and Corresponding Instructional Methods:

- "PHeT Atomic Models and Spectroscopes" Activity
- Reading of Chapter 4 in Textbook
- Direct Instruction (lecture with fill-in note pages for student completion)
- Online Chapter 4 Independent Practice and Review through the Pearson Mastering Astronomy website
- "The Electromagnetic Spectrum" Lab

Assessments:

- Diagnostic: Teacher observations and questioning
- Formative: student responses to independent practice, labs, and activities
- Summative: Unit 4 Test; Lab

Unit 5: Telescopes: The Tools of Astronomy Time/Days (11 days)

Standards (by number): 3.2.10.B5, 3.2.12.B5, 3.2.P.B5, 3.2.10.B6, 3.2.P.B6, 3.2.12.B6, 3.2.7.B7, 3.2.P.B7, 3.2.12.B7, 3.3.10.B2, CC.3.5.9-10.A., CC 3.5.11-12.A, CC.3.5.9-10.B, CC.3.5.11-12.B, CC.3.5.9-10.C, CC.3.5.11-12.C, CC.3.5.9-10.D, CC3.5.11-12.D, CC.3.5.9-10.E, CC.3.5.11-12.E.

Anchors: A1.1.1.1, A1.1.1.3

Eligible Content: Chapter 5 of textbook: Optical Telescopes, Telescope Size, Images and Detectors, High-Resolution Astronomy, Radio Astronomy, Interferometry, Space-Based Astronomy, Full-Spectrum Coverage.

Objectives: Students shall:

- Sketch how optical telescopes work and specify the advantages of reflecting telescopes over refractors. (DOK Level 3)
- Explain why larger telescopes gather more light and can make more detailed images. (DOK Level 3)
- Outline the purpose of some of the detectors used in astronomical telescopes. (DOK Level 2)
- Describe how Earth's atmosphere limits astronomical observations, and how astronomers overcome these limitations. (DOK Level 2)
- List some relative advantages and disadvantages of radio and optical astronomy. (DOK Level 1)
- Explain how interferometry is used to improve astronomical observations. (DOK Level 2)
- Describe the design of infrared, ultraviolet, and high-energy telescopes, and explain why some telescopes must be placed in space. (DOK Level 2)
- Say why it is important to make astronomical observations at many different wavelengths across the electromagnetic spectrum. (DOK Level 4)

Core Activities and Corresponding Instructional Methods:

- "PHeT Atomic Models and Spectroscopes" Activity
- Reading of Chapter 5 in Textbook
- Direct Instruction (lecture with fill-in note pages for student completion)
- Online Chapter 5 Independent Practice and Review through the Pearson Mastering Astronomy website
- "Working With Our Telescopes" Lab

Assessments:

- Diagnostic: Teacher observations and questioning
- Formative: student responses to independent practice, labs, and activities
- Summative: Unit 5 Test; Lab

Unit 6: The Solar System: Comparative Planetology and Formation Models Time/Days (11 days)

Standards (by number): 3.2.10.B1, 3.2.12.B1, 3.2.P.B2, 3.2.10.B6, 3.2.P.B6, 3.2.12.B6, 3.2.7.B7, 3.2.P.B7, 3.2.12.B7, 3.3.10.B1, 3.3.12.B, CC.3.5.9-10.A., CC 3.5.11-12.A, CC.3.5.9-10.B, CC.3.5.11-12.B, CC.3.5.9-10.C, CC.3.5.11-12.C, CC.3.5.9-10.D, CC3.5.11-12.D, CC.3.5.9-10.E, CC.3.5.11-12.E.

Anchors: A1.1.1.1, A1.1.1.3

Eligible Content: Chapter 6 of textbook: An Inventory of the Solar System, Measuring the Planets, The Overall Layout of the Solar System, Terrestrial and Jovian Planets, Interplanetary Matter, How Did the Solar System Form? Jovian Planets and Planetary Debris.

Objectives: Students shall:

- Explain the importance of comparative planetology to solar system studies. (DOK Level 2)
- Describe the overall scale and structure of the solar system. (DOK Level 1)
- Summarize the basic differences between the terrestrial and the Jovian planets. (DOK Level 1)
- Identify and describe the major non-planetary components of the solar system. (DOK Level 1)
- Outline the theory of solar system formation that accounts for the overall properties of our planetary system. (DOK Level 3)
- Explain how the terrestrial planets formed. (DOK Level 3)
- Contrast the leading theories for the formation of the Jovian worlds. (DOK Level 4)
- Describe how comets and asteroids formed and explain their role in determining planetary properties. (DOK Level 3)

Core Activities and Corresponding Instructional Methods:

- "Dimensions of the Solar System" Activity
- Reading of Chapter 6 in Textbook
- Direct Instruction (lecture with fill-in note pages for student completion)
- Online Chapter 6 Independent Practice and Review through the Pearson Mastering Astronomy website
- "How to Build a Planet" Lab

Assessments:

- Diagnostic: Teacher observations and questioning
- Formative: student responses to independent practice, labs, and activities
- Summative: Unit 6 Test; Lab

Unit 7: Planetology: Planets of Our Solar System and Exoplanets Time/Days (14 days)

Standards (by number): 3.2.10.B2, 3.2.10.B3, 3.2.P.B3, 3.2.10.B6, 3.2.P.B6, 3.2.12.B6, 3.2.7.B7, 3.2.P.B7, 3.2.12.B7, 3.3.10.A1, 3.3.12.A1, 3.3.12.A4, 3.3.10.B1, 3.3.12.B, CC.3.5.9-10.A., CC 3.5.11-12.A, CC.3.5.9-10.B, CC.3.5.11-12.B, CC.3.5.9-10.C, CC.3.5.11-12.C, CC.3.5.9-10.D, CC3.5.11-12.D, CC.3.5.9-10.E, CC.3.5.11-12.E.

Anchors: A1.1.1.1, A1.1.1.3

Eligible Content: Chapter 7-15 of textbook: Earth: Our Home in Space, The Moon and Mercury: Scorched and Battered Worlds, Venus: Earth's Sister Planet, Mars: A Near Miss for Life? Jupiter: Giant of the Solar System, Saturn: Spectacular Rings and Mysterious Moons, Uranus and Neptune: The Outer Worlds of the Solar System, Solar System Debris: Keys to Our Origin, Exoplanets: Planetary Systems Beyond Our Own.

Objectives: Students shall:

- Summarize the physical properties of our planet Earth. (DOK Level 1)
- Summarize the evidence for the phenomenon of "continental drift". (DOK Level 3)
- Describe the nature and origin of Earth's atmosphere. (DOK Level 2)
- Specify the general characteristics of the Moon and Mercury and compare them with those of Earth. (DOK Level 3)
- Summarize Venus's general orbital and physical properties. (DOK Level 1)
- Describe the characteristics of Venus's atmosphere and contrast it with that of Earth. (DOK Level 3)
- Explain why the greenhouse effect has produced conditions on Venus very different from Earth. (DOK Level 4)
- Summarize the general orbital and physical properties of Mars. (DOK Level 1)
- Present evidence that Mar once had a much denser atmosphere and running water on its surface. (DOK Level 4)
- Specify the ways in which Jupiter differs from the terrestrial planets in its physical and orbital properties. (DOK Level 3)
- Describe Jupiter's internal structure and composition and explain how their properties are inferred from external measurements. (DOK Level 3)
- List the orbital and physical properties of the Galilean moons of Jupiter and describe the appearance and interior structure of each. (DOK Level 1)
- Summarize the orbital and physical properties of Saturn and compare them with those of Jupiter. (DOK Level 3)
- Describe the composition and structure of Saturn's atmosphere and interior. (DOK Level 1)
- Summarize the general characteristics of Titan and discuss the chemical processes in its atmosphere. (DOK Level 1)
- Summarize the similarities and differences between Uranus and Neptune and compare these planets with the other two Jovian worlds. (DOK Level 3)
- Describe the orbital properties of the major groups of asteroids. (DOK Level 1)
- Summarize the composition and physical properties of a typical asteroid. (DOK Level 1)

- Detail the composition and structure of a typical comet and explain the formation and appearance of its tail. (DOK Level 1)
- Describe the solar system beyond Neptune and explain why astronomers no longer regard Pluto as a planet. (DOK Level 2)
- Describe some techniques astronomers use to detect planets beyond our solar system. (DOK Level 4)
- Outline the properties of known extrasolar planets and list some categories of exoplanet not found in the solar system. (DOK Level 2)

Core Activities and Corresponding Instructional Methods:

- "Introduction to Our Solar System with NASA's Eyes Software" Activity
- Reading of highlights of Chapters 7 to 15 in Textbook
- Direct Instruction (lecture with fill-in note pages for student completion)
- Online Chapter 7-15 Independent Practice and Review through the Pearson Mastering Astronomy website
- "Mass of Jupiter" Stellarium Lab on the Pearson Mastering Astronomy website
- "Planets in Stereo" Lab

Assessments:

- Diagnostic: Teacher observations and questioning
- Formative: student responses to independent practice, labs, and activities
- Summative: Unit 7 Test; Lab

Unit 8: Stars and Stellar Evolution Time/Days (10 days)

Standards (by number): 3.2.10.B1, 3.2.P.B1, 3.2.12.B1, 3.2.10.B2, 3.2.P.B2, 3.2.10.B3, 3.2.P.B3, 3.2.10.B6, 3.2.P.B6, 3.2.12.B6, 3.2.7.B7, 3.2.P.B7, 3.2.12.B7, 3.3.10.B1, 3.3.12.B1, CC.3.5.9-10.A., CC 3.5.11-12.A, CC.3.5.9-10.B, CC.3.5.11-12.B, CC.3.5.9-10.C, CC.3.5.11-12.C, CC.3.5.9-10.D, CC3.5.11-12.D, CC.3.5.9-10.E, CC.3.5.11-12.E.

Anchors: A1.1.1.1, A1.1.1.3, A1.2.1.1

Eligible Content: Chapter 16-22 of textbook: The Sun, The Stars, The Interstellar Medium, Star Formation, Stellar Evolution, Stellar Explosions, Neutron Stars and Black Holes

Objectives: Students shall:

- Summarize the overall properties and internal structure of the Sun. (DOK Level 2)
- List and describe the outer layers of the Sun. (DOK Level 1)
- List the various types of solar activity and explain their relationship to solar magnetism. (DOK Levels 1 & 3)
- Outline the process by which energy is produced in the Sun's interior. (DOK Level 3)
- Explain how stellar distances are determined. (DOK Level 4)
- Distinguish between luminosity and apparent brightness and explain how stellar luminosity is determined. (DOK Level 3)
- Explain the usefulness of classifying stars according to their colors, surface temperatures, and spectral characteristics. (DOK Level 2)
- Describe how a Hertzsprung-Russell diagram is used to identify stellar properties. (DOK Level 2)
- Explain how stellar mass is related to other stellar properties. (DOK Level 3)
- Summarize the composition and physical properties of the interstellar medium. (DOK Level 1)
- Summarize the sequence of events leading to the formation of a star like our Sun. (DOK Level 2)
- Explain how the formation of a star depends on its mass. (DOK Level 3)
- Explain why stars evolve off the main sequence. (DOK Level 2)
- Outline the events that occur as a Sun-like star evolves from the main sequence to the giant branch. (DOK Level 2)
- Explain how the Sun will eventually come to fuse helium in its core and describe what happens when that occurs. (DOK Level 3)
- Summarize the stages in the death of a typical low-mass star and describe the resulting remnant. (DOK Level 2)
- Contrast the evolutionary histories of high-mass and low-mass stars. (DOK Level 3)
- Explain how the evolution of stars in binary systems may differ than that of isolated stars. (DOK Level 3)
- Explain how white dwarfs in binary-star systems can become explosively active. (DOK Level 2)
- Summarize the sequence of events leading to the violent death of a massive star. (DOK Level 2)
- Describe the two types of supernovae and explain how each is produced. (DOK Level 1)
- Explain the origin of elements heavier than helium and discuss the significance of these elements for the study of stellar evolution. (DOK Level 4)
- Describe the properties of neutron stars and explain how these strange objects are formed. (DOK Level 3)

- Describe how black holes are formed and discuss their effects on matter and radiation in their vicinity. (DOK Level 3)

Core Activities and Corresponding Instructional Methods:

- "Life Cycle of Stars" Activity from Adler Planetarium
- Reading of highlights of Chapters 16 to 22 in Textbook
- Direct Instruction (lecture with fill-in note pages for student completion)
- Online Chapter 16-22 Independent Practice and Review through the Pearson Mastering Astronomy website

Assessments:

- Diagnostic: Teacher observations and questioning
- Formative: student responses to independent practice, labs, and activities
- Summative: Unit 8 Test; Lab

Unit 9: Galaxies and Cosmology Time/Days (4 days)

Standards (by number): 3.2.10.B6, 3.2.P.B6, 3.2.12.B6, 3.2.7.B7, 3.2.P.B7, 3.2.12.B7, 3.3.10.B1, 3.3.12.B1, CC.3.5.9-10.A., CC 3.5.11-12.A, CC.3.5.9-10.B, CC.3.5.11-12.B, CC.3.5.9-10.C, CC.3.5.11-12.C, CC.3.5.9-10.D, CC3.5.11-12.D, CC.3.5.9-10.E, CC.3.5.11-12.E.

Anchors: A1.1.1.1, A1.1.1.3

Eligible Content: Chapter 23-28 of textbook: The Milky Way Galaxy, Galaxies, Galaxies and Dark Matter, Cosmology, The Early Universe, Life in the Universe

Objectives: Students shall:

- Describe the overall structure of the Milky Way Galaxy and say how the various regions differ from each other. (DOK Levels 2 &3)
- Describe the evidence for a supermassive black hole at the center of our Galaxy. (DOK Level 3)
- Outline the distance-measurement techniques that enable astronomers to map the universe beyond the Milky Way. (DOK Level 2)
- State Hubble's Law and explain how it is used to derive distances to the most remote objects in the observable universe. (DOK Level 2)
- Specify the basic differences between active and normal galaxies. (DOK Level 3)
- Explain why astronomers think that most of the matter in the universe is dark. (DOK Level 3)
- Describe the Big Bang theory of the expanding universe. (DOK Level 2)
- Summarize the various probabilities used to estimate the number of advanced civilizations that might exist in the Galaxy. (DOK Level 2)

Core Activities and Corresponding Instructional Methods:

- Reading of highlights of Chapters 23 to 28 in Textbook
- Direct Instruction (lecture with fill-in note pages for student completion)

Assessments:

- Diagnostic: Teacher observations and questioning

Checklist to Complete and Submit:

(Scan and email)

_____ **Copy of the curriculum using the template entitled "Planned Instruction," available on the district website.**

_____ **The primary textbook form(s).**

_____ **The appropriate payment form, in compliance with the maximum curriculum writing hours noted on the first page of this document.**

Each principal and/or department chair has a schedule of First and Second Readers/Reviewers. Each Reader/Reviewer must sign & date below.

First Reader/Reviewer Printed Name_____

First Reader/Reviewer Signature_____ Date_____

Second Reader/Reviewer Printed Name_____

Second Reader/Reviewer Signature _____ Date_____