Astronomy 2024 Cover Page

Content Area: **Science**
Course(s): **Astronomy (s)**
Time Period: **1st Semester**
Length:
Status: **Not Published**

Course Overview

The goal of the Astronomy course is to provide students with the scientific principles, concepts, and methodologies required to understand the foundation of Astronomy and the Universe, our Planetary System, Stars and Stellar Evolution, and Galaxies and Cosmology. Astronomy is one of the oldest sciences and is part of every culture's history and roots. In the past, it has been used to measure time, mark the seasons, and navigate the oceans. We use astronomy to understand the universe and our place in it.

Course Name, Length, Date of Revision and Curriculum Writer

Astronomy

Half Year

08/27/24

Emily Koester

Table of Contents

Astronomy Unit 1: Astronomy and the Universe

Content Area: **Science**
Course(s): **Astronomy (s)**
Time Period: **1st Semester**
Length: **3 weeks**
Status: **Awaiting Review**

Summary of the Unit

The unit describes the study of the universe and foundations of Astronomy. It explores the progression of Modern Science through the contributions of several astronomers. It also helps us understand how radiation allows us to gather information from the cosmos and how astronomers use telescopes and other tools of Astronomy to make discoveries.

Enduring Understandings

Astronomy is one of the oldest sciences and is part of every culture's history and roots. In the past, it has been used to measure time, mark the seasons, and navigate the oceans. We use astronomy to understand the universe and our place in it. Space is filled with many different kinds of invisible radiation and by studying this, astronomers are able to study stars and other distant objects. Using telescopes allows us to detect objects much farther away than we could perceive with our unaided eyes.

Essential Questions

The Foundations of Astronomy Big Question: Are there other planets around some of the billions of stars in our Galaxy? Are there intelligent beings on some of those planets?

The Copernican Revolution Big Question: Scientists are beginning to grapple with the notion that other (unknown) forces may dominate the universe on the largest scales. Will relativity be replaced by a new paradigm?

Radiation Big Question: Can anything travel faster than light?

Telescopes Big Question: Today, astronomers are opening new, non-electromagnetic windows, in the form of neutrinos and gravitational radiation. What will we learn from them, and are there other, as yet unknown, channels still awaiting discovery?

Summative Assessment and/or Summative Criteria

- Quarterly Assessment

- Project Rubrics

- Tests/Quizzes

Resources

- Textbook: Astronomy Today 9e by Chaisson and McMillan

- Supplemental Textbook

- Worksheets

- Science videos

- Achieve 3000

- Discovery Education

- Simulations

- Labs

- Brain Pop

- Blooket

Topic/Selection Timeframe	General Objectives	Instructional Activities	Benchmarks/Assessments
The Foundations of Astronomy (5-7 days)	Distinguish among scientific theories, hypotheses, predictions, and observations, and describe how scientists combine observation, theory, and testing, in their study of the universe. Explain how	Play a game to distinguish whether the statement is a hypothesis, prediction, scientific theory, or observation. Collaboratively discuss why we have seasonal changes. Zodiac Drawing Lunar Phase	Analysis Questions Lunar Phase Model Unit Test

	Earth's axial tilt causes the seasons, and why the seasons change over time as Earth processes. Create a model of the Lunar Phases	Cookie Model	
The Copernican Revolution: The Birth of Modern Science (5 days)	Describe the major contributions of Copernicus, Galileo, Brahe, and Kepler to our understanding of the solar system. Compare the geocentric and heliocentric views of the solar system. State Kepler's Laws. Explain how Newton's Laws of motion and universal gravitation account for Kepler's laws. Explain how the law of gravitation	Graphic Organizer of the astronomers. Class discussion about the Copernican revolution and the difference between the geocentric and heliocentric model. Draw an ellipse and discuss how the shape of the ellipse changes as you vary the distance between the pins. Guided reading and textbook questions.	Graphic Organizer Analysis Questions Guided reading questions Section Quiz Unit Test

	enables us to predict motions and measure the masses of astronomical bodies. Determine how the Doppler effect would be useful in determining the masses of the stars.		
Radiation: Information from the Cosmos (1-2 days)	Outline the basic properties of wave motion. Explain how electromagnetic radiation transfers energy and information through interstellar space. Describe the major regions of the electromagnetic spectrum. Justify how the Doppler effect would be useful in determining the masses of stars.	Analysis Questions Poster or PowerPoint depicting the Electromagnetic Spectrum Doppler Effect Video Doppler Effect Activity	Analysis Questions Electromagnetic Spectrum Poster/Powerpoint Doppler Effect Activity Unit Test

The Tools of Astronomy (1-2 days)	Sketch how optical telescopes collect and focus light, and specify the advantages of reflecting telescopes over refractors. Explain the relationship between a telescope's size, light-gathering power, and resolving power. Compare radio and optical astronomy. Explain why it is important to make astronomical observations at many different wavelengths across the electromagnetic spectrum.	Refraction and Reflection Lab with Drawings Class Discussion Pros and Cons List of Radio and Optical Astronomy	Refraction and Reflection Lab Tools of Astronomy Quiz Unit Test

Standards

LA.SL.8.5	Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.
LA.SL.11-12.4	Present information, findings and supporting evidence clearly, concisely, and logically. The content, organization, development, and style are appropriate to task, purpose, and audience.
LA.RST.11-12.1	Accurately cite strong and thorough evidence from the text to support analysis of science

	and technical texts, attending to precise details for explanations or descriptions.
LA.RST.11-12.8	Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.
LA.WHST.9-10.1	Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant sufficient textual and non-textual evidence.
LA.WHST.9-10.2	Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
MA.K-12.2	Reason abstractly and quantitatively.
SCI.HS.PS4.B	Electromagnetic Radiation
SCI.HS.ESS1.B	Earth and the Solar System
SCI.HS-ESS1-4	Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.
SCI.HS-ESS1-1	Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun's core to release energy that eventually reaches Earth in the form of radiation.
SCI.HS-ESS1	Earth's Place in the Universe
SCI.HS-ESS1-6	Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth's formation and early history.
SCI.HS-ESS1-2	Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe.
SCI.MS-ESS1-2	Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.
	Energy cannot be created or destroyed—only moved between one place and another place, between objects and/or fields, or between systems.
	Algebraic thinking is used to examine scientific data and predict the effect of a change in one variable on another (e.g., linear growth vs. exponential growth).
	Mathematical representations for the gravitational attraction of bodies and Kepler's Laws of orbital motions should not deal with more than two bodies, nor involve calculus.
	Scale, Proportion, and Quantity
	Emphasis is on Newtonian gravitational laws governing orbital motions, which apply to human-made satellites as well as planets and moons.
	Kepler's laws describe common features of the motions of orbiting objects, including their elliptical paths around the sun. Orbits may change due to the gravitational effects from, or collisions with, other objects in the solar system.
	Energy and Matter

Suggested Modifications for Special Education, ELL and Gifted Students

Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.; Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling). Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).; Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.; Use project-based science learning to connect science with observable phenomena.; Provide ELL students with multiple literacy

strategies. Collaborate with after-school programs or clubs to extend learning opportunities.

*Consistent with individual plans, when appropriate.

Suggested Technological Innovations/Use

- Google Classroom

- Google Drive

- CK-12

- NASA.gov resources

- Web Quests

- Virtual labs

- Simulations

- Discovery Education

- Blooket

- Kahoot

- Quizlet

Cross Curricular/Career Readiness, Life Literacies and Key Skills Practice

9.1 21st Century Life and Career Skills: All students will demonstrate the creative, critical thinking, collaboration, and problem-solving skills needed to function successfully as both global citizens and workers in diverse ethnic and organizational cultures.

9.3 21st Century Life and Career Skills: Career Awareness, Exploration, and Preparation: All students will apply knowledge about and engage in the process of career awareness, exploration, and preparation in order to navigate the globally competitive work environment of the information age.

UDL Framework

In this Astronomy and the Universe unit designed using the UDL framework, students will first encounter clear and attainable outcomes that highlight the universe and foundations of Astronomy. Their diverse needs,

backgrounds, strengths, and barriers will be anticipated, ensuring that all students can access and engage with the material. They will experience instructional activities tailored to include presentations, interactive simulations, and group discussions. Students will have multiple ways to demonstrate their understanding through projects, presentations, and written reflections as part of the assessment plan. Lastly, ongoing reflection and adaptation will ensure that instructional strategies remain effective, inclusive, and aligned with students needs and overall learning goals.

Astronomy Unit 2: Our Planetary System

Content Area: **Science**
Course(s): **Astronomy (s)**
Time Period: **1st Semester**
Length: **4 weeks**
Status: **Awaiting Review**

Summary of the Unit

The unit describes the overall structure of the Solar System, and the differences between the Terrestrial and Jovian planets. It outlines the six main regions of Earth's interior, as well as its atmosphere, and magnetosphere. The general characteristics of the moon are covered, while also comparing its surface to Mercury. The general orbit and physical properties of the Terrestrial planets and Jovian planets are summarized. The unit also dives into Exoplanets and Solar System debris, which explains the differences between comets, asteroids, meteors, meteoroids, and meteorites.

Enduring Understandings

The solar system is made up of gravitationally interacting bodies, including Earth and the Moon. The planets orbit around the sun in an elliptical path, due to the force of Gravity. The Earth's position, motion, and posture account for a variety of cyclic events observable from Earth, such as day and night. The moon has different phases that repeat in a sequencing cycle, and the relationship between the Earth, the Sun, and the Moon causes these phases.

Essential Questions

The Solar System Big Question: How common or different is our solar system of planets compared to all those planets orbiting other stars in the universe?

Earth Big Question: Not long after Earth formed, debris bombardment from outside and radioactive heating from inside caused the whole planet to melt. Any water present early on would have evaporated

and escaped. So, where did all the water now on Earth come from?

The Moon Big Question: Will humans eventually colonize the Moon -- perhaps even "terraforming," or changing, it to suit our purposes? Should governments, even the UN, lead the return to the Moon, or will it be best accomplished with private entrepreneurial ventures like those that settled the Americas centuries ago?

The Terrestrial Planets Big Questions : Is there life on Mars? Could Earth someday heat up as much as Venus? How much CO2 dare we humans release into our own air?

The Jovian Planets Big Questions: What caused Jupiter's Red Spot to form in Jupiter's atmosphere? How has it continued swirling for hundreds of years? What gives it its color and how much longer will it last? Why does Saturn have such awesome rings around it? If extraterrestrial life exists, could unearthly environments such as Uranus and Neptune be likely to host it?

Solar System Debris Big Question: When will the next asteroid or comet hit Earth?

Exoplanets Big Questions: People eagerly await the discovery of a true Earth-like planet orbiting another star. When will Earth's twin be found, and will it have a solid surface, water oceans, and a hospitable atmosphere? Will it be inhabited?

Unit Plan

In this section you may fill in this table or delete it and paste your own.

THEN you will associate your standards by selecting the "standards" tab above, clicking "associate standards" and selecting your standards for this unit from the list.

Topic/Selection Timeframe	General Objectives	Instructional Activities	Benchmarks/Assessments

The Solar System (2-3 days)	Describe the overall size, scale, and structure of the solar system. Summarize the differences between the terrestrial and the Jovian planets. Outline the theory of solar system formation. Explain how the terrestrial planets formed. Contrast the leading theories for the formation of the Jovian planets. Describe how comets and asteroids formed, and explain their role in determining planetary properties.	Graphic Organizer Solar System Modeling Activity Short essay to justify what the U.S. government's policy on the mining of minerals from asteroids should be.	Solar System Model Essay Question Unit Test
Earth (1-2 days)	Summarize the physical properties of	Graphic Organizer	Atmosphere Drawing

	planet Earth. Describe the structure of Earth's atmosphere, and explain its effects on the planet's surface. Construct a current model of Earth's interior, and describe some of the experimental techniques used to establish the model. Summarize the evidence for continental drift and discuss the physical processes that drive it. Describe the nature and origin of Earth's magnetosphere Explain how the Sun influences Earth's surface and affects our	Atmosphere drawing Create a model of Interior of the earth Surface Activity Lab Questions	Interior of the Earth Model Surface Activity Lab Unit Test

	planet's spin.		
The Moon (1-2 days)	Specify the general characteristics of the Moon. Compare the surface features of the Moon and Mercury. Explain how the Moon's rotation is influenced by its orbit around the Sun. Compare the Interior Structures of the Moon and Mercury. Summarize the leading theory of the formation of the moon.	Graphic Organizer Create a Venn Diagram to compare and contrast Earth's Moon and Mercury. Case Study about the Moon	Case Study Questions Section Quiz Unit Test
The Terrestrial Planets (2-3 days)	Summarize the general orbit of the Terrestrial planets (Mercury, Venus, Earth, and Mars). Summarize the physical properties of	Guided Reading with questions Graphic Organizer Plan a trip to Mars and explain what you would	Trip to Mars essay Model of Jupiter and its moons Section Quiz Unit Test

	the Terrestrial planets (Mercury, Venus, Earth, and Mars). Describe the atmospheres of the Terrestrial Planets Explain why the greenhouse effect has produced conditions on Venus very different from those on Earth. Compare the geology on different Terrestrial planets. List the orbital and physical properties of the Galilean moons of Jupiter.	need in order to survive. Questions Draw Jupiter and its moons.	
The Jovian Planets (2-3 days)	Summarize the general orbit of the Jovian planets Summarize the physical properties of the Jovian	Graphic Organizer Analysis Questions Develop a robotic mission to	Analysis Questions Section Quiz Unit Test

	planets Describe the composition and structure of the atmospheres of the Jovian planets. Compare Saturn to Jupiter. Summarize the general characteristics of Titan, and discuss the chemical processes in its atmosphere. Outline some of the orbital and geological properties of Saturn's smaller moons Explain what the moons of the outer planets tell us about their past. Contrast the rings of Uranus and Neptune with	either Neptune or Uranus. Which questions would your mission address? What instruments would you include and what technical challenges would you anticipate?	

	those of Jupiter and Saturn.		
Solar System Debris (1-2 days)	Describe the orbital properties of the major groups of asteroids. Summarize the typical composition and physical properties of a typical asteroid. Illustrate the structure of a typical comet, and explain the formation and appearance of its tail. Describe the solar system beyond Neptune and explain why Pluto is considered a dwarf planet. Distinguish among the terms meteor, meteoroid, and meteorite. Describe the frequency and effects of	Guided reading with questions Analysis Questions Class discussion about the differences between the types of solar system debris and why people believed comets were a bad omen.	Analysis Questions Unit Test

	impacts on Earth.		
Exoplanets (1-2 days)	Describe the three main exoplanet detection methods and their selection biases. Explain how extrasolar planets support and challenge current theories of solar system formation. Define the habitable zone and describe the current observational evidence for habitable Earth-like planets beyond our solar system.	Analysis Questions Class discussions Essay question: Do you think our solar system is unusual? Justify your opinion with research.	"Is our solar system unusual?" essay Analysis questions Unit Test Quarterly Assessment

Summative Assessment and/or Summative Criteria

- Quarterly Assessment

- Project Rubrics

- Tests/Quizzes

Standards

LA.RI.11-12.1	Accurately cite strong and thorough textual evidence, (e.g., via discussion, written response, etc.), to support analysis of what the text says explicitly as well as inferentially, including determining where the text leaves matters uncertain.
LA.SL.8.5	Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.
SCI.HS.ESS2.B	Plate Tectonics and Large-Scale System Interactions
SCI.MS.ESS1.C	The History of Planet Earth
SCI.HS-ESS1-4	Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.
SCI.HS-ESS1-1	Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun's core to release energy that eventually reaches Earth in the forr of radiation.
SCI.HS-ESS1-6	Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth's formation and early history.
SCI.HS-ESS1-5	Evaluate evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks.
SCI.HS-ESS1	Earth's Place in the Universe
SCI.MS-ESS1-1	Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons.
SCI.MS-ESS2-3	Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.
SCI.MS-ESS2-1	Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.
SCI.MS-ESS2-2	Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.
	Plate tectonics is the unifying theory that explains the past and current movements of the rocks at Earth's surface and provides a framework for understanding its geologic history.
	Continental rocks, which can be older than 4 billion years, are generally much older than the rocks of the ocean floor, which are less than 200 million years old.
	Although active geologic processes, such as plate tectonics and erosion, have destroyed o altered most of the very early rock record on Earth, other objects in the solar system, such as lunar rocks, asteroids, and meteorites, have changed little over billions of years. Studying these objects can provide information about Earth's formation and early history.

Resources

- Textbook: Astronomy Today 9e by Chaisson and McMillan

- Supplemental Textbook

- Worksheets

- Science videos

- Achieve 3000

- Discovery Education

- Simulations

- Labs

- Brain Pop

- Blooket

Suggested Modifications for Special Education, ELL and Gifted Students

Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.; Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling). Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).; Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.; Use project-based science learning to connect science with observable phenomena.; Provide ELL students with multiple literacy strategies. Collaborate with after-school programs or clubs to extend learning opportunities.

*Consistent with individual plans, when appropriate.

Suggested Technological Innovations/Use

- Google Classroom

- Google Drive

- CK-12

- NASA.gov resources

- Web Quests

- Virtual labs

- Simulations

- Discovery Education

- Blooket

- Kahoot

- Quizlet

Cross Curricular/Career Readiness, Life Literacies and Key Skills Practice

9.1 21st Century Life and Career Skills: All students will demonstrate the creative, critical thinking, collaboration, and problem-solving skills needed to function successfully as both global citizens and workers in diverse ethnic and organizational cultures.

9.3 21st Century Life and Career Skills: Career Awareness, Exploration, and Preparation: All students will apply knowledge about and engage in the process of career awareness, exploration, and preparation in order to navigate the globally competitive work environment of the information age.

UDL Framework

In this Planetary System unit designed using the UDL framework, students will first encounter clear and attainable outcomes that describe the overall structure of the Solar System. Their diverse needs, backgrounds, strengths, and barriers will be anticipated, ensuring that all students can access and engage with the material. They will experience instructional activities tailored to include presentations, interactive simulations, and group discussions. Students will have multiple ways to demonstrate their understanding through projects, presentations, and written reflections as part of the assessment plan. Lastly, ongoing reflection and adaptation will ensure that instructional strategies remain effective, inclusive, and aligned with students needs and overall learning goals.

Astronomy Unit 3: Stars and Stellar Evolution

Content Area: **Science**
Course(s): **Astronomy (s)**
Time Period: **1st Semester**
Length: **5 weeks**
Status: **Awaiting Review**

Summary of the Unit

In this unit of study, the students will learn all about stars. Students will discuss the physical properties and

internal structure of our Parent Star, the Sun. The Sun is so important as it is responsible for all life on Earth. This unit also teaches us about the Main Sequence, White Dwarfs and Red Giants. It will review how stars form, evolve, and even explode. It also covers the formation of Neutron Stars and Black Holes.

Enduring Understandings

The Sun is our star and the main source of energy that powers weather, climate, and life on Earth. Without the sun we would not exist. Stars are everywhere in the night sky and they tell us more about the fundamentals of astronomy than any other class of objects in the universe. By analyzing the light from millions of distant stars, astronomers have learned a great deal about stellar properties, including their masses and radii, luminosities, ages, and densities. Like archaeologists who examine bones and artifacts to learn about the evolution of human culture, astronomers observe stars of different ages to construct a consistent model of how stars evolve over billions of years. Many of the elements composing our world and ourselves were created in the violent explosions of long-gone stars. Depending on the type of supernova and the mass of the original star, supernova explosions may create neutron stars and even blackholes.

Essential Questions

The Sun Big Questions: How does the Sun's corona get so hot? What causes the 11-year solar cycle of activity? Why do sunspots exist and why do they look so messy?

The Stars Question: Once you specify the mass and composition of a star, its structure and future evolution are largely set. But are the masses of newly formed stars pretty much the same everywhere, or do they vary systematically from place to place in our Galaxy and beyond?

Star Formation Big Questions: When did the first stars form? How and when were conditions in the early universe first allowed gas without walls to ignite as brilliant balls of fire?

Stellar Evolution Big Questions: If stars like the Sun end their lives so quiescently and so similarly, why do their scattered remnants look so different on the sky? Planetary nebulae display all sorts of weird shapes and sizes, some with rings and spheres, others with loops and jets. What causes theses dissimilar structures? Are they somehow intrinsic to the stars themselves, or are they due to the complex environment through which dying stars expel their contents back into interstellar space?

Stellar Explosions Big Question: Despite widespread observations of supernovae and their scattered debris, researchers still don't know exactly how these massive stars actually manage to explode. How do they do it, reversing their catastrophic inward collapse to become outwardly exploding stars?

Neutron Stars and Black Holes Big Question: Improved observations point toward the existence of black holes. Some researchers still wonder, might there be other dense remnants--quark stars, perhaps-- that stop short of being genuine black holes?

Unit Plan

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Topic/Selection Timeframe	General Objectives	Instructional Activities	Benchmarks/Assessments

The Sun: Our Parent Star (3-5 days)	Summarize the physical properties and internal structure of the sun. Describe the concept of luminosity, and explain how it is measured. Outline the process by which energy is produced in the Sun's interior. Explain how observations of the Sun's core changed our understanding of fundamental physics.	Graphic Organizer Build a sundial Draw Nuclear Fusion diagram Analysis Questions	Nuclear Fusion diagram with explanation Analysis Questions Unit Test

The Stars: Giants, Dwarfs, and Main Sequence (2-3 days)	Explain how distances to stars are measured. Describe the motions of the stars through space, and how those motions are measured from Earth. Distinguish between luminosity and apparent brightness, and explain how stellar luminosity is determined. Classify stars according to their colors, surface temperatures, and spectral characteristics. Describe how a Hertzsprung-Russell diagram is used to identify stellar properties.	Class discussion Inspect an image from the Hubble Space Telescope Gallery and describe the properties of the stars.	Section Quiz Unit Test
Star Formation (2-3 days)	Summarize the sequence of events leading to the formation of a star like our Sun.	Drawing or description of the basic chain of events leading to the	Star Formation Drawing/Description Analysis Questions

	Describe some of the observational evidence supporting the modern theory of star formation. Describe the nature of interstellar shock waves, and discuss their possible role in the formation of stars. Explain why stars form in clusters and distinguish between open and globular star clusters.	formation of a star. Use online image galleries to find observational images of star formation. Which stages are easiest to find images for? Analysis Questions	Unit Test
Stellar Evolution (3-5 days)	Explain why stars evolve away from the main sequence. Describe the events that occur as a Sun-like star evolves from the main sequence to the giant branch. Explain how core helium fusion begins in a Sun-like star,	Analysis Questions Discussion about how astronomers test the theory of stellar evolution. Create a timeline of the stages for the evolution of a Sun-like star and a high-mass star,	Evolution of stars Timeline Analysis Questions Unit Test

	and describe what happens as a result. Summarize the stages in the death of a typical low-mass star and describe the resulting remnant. Illustrate the evolutionary stages and lifetimes of high-mass and low-mass stars.	from formation to remnant	
Stellar Explosions (3-5 days)	Explain how white dwarfs in binary-star systems can become active. Summarize the sequence of events leading to the explosive death of a massive star. Describe the two types of supernovae and explain how they are produced. Explain the origin of elements	Analysis Questions Draw diagrams of Type I and Type II Supernova. Create a diagram to demonstrate Stellar Recycling using images for each stage.	Supernova Diagrams Stellar Recycling Diagram Analysis Questions Unit Test

	heavier than helium and discuss the significance of these elements for the study of stellar evolution.		
Neutron Stars and Black Holes (2-4 days)	Describe the properties of neutron stars, and explain how they are formed. Explain the nature and origin of pulsars, and account for their characteristic radiation. Describe how black holes are formed, and discuss their effects on matter and radiation in their vicinity. Research Einstein's theories of relativity, and discuss how they relate to neutron stars and black holes.	Class discussions Analysis Questions Group research and presentation on Schwarzschild and Kerr black holes.	Group Research Presentation Analysis Questions Unit Test

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Standards

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SCI.HS.PS1.C	Nuclear Processes
SCI.HS.PS3.D	Energy in Chemical Processes and Everyday Life
SCI.HS.PS4.B	Electromagnetic Radiation
SCI.HS.ESS1.A	The Universe and Its Stars
SCI.MS.ESS1.A	The Universe and Its Stars
SCI.HS-ESS1-3	Communicate scientific ideas about the way stars, over their life cycle, produce elements.
SCI.HS-ESS1-6	Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth's formation and early history.
SCI.HS-ESS1-2	Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe.
SCI.HS-ESS1-1	Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun's core to release energy that eventually reaches Earth in the form of radiation.
SCI.MS-ESS1-1	Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons.
	Nuclear Fusion processes in the center of the sun release the energy that ultimately reaches Earth as radiation.
	The star called the sun is changing and will burn out over a lifespan of approximately 10 billion years.
	Scale, Proportion, and Quantity
	The significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs.

Resources

- Textbook: Astronomy Today 9e by Chaisson and McMillan

- Supplemental Textbook

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UDL Framework

In this Stars and Stellar Evolution unit designed using the UDL framework, students will first encounter clear and attainable outcomes that summarize how stars form, evolve, and explode. Their diverse needs, backgrounds, strengths, and barriers will be anticipated, ensuring that all students can access and engage with the material. They will experience instructional activities tailored to include presentations, interactive simulations, and group discussions. Students will have multiple ways to demonstrate their understanding through projects, presentations, and written reflections as part of the assessment plan. Lastly, ongoing reflection and adaptation will ensure that instructional strategies remain effective, inclusive, and aligned with students needs and overall learning goals.

Astronomy Unit 4: Galaxies and Cosmology

Content Area: **Science**
Course(s): **Astronomy (s)**
Time Period: **1st Semester**
Length: **6 weeks**
Status: **Awaiting Review**

Summary of the Unit

This unit not only talks about our home galaxy, The Milky Way Galaxy, but also about what we know of other Galaxies in the Universe. The universe continues to expand, but the end of its growth is a mystery to us.It covers the science of Cosmology, the study of the cosmos on the largest scales. We review the Big Bang Theory and the characteristics of the universe immediately after it was formed. We also discuss the possibility of extraterrestrial life in the Universe and some techniques we might use to search for them.

Enduring Understandings

Our Milky Way Galaxy is just one of nearly a hundred billion other galaxies in the observable universe. We understand galaxies because of our knowledge of the size, scale, structure, composition and dynamics of our own galaxy. Radiation can tell us about the properties of faraway galaxies as well as the history of our Galaxy and universe in which we live. Vast quantities of unseen cosmic material known as dark matter, actually accounts for most of the mass in the universe. The expansion of the universe continues but its end point remains a mystery.

Essential Questions

The Milky Way Galaxy Big Questions: How big is the Milky Way? How well do we knows the size, shape, and mass of our colossal home in the cosmos?

Galaxies Big Question: Galaxies were discovered only in the 20th century, and we are still learning about them. How did they form, and how do they evolve?

Galaxies and Dark Matter Big Questions: What is dark matter? Is it actual matter that exerts a gravitational pull but is impossible to detect by electromagnetic means, or does it imply that something is badly wrong with our theoretical understanding of the way gravity works on very large scales?

Cosmology Big Question: What is the origin of the universe and what will be its ultimate fate?

The Early Universe Big Question: What is the origin of the universe? Did it actually have an origin or has it

existed forever? If it had an origin, what existed before, or is that question even meaningful?

Life in the Universe Big Question: Do alien beings reside beyond Earth?

Unit Plan

In this section you may fill in this table or delete it and paste your own.

THEN you will associate your standards by selecting the "standards" tab above, clicking "associate standards" and selecting your standards for this unit from the list.

Topic/Selection Timeframe	General Objectives	Instructional Activities	Benchmarks/Assessments
The Milky Way Galaxy (3-5 days)	Describe the overall structure of the Milky Way Galaxy and explain how the various regions differ from one another. Compare and contrast the orbital motions of stars in different regions of the Galaxy. Research possible explanations for the spiral arms in our own and many other	Design and construct a model of the Milky Way Galaxy. Research possible explanations for the spiral arms in our own and many other galaxies. Analysis Questions	Milky Way Galaxy model Analysis Questions Unit Test

	galaxies. Describe the evidence for a supermassive black hole and some of the other phenomena observed at the center of our Galaxy.		

Galaxies (5-7 days)	List the basic properties of normal galaxies. Describe how galaxies clump into groups and clusters. Explain how Hubble's law is used to derive distances to the most remote objects in the observable universe. Specify the basic differences between active and normal galaxies.	Graphic Organizer Analysis Questions Class Discussion	Analysis Questions Section Quiz Unit Test
Galaxies and Dark Matter (2-3 days)	Describe methods used to determine the masses of galaxies and galaxy clusters. Research	Read Discovery 25-1 and answer questions. Research evidence for supermassive	Discovery 25-1 Questions Research results Unit Test

	evidence for supermassive black holes in the centers of galaxies and explain how active galaxies fit into current theories of galactic evolution.	black holes in the centers of galaxies and explain how active galaxies fit into current theories of galactic	
Cosmology (2-3 days)	Describe the Big Bang theory of the expanding universe and how it relates to Hubble's law. Discuss possible outcomes of the present cosmic expansion. Explain why astronomers think the expansion of the universe is accelerating, and discuss the cause.	Class discussion Balloon model of 2-D universe to examine Hubble's law.	Unit Test
The Early Universe (1-2 days)	Describe the characteristics of the universe immediately after its birth. Explain how radiation and matter evolved as the universe expanded and	Groups work to create a timeline of the early universe from the Big Bang to recombination and answer questions. Analysis	Big Bang to Recombination Timeline Unit Test

	cooled. Describe the formation of large-scale structures in the cosmos.	Questions	
Life in the Universe (3-5 days)	Summarize the process of cosmic evolution as it is currently understood. Describe the basic ingredients of life on Earth. Identify the most promising sites for life elsewhere in the solar system, and explain why they are promising. Outline some techniques we might use to search for extraterrestrials and to communicate with them	Read Discovery 28-1 and answer questions Group roleplay. You were asked to "speak for Earth" when communicating with an extraterrestrial world. Interview others outside of the class. "Do you think extraterrestrial life exists? Why?". From your results, decide whether discovery of extraterrestrial life would have a profound effect on human culture.	Discovery 28-1 Questions Group Roleplay Interview/Presentation Unit Test

Summative Assessment and/or Summative Criteria

- Quarterly Assessment

- Project Rubrics

- Tests/Quizzes

Standards

LA.SL.8.5	Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.
LA.SL.11-12.4	Present information, findings and supporting evidence clearly, concisely, and logically. The content, organization, development, and style are appropriate to task, purpose, and audience.
SCI.HS.PS4.B	Electromagnetic Radiation
SCI.HS.ESS1.A	The Universe and Its Stars
SCI.HS-ESS1-2	Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe.
SCI.HS-ESS1-3	Communicate scientific ideas about the way stars, over their life cycle, produce elements.
SCI.HS-ESS1-4	Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.
SCI.MS-ESS1-2	Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.
SCI.MS-ESS1-1	Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons.
	The Big Bang theory is supported by observations of distant galaxies receding from our own, of the measured composition of stars and non-stellar gases, and of the maps of spectra of the primordial radiation (cosmic microwave background) that still fills the universe.
	Other than the hydrogen and helium formed at the time of the Big Bang, nuclear fusion within stars produces all atomic nuclei lighter than and including iron, and the process releases electromagnetic energy. Heavier elements are produced when certain massive stars achieve a supernova stage and explode.

Resources

- Textbook: Astronomy Today 9e by Chaisson and McMillan

- Supplemental Textbook

- Worksheets

- Science videos

- Achieve 3000

- Discovery Education

- Simulations

- Labs

- Brain Pop

- Blooket

Suggested Modifications for Special Education, ELL and Gifted Students

Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.; Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling). Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).; Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.; Use project-based science learning to connect science with observable phenomena.; Provide ELL students with multiple literacy strategies. Collaborate with after-school programs or clubs to extend learning opportunities.

*Consistent with individual plans, when appropriate.

Suggested Technological Innovations/Use

- Google Classroom

- Google Drive

- CK-12

- NASA.gov resources

- Web Quests

- Virtual labs

- Simulations

- Discovery Education

- Blooket

- Kahoot

- Quizlet

Cross Curricular/Career Readiness, Life Literacies and Key Skills Practice

9.1 21st Century Life and Career Skills: All students will demonstrate the creative, critical thinking, collaboration, and problem-solving skills needed to function successfully as both global citizens and workers in diverse ethnic and organizational cultures.

9.3 21st Century Life and Career Skills: Career Awareness, Exploration, and Preparation: All students will apply knowledge about and engage in the process of career awareness, exploration, and preparation in order to navigate the globally competitive work environment of the information age.

UDL Framework

In this Galaxies and Cosmology unit designed using the UDL framework, students will first encounter clear and attainable outcomes that highlight the Big Bang Theory and the characteristics of the universe immediately after it was formed. Their diverse needs, backgrounds, strengths, and barriers will be anticipated, ensuring that all students can access and engage with the material. They will experience instructional activities tailored to include presentations, interactive simulations, and group discussions. Students will have multiple ways to demonstrate their understanding through projects, presentations, and written reflections as part of the assessment plan. Lastly, ongoing reflection and adaptation will ensure that instructional strategies remain effective, inclusive, and aligned with students needs and overall learning goals.