Township of Ocean Schools

Assistant Superintendent
Office of Teaching and Learning

SPARTAN MISSION:
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DEPARTMENT: **Science** COURSE: **Astronomy**

Curriculum Development Timeline

School: Ocean Township High School

Course: Astronomy

Department: Science

Board Approval	Supervisor	Notes
July 2008	Patrick Sullivan	Born Date/Alignment to NJCCCS
August 2011	Patrick Sullivan	Update Standards
August 2013	Patrick Sullivan	Update Standards
December 2017	Patrick Sullivan	Update Standards
August 2018	Patrick Sullivan	Revisions
August 2019	Patrick Sullivan	Review
August 2022	Patrick Sullivan	Alignment to Standards

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Township of Ocean Pacing Guide			
Week	**Marking Period 1-2**	**Week**	**Marking Period 3-4**
1	Nature of Science	11	Galaxies
2	Astronomy's Place in Science	12	The Sun
3	Astronomy on Earth	13	Life Cycles of Stars
4	History of Astronomy	14	Solar Systems
5	Planetary Motion	15	Planets & Moons
6	The Moon	16	Planets & Moons
7	Waves & Electromagnetism	17	Asteroids, Meteors & Comets
8	Telescopes	18	Space Exploration & Technology
9	The Universe	19	Life in the Universe
10	Midterm/Project	20	Final Exam/Project

Climate Change: Waves & Electromagnetism (NJSLS-S: HS-ESS3-5)

Core Instructional & Supplemental Materials including various levels of Texts

Text:
Required Reading: Cosmos, by Carl Sagan
Observation Exercises in Astronomy, by Lauren Jones

Digital Resources Across All Levels: (D=differentiated)
Edpuzzle (D)
Gizmo (D)
New York Times Articles
PhET Interactive Simulations (D)
Science News (D)
Ted Talks
Stellarium
Streaming and Video Clips

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DEPARTMENT: **Science** COURSE: **Astronomy**

Time Frame	**4 Weeks**

Topic

Nature of Science
Astronomy's Place in Science
Astronomy on Earth
History of Astronomy

Alignment to Standards

HS-PS4-1: Use mathematical representations to support a claim regarding relationships among the frequency, wavelength and speed of waves traveling in various media.
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.

Learning Objectives and Activities

Learning Objectives:

- Why should students study Astronomy?
- What is the history of the discovery of the sun centered universe?
- Who were the important figures in the early years of astronomical discovery?
- What is the importance of revealing scientific breakthroughs to the general public?
- What is the size or scale of the universe?
- How has our understanding of Astronomy changed during human history?
- What are constellations and how are they identified?

Learning Activities:

- Classroom Discussion
- Computer Research Projects (Historical Astronomer Project)
- Astronomy Journal
- Current Events
- Hands-On Lab Activities (Grains of Sand Lab; Star Wheel Activity; 3-D Constellation Lab; Parallax Lab)
- Cosmos Readings
- Describe why Copernicus' discoveries were censured by the Catholic Church
- Explain what role the defining of gravity played in the understanding of celestial motion
- Identify the contributions Galileo and Newton made to the reversal of the church's positions on the heavens
- Describe the importance of Haley's Comet in the final chapter of the understanding of

orbital and elliptical motion

Assessments

Formative:

- Do Now/Warm-up: speed/distance/time equations, speed of light calculations, solar system and galaxy distances
- Strategic Questioning
- Pre & Post Lab Analysis Questions

Summative:

- Unit Assessments (multiple choice and free response)
- Cosmos Reading Quizzes (free response)

Benchmark:

- A pre-test and post-test will be given to measure skills and knowledge with core course concepts (pre-test during week 1)

Alternative:

- Students apply astronomy and physics concepts as well as problem-solving techniques to solve problems involving estimation & sizes of and distances to certain celestial bodies.

Interdisciplinary Connections

ELA:
WHST.9-12.2: Write informative/explanatory texts including the narration of historical events, scientific procedures, experiments or technical processes. (HS-ESS1-2), (HS-ESS1-3), (HS-ESS1-5)
HSN-Q.A.2: Define appropriate quantities for the purpose of descriptive modeling. (HS-ESS1-1), (HS-ESS1-2), (HS-ESS1-4), (HS-ESS1-5), (HS-ESS1-6)

Career Readiness, Life Literacies, and Key Skills

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Technology Integration

Career Education

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DEPARTMENT: **Science** COURSE: **Astronomy**

CRP-2: Students use knowledge and skills through their lab work.
CRP-4: Communicate clearly and effectively and with reason.
CRP-11: Use technology to enhance productivity.
CRP-12: Students work productively in collaborative groups using culturally global competence.

Time Frame	**2 Weeks**

Topic

Planetary Motion
The Moon

Alignment to Standards

HS-PS4-5: Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.
HS-ESS1-4: Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.
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.

Learning Objectives and Activities

Learning Objectives:

- How is the Moon's orbit tied to the Earth?
- What were Tycho Brahe's & Johannes Kepler's contributions to planetary motion?
- What are Kepler's Three Laws of Planetary Motion?
- What are the characteristics of an ellipse?
- How many/what types of Moon Missions have occurred?
- Explain the most up to date information on the moon

Learning Activities:

- Classroom Discussion
- Computer Research Projects (Moon Missions)
- Astronomy Journal (Brahe-Kepler relationship)
- Current Events
- Hands-On Lab Activities (Distance to Moon Lab; Mercury Orbit-Kepler's Law Lab)
- Cosmos Readings

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- Explain how Kepler's Laws re-defined our understanding of the clockwork universe
- Identify the angle and tilt of the moon that creates phases and makes an eclipse a regular but rare occurrence
- Identify scientific facts that prove that the moon landings were not a "hoax"
- Understand and explain why the moon was created by an off center collision with another heavenly body the size of Mars
- Describe the future plans regarding a return to the moon by either probes or humans

Assessments

Formative:

- Do Now/Warm-Up: Kepler's 3rd Law questions & calculations, Ellipse drawings
- Strategic Questioning
- Explain the formation of Maria, highlands and rills on the lunar surface

Summative:

- Define the most common terms related to the appearance of the moon during its various phases and eclipses
- Cosmos Reading Quizzes (multiple choice and free response)
- Explain the "Moon Race" in terms of the Cold War

Benchmark: N/A

Alternative:

- Students apply physics concepts and problem-solving techniques to solve problems involving Kepler's 3 Laws of Planetary Motion and Eclipse phenomena.
- Students track orbiting comets and near-earth asteroids and predict their respective locations in the future.

Interdisciplinary Connections

ELA:
WHST.9-12.2: Write informative/explanatory texts including the narration of historical events, scientific procedures, experiments or technical processes. (HS-PS4-5

Career Readiness, Life Literacies, and Key Skills

Technology Integration

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Career Education
CRP-2: Students use knowledge and skills through their lab work. **CRP11:** Use technology to enhance productivity. **CRP-12:** Students work productively in collaborative groups using culturally global competence.

Time Frame	**2 Weeks**

Topic
Waves & Electromagnetism Telescopes

Alignment to Standards
HS-PS3-1: Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known. **HS-PS4-3:** Evaluate the claims, evidence and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other. **HS-PS4-4:** Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter. **HS-ESS3-5:** Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.

Learning Objectives and Activities
Learning Objectives: • What is the Electromagnetic Spectrum? • How can the EM Spectrum be classified? • How can properties of wavelength, frequency, speed and energy be described for light? • What is spectroscopy? • What is the Doppler Effect and Redshift/Blueshift? • What are some of the basic characteristics of the refractor and reflector telescopes? • What is the basic design of the Hubble space telescope? • How can digital cameras be used to aid in astrophotography?

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- Students will explain the tools used by astronomers to study electromagnetic radiation to determine composition, motions and other physical attributes of astronomical objects.
- Students will be able to understand why Newton's invention of the reflector telescope is still used today over 500 years later.
- Discuss the role of solar radiation in Climate Change.

Learning Activities:

- Classroom Discussion
- Computer Research Projects (Electromagnetic Spectrum WebQuest; Famous Telescope Slideshow Project)
- Astronomy Journal (Describing 'Waves' and 'Light')
- Current Events
- Hands-On Lab Activities (Build a Spectrometer Lab; Spectroscopy Lab; Designing a Virtual Telescope)
- Cosmos Readings
- Describe the observations made by Galileo that change the face of astronomy
- Describe the concept of spectroscopy and its uses
- Explain how the expanding universe was discovered by the red shift.
- Construct a timeline of the impacts of climate change

Assessments

Formative:

- Do Now/Warm-up: EM Spectrum Ranking Tasks; Name That Telescope.
- Explain the challenges faced by astronomers due to the properties of light and the vast distances in the cosmos.
- Rank the seven categories of the EM Spectrum in terms of frequency, wavelength and energy.

Summative:

- Evaluate the types of telescopes used by astronomers for examining different frequencies of electromagnetic radiation; compare and contrast the uses and advantages of each (e.g. radio, microwave, IR, visible, UV, X-ray, gamma ray; reflectors vs. refractors).
- Discuss how spectroscopy provides information about the inherent properties and motions of objects.
- The Role of Climate Change Presentations

Benchmark: N/A

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DEPARTMENT: **Science** COURSE: **Astronomy**

Alternative:

- WebQuest (Light); Mystery Spectra; Telescope Presentations
- Quantitatively analyze data from telescopes (e.g. spectra, multi-wavelength photometry and images) and/or other astronomical sources (e.g. tide tables, sky charts)

Interdisciplinary Connections

ELA:
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. (HS-PS4-2), (HS-PS4-3), (HS-PS4-4)

Mathematics:
HSA.CED.A: 4: Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. (HS-PS4-1), (HS-PS4-3)

Career Readiness, Life Literacies, and Key Skills

9.4.12.CI.1: Demonstrate the ability to reflect, analyze and use creative skills and ideas (e.g., 1.1.12prof.CR3a).

Technology Integration

Career Education

CRP-2: Students use knowledge and skills through their lab work.
CRP-11: Use technology to enhance productivity.
CRP-12: Students work productively in collaborative groups using culturally global competence.

Time Frame	**3 Weeks**

Topic

The Universe
Midterm/Project
Galaxies

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DEPARTMENT: **Science** COURSE: **Astronomy**

Alignment to Standards

HS-PS1-8: Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion and radioactive decay.
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.

Learning Objectives and Activities

Learning Objectives:

- How can information about light spectra, motion of galaxies and composition of matter in the universe support the Big Bang Theory?
- How does the Big Bang Theory explain the origins and expansion of our universe?
- How do galaxies form?
- What sizes and types of galaxies are there?
- What are the physical characteristics of the Milky Way Galaxy?
- Who was Edwin Hubble and what is Hubble's Law?

Learning Activities:

- Gizmos (online simulation): The Big Bang Theory
- Hubble's Constant Lab
- Galaxy Classification Activity
- Current Events
- Cosmos Reading
- Class Discussion
- The Big Bang Theory describes the origin of the universe and is supported by observations of moving celestial objects, including galaxies and stars.
- Galaxies are clusters of stars, gases and other celestial debris and exist in various forms. Galaxies are grouped in clusters.
- The electromagnetic spectrum describes the various forms of radiation that exist in our universe and each form of radiation can be differentiated based on wavelength, frequency and speed.
- Wein's displacement law and Planck's law can be used to further understand the electromagnetic radiation of an object in space.

Assessments

Formative:

- Do Now/Warm-Ups: Fate of Universe Questions
- Describe the Big Bang Theory and evidence that supports the theory

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Summative:
- Describe theories regarding the end of the universe including the Big Freeze, the Big Crunch and Steady State Theories
- Identify the different types of galaxies based upon Hubble's tuning fork model

Benchmark: N/A

Alternative:
- Gizmos simulations; Hubble Law Graphs
- Describe the size, structure and physical components of the Milky Way Galaxy

Interdisciplinary Connections

ELA:
RST.11-12.1: Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-ESS1-1), (HS-ESS1-2), (HS-ESS1-5), (HS-ESS1-6).

Mathematics:
MP.4: Model with mathematics. (HS-PS1-4), (HS-PS1-8)
HSN-Q.A.2: Define appropriate quantities for the purpose of descriptive modeling. (HS-PS1-4), (HS-PS1-7), (HS-PS1-8)

Career Readiness, Life Literacies, and Key Skills

Technology Integration

Career Education

CRP-2: Students use knowledge and skills through their lab work.
CRP-11: Use technology to enhance productivity.
CRP-12: Students work productively in collaborative groups using culturally global competence.

Time Frame	**3 Weeks**

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DEPARTMENT: **Science** COURSE: **Astronomy**

Topic
The Sun Life Cycles of Stars Solar Systems
Alignment to Standards
HS-PS1-8: Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion and radioactive decay. **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.
Learning Objectives and Activities

Learning Objectives:

- What is the role of energy in our world?
- What is a star?
- How is the creation of chemical elements related to stars?
- What is the structure and what are properties of our Sun?
- How are stars classified?
- Discuss the motions of stars through space and how those motions are measured from Earth
- Summarize the events leading to the violent death of a massive star
- Describe the two types of supernovae
- Discuss the nature of neutron stars, pulsars, gamma ray bursts and black holes
- Describe a Hertzsprung-Russell Diagram
- Describe what Wien's Law tells us about a star

Learning Activities:

- Classroom Discussion
- Computer Research Projects (Life Cycle of a Star Project: From Proto-Star to Black Hole)
- Astronomy Journal
- Current Events
- Hands-On Lab Activities (Wien's Law Lab; Diameter of the Sun Lab; H-R Diagram Activity; Black Hole Lab; Magnetism Observation Lab)
- Cosmos Readings
- Describe differences in lives of low-mass stars compared to lives of high-mass stars
- Use an H-R diagram to identify stellar properties

DEPARTMENT: **Science** COURSE: **Astronomy**

- Use Wien's Law to determine the temperature of the surface of a star
- Calculate differences between apparent and absolute magnitude

Assessments

Formative:

- Do Now/Warm-Up: Layers of the Sun; Magnetism Q's
- Trace the production of energy by the Sun
- Summarize the composition and properties of the interstellar medium including dark matter
- Summarize the sequence of events leading to star formation

Summative:

- Analyze the evolution of stars off the main sequence
- Describe the magnetic properties of stars
- Discuss the observations that help verify the theory of stellar evolution

Benchmark: N/A

Alternative:

- Students apply physics concepts to explain solar phenomena (solar wind, solar flares, magnetic storms, coronal mass ejections) and relate to the Auroras
- Life Cycle of Star Packet
- Summarize the events leading to the violent death of a massive star

Interdisciplinary Connections

ELA:
RST.11-12.1: Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-ESS1-1), (HS-ESS1-2), (HS-ESS1-5), (HS-ESS1-6)

Mathematics:
MP.4: Model with mathematics. (HS-PS1-4), (HS-PS1-8)
HSN-Q.A.2: Define appropriate quantities for the purpose of descriptive modeling. (HS-PS1-4), (HS-PS1-7), (HS-PS1-8)

Career Readiness, Life Literacies, and Key Skills

9.4.12.CI.1: Demonstrate the ability to reflect, analyze and use creative skills and ideas (e.g., 1.1.12prof.CR3a).

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Technology Integration
9.4.12.IML.9: Analyze the decisions creators make to reveal explicit and implicit messages within information and media (e.g., 1.5.12acc.C2a, 7.1.IL.IPRET.4).
Career Education
CRP-2: Students use knowledge and skills through their lab work. **CRP-11:** Use technology to enhance productivity. **CRP-12:** Students work productively in collaborative groups using culturally global competence.

Time Frame	**3 Weeks**
Topic	
Planets & Moons Asteroids, Meteors & Comets	
Alignment to Standards	
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. **HS-ESS2-1:** Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features.	
Learning Objectives and Activities	

Learning Objectives:

- What is the current theory of planetary system formation?
- How do the properties differ between the Terrestrial and Jovian planets?
- What are the characteristics of moons in our solar system?
- What is an extrasolar planet (exoplanet) and how many have been discovered?
- What are the techniques that are used for exoplanet detection?
- Discuss the role of collisions in determining planetary characteristics.

Learning Activities:

- Create a scale model of the Earth-Moon system.
- Computer Research projects (Exoplanet research project; detection techniques)
- Astronomy Journal (Oumuamua: Asteroid, Comet, neither or both?)
- Current Events (Modeling an Asteroid Activity)

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- Cosmos Readings
- Describe different exoplanet environments
- Identify the characteristics of asteroids, meteoroids and comets
- Describe the composition of a comet
- List the phenomenon that creates the two tails of a comet
- Explain how the direction of the comet tail changes as it circles the sun
- Explain why comets will eventually "burn out"
- Describe the events that led to the extinction of the dinosaurs
- Explain the methods used to detect "Near Earth" objects
- Describe the sequence of events that would follow an impact in the ocean or on the earth's surface
- Explain how an impact might be avoided in the future
- Describe the precautions that might preserve life on the planet in the event of an impact

Assessments

Formative:
- Do Now/Warm-Up: Classifying objects: meteoroid, asteroid, moon or planet?
- Describe the overall scale and structure of the solar system
- Compare and contrast the Terrestrial and Jovian planets

Summative:
- Compare and contrast the characteristics and theories of formation of the Moon and the planets in our solar system.
- Describe (compare and contrast) physical characteristics of planets, moons, asteroids, meteors and comets (including formation theories of each).

Benchmark: N/A

Alternative:
- Exoplanet Research and Presentations
- Outline the theory of solar-system formation

Interdisciplinary Connections

ELA:
WHST.9-12.1: Write arguments focused on discipline-specific content. (HS-ESS1-6)
SL.11-12.5: Make strategic use of digital media (e.g., textual, graphical, audio, visual and interactive elements) in presentations to enhance understanding of findings, reasoning and evidence and to add interest. (HS-ESS2-1), (HS-ESS2-3), (HS-ESS2-4)

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Mathematics:
HSN-Q.A.2: Define appropriate quantities for the purpose of descriptive modeling. (HS-ESS2-1), (HS-ESS2-3), (HS-ESS2-4), (HS-ESS2-6)

Career Readiness, Life Literacies, and Key Skills

Technology Integration

Career Education

CRP-2: Students use knowledge and skills through their lab work.
CRP-11: Use technology to enhance productivity.
CRP-12: Students work productively in collaborative groups using culturally global competence.

Time Frame	**2 Weeks**

Topic

Space Exploration & Technology
Life in the Universe

Alignment to Standards

HS-PS2-3: Apply scientific and engineering ideas to design, evaluate and refine a device that minimizes the force on a macroscopic object during a collision.
HS-ESS2-7: Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth.

Learning Objectives and Activities

Learning Objectives:

- What Moon and Mars missions have taken place and what types of technologies have been used?
- What technologies are being used today or are planned for the future in regards to learning more about astronomy?

DEPARTMENT: **Science** COURSE: **Astronomy**

- What is the process of cosmic evolution?
- What is the Drake Equation?
- What are some techniques we might use to search for extraterrestrials and to communicate with them?

Learning Activities:

- Computer Research Projects (SETI)
- Astronomy Journal (Sagan's Contact)
- Current Events
- Hands-On Lab Activities (Solar Sail Construction Lab, Hubble Telescope Models)
- Cosmos Readings
- Cosmic evolution is the continuous process that has led to the appearance of galaxies, stars, planets and life on Earth.
- The Drake Equation provides a means for estimating the probability of intelligent life in the galaxy.
- Currently, space travel is not a feasible means of searching for intelligent life. Scanning the EM spectrum for signals is our best current method of searching.
- The Apollo Program successfully landed men on the moon.
- Mars has been the target of active robotic exploration.
- Mariner, Pioneer and Voyager Missions in the 1960s & 1970s paved the way for more modern solar system exploration.

Assessments

Formative:

- Do Now/Warm-Up: Drake's Equation; Relativity Equations; Wormholes; Outcomes of Quantum Mechanical Theory
- Identify the most promising sites for life elsewhere in the solar system and explain why they are promising.

Summative:

- Summarize the process of cosmic evolution.
- Summarize the various probabilities used to estimate the number of advanced civilizations that might exist in a galaxy.

Benchmark: N/A

Alternative:

- SETI@home Research
- Describe Mars missions from historical, technological and astronomical perspectives.

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Interdisciplinary Connections
ELA: **WHST.9-12.7:** Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS-PS2-3), (HS-PS2-5) **WHST.9-12.1:** Write arguments focused on discipline-specific content. (HS-ESS2-7)
Career Readiness, Life Literacies, and Key Skills
9.4.12.CI.2: Identify career pathways that highlight personal talents, skills and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8).
Technology Integration
Career Education
CRP-2: Students use knowledge and skills through their lab work. **CRP-11:** Use technology to enhance productivity. **CRP-12:** Students work productively in collaborative groups using culturally global competence.

Time Frame	**1 Week**
Topic	
Astronomy Picture of the Day (APOD) Final Exam Project	
Alignment to Standards	
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. **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. **HS-ESS1-3:** Communicate scientific ideas about the way stars, over their life cycle, produce elements.	

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Learning Objectives and Activities

Learning Objectives:

- Who created the image, where and when?
- Why were you drawn to the image?
- Is there any relevant history associated with the image?
- What is the object classified as (planet, star, galaxy, etc.)?
- Have any scientific discoveries been made regarding your object?
- What does the image bring to the scientific community? (ex: is it the discovery of a new object, an object we use for some purpose, a piece of equipment?, etc).

Learning Activities:

- Visit apod.nasa.gov and search images
- Computer Research
- Writing Descriptions
- Creating Slideshows
- Student Presentations
- Describe where, when and by whom the image was taken
- Describe the history of the image
- Differentiate between types of celestial objects
- Display scientific research in multiple formats (written paper and visual slideshow)
- Demonstrate knowledge of selected image
- Identify how the image relates to topics covered in the course

Assessments

Formative:

- Essential Questions & Discussions

Summative:

- Written Descriptions
- Slideshow
- Presentation

Benchmark:

- A pre-test and post-test will be given to measure skills and knowledge with core course concepts. (Post-test during week 20)

Alternative: N/A

Interdisciplinary Connections

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DEPARTMENT: **Science** COURSE: **Astronomy**

ELA:
WHST.9-12.2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments or technical processes. (HS-ESS1-2), (HS-ESS1-3), (HS-ESS1-5)
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. (HS-ESS1-3)

Mathematics:
HSA-CED.A.4: Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. (HS-ESS1-1), (HS-ESS1-2), (HS-ESS1-4)

Career Readiness, Life Literacies, and Key Skills

9.4.12.CI.1: Demonstrate the ability to reflect, analyze and use creative skills and ideas (e.g., 1.1.12prof.CR3a).

Technology Integration

Career Education

CRP-2: Students use knowledge and skills through their lab work.
CRP-4: Communicate clearly and effectively and with reason.
CRP-11: Use technology to enhance productivity.
CRP-12: Students work productively in collaborative groups using culturally global competence.

Modifications (ELL, Special Education, At Risk Students, Gifted & Talented, & 504 Plans)

ELL:

- Work toward longer passages as skills in English increase
- Use visuals
- Introduce key vocabulary before lesson
- Teacher models reading aloud daily
- Provide peer tutoring
- Use of Bilingual Dictionary
- Guided notes and/or scaffold outline for written assignments
- Provide students with English Learner leveled readers.

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DEPARTMENT: **Science** COURSE: **Astronomy**

Supports for Students With IEPs:

- Allow extra time to complete assignments or tests
- Guided notes and/or scaffold outline for written assignments
- Work in a small group
- Allow answers to be given orally or dictated
- Use large print books, Braille, or books on CD (digital text)
- Follow all IEP modifications

At-Risk Students:

- Guided notes and/or scaffold outline for written assignments
- Introduce key vocabulary before lesson
- Work in a small group
- Lesson taught again using a differentiated approach
- Allow answers to be given orally or dictated
- Use visuals / Anchor Charts
- Leveled texts according to ability

Gifted and Talented:

- Create an enhanced set of introductory activities (e.g. advance organizers, concept maps, concept puzzles)
- Provide options, alternatives and choices to differentiate and broaden the curriculum
- Organize and offer flexible small group learning activities
- Provide whole group enrichment explorations
- Teach cognitive and methodological skills
- Use center, stations, or contracts
- Organize integrated problem-solving simulations
- Propose interest-based extension activities
- Expose students to beyond level texts.

Supports for Students With 504 Plans:

- Follow all the 504 plan modifications
- Text to speech/audio recorded selections
- Amplification system as needed
- Leveled texts according to ability
- Fine motor skill stations embedded in rotation as needed
- Modified or constrained spelling word lists

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- Provide anchor charts with high frequency words and phonemic patterns

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