Pascack Valley Regional High School District

Pascack Hills High School, Montvale, New Jersey
Pascack Valley High School, Hillsdale, New Jersey

Course Name: Astronomy

Born On: August, 2017
Revised On: August, 2020
Revised On: August, 2022
Current Revision: August, 2023
Board Approval: 8/28/2023

New Jersey Curricular Mandates for Science Instruction

Disabled & LGBT:
18A:35-4.35 - History of disabled and LGBT persons included in middle and high school curriculum. A board of education shall include instruction on the political, economic, and social contributions of persons with disabilities and lesbian, gay, bisexual, and transgender people, in an appropriate place in the curriculum of middle school and high school students as part of the district's implementation of the New Jersey Student Learning Standards.

Diversity, Equity, and Inclusion (DEI):
C.18A:35-4.36a - Curriculum to include instruction on diversity and inclusion. 1. a. Beginning in the 2021-2022 school year, each school district shall incorporate instruction on diversity and inclusion in an appropriate place in the curriculum of students in grades kindergarten through 12 as part of the district's implementation of the New Jersey Student Learning Standards. b. The instruction shall: (1) highlight and promote diversity, including economic diversity, equity, inclusion, tolerance, and belonging in connection with gender and sexual orientation, race and ethnicity, disabilities, and religious tolerance; (2) examine the impact that unconscious bias and economic disparities have at both an individual level and on society as a whole; and (3) encourage safe, welcoming, and inclusive environments for all students regardless of race or ethnicity, sexual and gender identities, mental and physical disabilities, and religious beliefs. c. The Commissioner of Education shall provide school districts with sample learning activities and resources designed to promote diversity and inclusion.

Amistad Law:
N.J.S.A. 18A 52:16A-88 Every board of education shall incorporate the information regarding the contributions of African Americans to our country in an appropriate place in the curriculum of elementary and secondary school students.

Climate Change:
2020 NJSLS-Science: Earth's climate is now changing faster than at any point in the history of modern civilization, primarily as a result of human activities. Global climate change has already resulted in a wide range of impacts across New Jersey and in many sectors of its economy. The addition of academic standards that focus on climate change is important so that all students will have a basic understanding of the climate system, including the natural and human-caused factors that affect it. The underpinnings of climate change span across physical, life, as well as Earth and space sciences. The goal is for students to understand climate science as a way to inform decisions that improve quality of life for themselves, their community, and globally and to know how engineering solutions can allow us to mitigate impacts, adapt practices, and build resilient systems.

Dissection Law
N.J.S.A. 18A:35-4.25 and N.J.S.A. 18A:35-4.24 authorizes parents or guardians to assert the right of their children to refuse to dissect, vivisect, incubate, capture or otherwise harm or destroy animals or any parts thereof as part of a course of instruction.

Astronomy
Unit 1: Introduction to Astronomy
Time Allotted: Approximately 3 Weeks
New Jersey Student Learning Standards (NJSLS)
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.
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-ESS1-4 Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.

Science & Engineering Practices	Disciplinary Core Ideas	Cross-Cutting Concepts
Constructing Explanations and Designing Solutions • Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. **Obtaining, Evaluating, and Communicating Information** • Communicate scientific ideas (e.g. about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). **Using Mathematical and Computational Thinking** • Use mathematical or computational representations of phenomena to describe explanations. - *Connections to Nature of Science* **Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena** • A scientific theory is a substantiated explanation of some aspect of the natural world, based on a body of facts that have been	**ESS1.A: The Universe and Its Stars** • The study of stars' light spectra and brightness is used to identify compositional elements of stars, their movements, and their distances from Earth. • 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. **ESS1.B: Earth and the Solar System** • 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** • Energy cannot be created or destroyed–only moved between one place and another place, between objects and/or fields, or between systems. • In nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved. - *Connections to Engineering, Technology, and Applications of Science* **Interdependence of Science, Engineering, and Technology** • Science and engineering complement each other in the cycle known as research and development (R&D). Many R&D projects may involve scientists, engineers, and others with wide ranges of expertise. **Scale, Proportion, and Quantity** • 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). - *Connections to Engineering, Technology, and Applications of Science* **Interdependence of Science, Engineering, and Technology** • Science and engineering complement each other in the cycle known as research and development (R&D). Many R&D projects may involve scientists, engineers, and others with wide ranges of expertise.

repeatedly confirmed through observation and experiment and the science community validates each theory before it is accepted. If new evidence is discovered that the theory does not accommodate, the theory is generally modified in light of this new evidence.	**PS4.B: Electromagnetic Radiation** • Atoms of each element emit and absorb characteristic frequencies of light. These characteristics allow identification of the presence of an element, even in microscopic quantities. *(secondary)*	*Connections to Nature of Science* **Scientific Knowledge Assumes an Order and Consistency in Natural Systems** • Scientific knowledge is based on the assumption that natural laws operate today as they did in the past and they will continue to do so in the future. • Science assumes the universe is a vast single system in which basic laws are consistent.

Essential Questions	Student Learning Objectives	Suggested Tasks/Activities	Evidence of Learning (Assessment)
- Where is the Earth located with respect to the rest of the cosmos? - If I could travel to the Milky Way, what would I encounter and see? - What are the objects and patterns we see in our nighttime sky? - What causes the moon to change shape and position over time? - How did we come to our current understanding of the Cosmos?	- Students will be able to create a model that shows our address in the cosmos - Students will use valid research sources to discover folk stories about the Milky Way's creation - Students will analyze the basic structure of the Milky Way - Students will communicate what causes the seasons on earth - Students will study the patterns we see in the sky and how the constellations can be studied - Students will understand the different phases of the moon. - Students will explore the different types of eclipses and understand what causes them - Students will investigate the astronomers that revolutionized modern astronomy. - Students will draw a labeled diagram of the structure of our planet and our solar system.	- "Starry Night" computer-based simulations to investigate solar system, stars, galaxies, and the known universe - Cosmic Timeline Activity - Milky Way creation story activity to communicate understanding of how the Milky Way was created - "Famous Astronomers" research project and presentations to evaluate and communicate understandings of the contributions of famous astronomers - Flat Earth Video and Debate to construct arguments pertaining to the Earth's structure - Gizmo "Phases of the Moon" Activity to investigate the phases of the moon - Gizmo "2D eclipse" and "3D eclipse" Activities to explore the formation of eclipses	- Assess computer-based simulations for understanding of solar system, stars, galaxies, and the known universe - Assessment of ability to evaluate and synthesize information to construct a model of the Cosmos - Assess analysis and communication of how the Milky Way was created - Assess for the evaluation and communication revolutionization of modern astronomy Assess participation in class discussions for current and ongoing understanding of astronomy - Assessment of construction and communication of arguments pertaining to the Earth's structure

	- Students will explain how the earth's position affects our seasons on the surface.		
Resources/Materials	- Paper, Rulers, Tape, Art Supplies - Presentation Technology: Google Presentation, Prezi, PowerPoint - Starry Night Computer Program - Explorelearning.com (Gizmos)		
ELA Companion Standards	**RST.11-12.7-** Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. **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. **RST.11-12.9**- Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.		
Interdisciplinary Connections	***Connections to NJSLS – English Language Arts*:** **SL.11-12.1**. Initiate and participate effectively in a range of collaborative discussions (one-on- one, in groups, and teacher-led) with peers on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively. **SL.11-12.2**. Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, qualitatively, orally) evaluating the credibility and accuracy of each source. **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. **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. ***Connections to NJSLS – Mathematics:*** **MP.2** - Reason abstractly and quantitatively. **MP.4**- Model with mathematics. **HSN.Q.A.1-**Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. **HSN.Q.A.2**- Define appropriate quantities for the purpose of descriptive modeling. **HSN.Q.A.3-** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.		
Career Readiness, Life Literacies, and Key Skills	9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas 9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice. 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving. 9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions. 9.2.12.CAP.8: Determine job entrance criteria (e.g., education credentials, math/writing/reading comprehension tests, drug tests) used by employers in various industry sectors.		

	Career Readiness, Life Literacies, and Key Skills Practices Demonstrate creativity and innovation. Utilize critical thinking to make sense of problems and persevere in solving them. Work productively in teams while using cultural/global competence.
Computer Science and Design Thinking	8.2.12.ED.6: Analyze the effects of changing resources when designing a specific product or system (e.g., materials, energy, tools, capital, labor). 8.2.12.ETW.4: Research historical tensions between environmental and economic considerations as driven by human needs and wants in the development of a technological product and present the competing viewpoints

Modifications

English Language Learners	Special Education	At-Risk	Gifted and Talented
● Display labeled images of designs and parts. ● Use body movement and gestures to further explain concepts to students. ● Restate design steps aloud before project activity. ● Assign a native language partner.	● Provide adequate scaffolds for projects and activities. ● Provide alternative choices (i.e. verbal or visual) to demonstrate proficiency. ● Provide an outline of lessons. ● Get a written list of instructions. ● Work or take a test in a different setting, such as a quiet room with few distractions. ● Sit where they learn best (for example, near the teacher) ● Use an alarm to help with time management. ● Work with a partner/peer.	● Incorporate student choice ● Invite parents, neighbors, friends, the school principal and other community members to support classroom activities. ● Provide peer mentoring to improve techniques.	● Lead the class in the deciphering of new learning. ● Create a more detailed report which includes additional research outside of project requirements.

Astronomy		
Unit 2: The Moon		
Time Allotted: Approximately 2 Weeks		
New Jersey Student Learning Standards (NJSLS)		
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.		
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-ESS1-4 Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.		
Science & Engineering Practices	**Disciplinary Core Ideas**	**Cross-Cutting Concepts**
Constructing Explanations and Designing Solutions • Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. **Obtaining, Evaluating, and Communicating Information** • Communicate scientific ideas (e.g. about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). **Using Mathematical and Computational Thinking** • Use mathematical or computational representations of phenomena to describe explanations. - *Connections to Nature of Science*	**ESS1.A: The Universe and Its Stars** • The study of stars' light spectra and brightness is used to identify compositional elements of stars, their movements, and their distances from Earth. • 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. **ESS1.B: Earth and the Solar System** • Kepler's laws describe common features of the motions of orbiting objects, including their elliptical paths around the sun. Orbits may	**Energy and Matter** • Energy cannot be created or destroyed–only moved between one place and another place, between objects and/or fields, or between systems. • In nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved. - *Connections to Engineering, Technology, and Applications of Science* **Interdependence of Science, Engineering, and Technology** • Science and engineering complement each other in the cycle known as research and development (R&D). Many R&D projects may involve scientists, engineers, and others with wide ranges of expertise. **Scale, Proportion, and Quantity** • 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). - *Connections to Engineering, Technology, and Applications of Science* **Interdependence of Science, Engineering, and Technology** • Science and engineering complement each other in the cycle known as research and development (R&D). Many R&D projects may involve scientists, engineers, and others with wide ranges of expertise.

Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena • A scientific theory is a substantiated explanation of some aspect of the natural world, based on a body of facts that have been repeatedly confirmed through observation and experiment and the science community validates each theory before it is accepted. If new evidence is discovered that the theory does not accommodate, the theory is generally modified in light of this new evidence.	change due to the gravitational effects from, or collisions with, other objects in the solar system. **PS4.B: Electromagnetic Radiation** • Atoms of each element emit and absorb characteristic frequencies of light. These characteristics allow identification of the presence of an element, even in microscopic quantities. *(secondary)*	- *Connections to Nature of Science* **Scientific Knowledge Assumes an Order and Consistency in Natural Systems** • Scientific knowledge is based on the assumption that natural laws operate today as they did in the past and they will continue to do so in the future. • Science assumes the universe is a vast single system in which basic laws are consistent.

Essential Questions	Student Learning Objectives	Suggested Tasks/Activities	Evidence of Learning (Assessment)
- What is the structure of the moon and how does it relate to earth's structure? - What are the theories for the moon's formation and which one is regarded as correct? - How did the moon's surface get its current characteristics? - How does the moon's atmosphere compare to earth's atmosphere? - What are the 4 phases of the moon (in detail)? - What are the different types of eclipses and how do they occur? - How does the moon rotate and how does this rotation affect the oceanic tides on earth?	- Students will investigate the structure of the moon and how it relates to earth's structure. - Students will compare and contrast the different theories about the moon's formation and debate the pros and cons of each hypothesis. - Students will explore the moon's atmosphere and compare it to the atmosphere of earth. - Students will research the moon's surface and learn the correct vocabulary to describe its features. - Students will learn the 4 phases of the moon and how the rotation and tilt of the moon affects the tides on earth.	- "Starry Night" computer-based simulations to investigate the moon's surface - Gizmo "Ocean Tides" Activity to explore the impact of the moon on ocean tides - Moon features vocabulary activities to explore the surface of the moon - "Formation Hypotheses" research activities and debate to construct and communicate arguments about the moon's formation	- Assess computer-based simulation submissions for understanding of the structure and function of the moon - Laboratory investigation submissions assessed for analysis of the impact of the the moon on ocean tides - Class Presentations assessed for ability to research, construct and communicate arguments about the moon's formation - Assess participation in class discussions for current and ongoing understanding of the structure and function of the moon
Resources/Materials	- Paper, Rulers, Tape, Art Supplies - Presentation Technology: Google Presentation, Prezi, PowerPoint - Starry Night Computer Program - Explorelearning.com (Gizmos)		

ELA Companion Standards	**RST.11-12.7-** Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. **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. **RST.11-12.9**- Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.
Interdisciplinary Connections	***Connections to NJSLS – English Language Arts*:** **SL.11-12.1**. Initiate and participate effectively in a range of collaborative discussions (one-on- one, in groups, and teacher-led) with peers on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively. **SL.11-12.2**. Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, qualitatively, orally) evaluating the credibility and accuracy of each source. **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. **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. ***Connections to NJSLS – Mathematics:*** **MP.2** - Reason abstractly and quantitatively. **MP.4**- Model with mathematics. **HSN.Q.A.1-**Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. **HSN.Q.A.2**- Define appropriate quantities for the purpose of descriptive modeling. **HSN.Q.A.3-** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
Career Readiness, Life Literacies, and Key Skills	9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas 9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice. 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving. 9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions. 9.2.12.CAP.8: Determine job entrance criteria (e.g., education credentials, math/writing/reading comprehension tests, drug tests) used by employers in various industry sectors. **Career Readiness, Life Literacies, and Key Skills Practices** Demonstrate creativity and innovation. Utilize critical thinking to make sense of problems and persevere in solving them. Use technology to enhance productivity, increase collaboration, and communicate effectively. Work productively in teams while using cultural/global competence.
Computer Science and Design Thinking	8.2.12.ED.6: Analyze the effects of changing resources when designing a specific product or system (e.g., materials,

	energy, tools, capital, labor). 8.2.12.ETW.4: Research historical tensions between environmental and economic considerations as driven by human needs and wants in the development of a technological product and present the competing viewpoints

Modifications			
English Language Learners	**Special Education**	**At-Risk**	**Gifted and Talented**
● Display labeled images of designs and parts. ● Restate steps aloud before project activity. ● Assign a native language partner. ● When possible, modify assignments so the ELL student writes less, has simpler questions to answer, fewer spelling words, etc. ● Provide a variety of texts and resources on curriculum topics at a range of reading levels. ● Provide models of completed homework assignments, projects, etc.	● Provide extended time for the creation of products. ● Scaffolded explanations for proper use of equipment. ● Provide an outline of lessons ● Get a written list of instructions ● Receive large project as smaller tasks with individual deadlines ● Work or take a test in a different setting, such as a quiet room with few distractions. ● Sit where they learn best (for example, near the teacher) ● Use an alarm to help with time management ● Work with a partner	● Provide peer mentoring to improve techniques. ● Provide an outline for project tasks. ● Incorporate student choice ● Use effort and achievement rubrics ● Assure students they can be successful ● Promote mastery or challenging tasks ● Allow students many opportunities for practice and learning ● Use scaffolding for complex tasks ● Evaluate students on the basis of mastery and not one another.	● Lead the class in the deciphering of new learning. ● Advanced product design.

Astronomy		
Unit 3: The Terrestrial Planets (The Inner Planets)		
Time Allotted: Approximately 2-3 Weeks		
New Jersey Student Learning Standards (NJSLS)		
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.		
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-ESS1-4 Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.		
Science & Engineering Practices	**Disciplinary Core Ideas**	**Cross-Cutting Concepts**
Constructing Explanations and Designing Solutions • Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. **Obtaining, Evaluating, and Communicating Information** • Communicate scientific ideas (e.g. about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). **Using Mathematical and Computational Thinking** • Use mathematical or computational representations of phenomena to describe explanations. - *Connections to Nature of Science*	**ESS1.A: The Universe and Its Stars** • The study of stars' light spectra and brightness is used to identify compositional elements of stars, their movements, and their distances from Earth. • 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. **ESS1.B: Earth and the Solar System** • 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	**Energy and Matter** • Energy cannot be created or destroyed–only moved between one place and another place, between objects and/or fields, or between systems. • In nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved. - *Connections to Engineering, Technology, and Applications of Science* **Interdependence of Science, Engineering, and Technology** • Science and engineering complement each other in the cycle known as research and development (R&D). Many R&D projects may involve scientists, engineers, and others with wide ranges of expertise. **Scale, Proportion, and Quantity** • 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). - *Connections to Engineering, Technology, and Applications of Science* **Interdependence of Science, Engineering, and Technology** • Science and engineering complement each other in the cycle known as research and development (R&D). Many R&D projects may involve scientists, engineers, and others with wide ranges of expertise.

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Essential Questions	Student Learning Objectives	Suggested Tasks/Activities	Evidence of Learning (Assessment)
- What is the structure of each terrestrial/inner planet? - How does each inner planet compare to the Earth?	- Students will learn to actively participate in group work - Students will research the inner planets history, structure and atmosphere and compare the information to the information about earth - Students will present their findings to the class in a presentation format	- Group inner planet research project (Poster/Pamphlet/Media Choice) and Presentation) to collaborate to communicate the structure of the inner planets - "Starry Night" computer-based simulations to investigate the structure of the inner planets - Gizmo "Solar System Explorer" Activity to explore the structures of the the inner planets - Gizmo "Compare Earth to Venus" activity to construct understandings about how the inner planets compare to the Earth	- Assessment of gathering, synthesis and communication of information in inner planets project research, project poster/pamphlet submissions and project group presentations - Laboratory activity submissions assessed for analysis of the structure and function of the inner planets as compared to the Earth - Assess computer-based simulation submissions for understanding of the inner planets - Assess participation in class discussions for current and ongoing understanding of the structure and function of the inner planets
Resources/Materials	- Paper, Rulers, Tape, Art Supplies - Presentation Technology: Google Presentation, Prezi, PowerPoint - Starry Night Computer Program - Explorelearning.com (Gizmos)		

ELA Companion Standards	**RST.11-12.7-** Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. **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. **RST.11-12.9**- Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.
Interdisciplinary Connections	***Connections to NJSLS – English Language Arts*:** **SL.11-12.1**. Initiate and participate effectively in a range of collaborative discussions (one-on- one, in groups, and teacher-led) with peers on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively. **SL.11-12.2**. Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, qualitatively, orally) evaluating the credibility and accuracy of each source. **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. **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. ***Connections to NJSLS – Mathematics:*** **MP.2** - Reason abstractly and quantitatively. **MP.4**- Model with mathematics. **HSN.Q.A.1-**Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. **HSN.Q.A.2**- Define appropriate quantities for the purpose of descriptive modeling. **HSN.Q.A.3-** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
Career Readiness, Life Literacies, and Key Skills	9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas 9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice. 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving. 9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions. 9.2.12.CAP.8: Determine job entrance criteria (e.g., education credentials, math/writing/reading comprehension tests, drug tests) used by employers in various industry sectors. **Career Readiness, Life Literacies, and Key Skills Practices** Demonstrate creativity and innovation. Utilize critical thinking to make sense of problems and persevere in solving them. Use technology to enhance productivity, increase collaboration, and communicate effectively. Work productively in teams while using cultural/global competence.
Computer Science and Design Thinking	8.2.12.ED.6: Analyze the effects of changing resources when designing a specific product or system (e.g., materials, energy, tools, capital, labor).

	8.2.12.ETW.4: Research historical tensions between environmental and economic considerations as driven by human needs and wants in the development of a technological product and present the competing viewpoints

Modifications			
English Language Learners	**Special Education**	**At-Risk**	**Gifted and Talented**
● When possible, modify assignments so the ELL student writes less, has simpler questions to answer, fewer spelling words, etc. ● Provide models of completed homework assignments, projects, etc. ● Assign a native language partner. ● Use sentence/paragraph frames to assist with writing peer review. ● Provide extended time for written responses and reports.	● Use scaffolds, such as prompting to assist with the learning process. ● Provide extended time for written responses and reports. ● Use a graphic organizer to categorize concepts. ● Get a written list of instructions ● Receive a large project as smaller tasks with individual deadlines. ● Work or take a test in a different setting, such as a quiet room with few distractions. ● Sit where they learn best (for example, near the teacher). ● Use an alarm to help with time management. ● Work with a partner.	● Use a graphic organizer to categorize concepts. ● Provide an outline for research and design tasks. ● Provide extended time for written responses and reports. ● Incorporate student choice. ● Provide peer mentoring to improve techniques. ● Use effort and achievement rubrics ● Assure students they can be successful. ● Promote mastery or challenging tasks. ● Allow students many opportunities for practice and learning. ● Use scaffolding for complex tasks.	● Take on an additional or more complex design challenge. ● Interview someone in the field of technology education about how they use the lesson content and skills in their profession. ● Offer choices, once finished with the standard lesson activity, taking into consideration students' interests and goals.

Astronomy
Unit 4: The Outer Planets
Time Allotted: Approximately 2-3 Weeks
New Jersey Student Learning Standards (NJSLS)
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.
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-ESS1-4 Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.

Science & Engineering Practices	Disciplinary Core Ideas	Cross-Cutting Concepts
Constructing Explanations and Designing Solutions • Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. **Obtaining, Evaluating, and Communicating Information** • Communicate scientific ideas (e.g. about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). **Using Mathematical and Computational Thinking** • Use mathematical or computational representations of phenomena to describe explanations. - *Connections to Nature of Science* **Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena** • A scientific theory is a substantiated explanation of some aspect of the natural	**ESS1.A: The Universe and Its Stars** • The study of stars' light spectra and brightness is used to identify compositional elements of stars, their movements, and their distances from Earth. • 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. **ESS1.B: Earth and the Solar System** • 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	**Energy and Matter** • Energy cannot be created or destroyed–only moved between one place and another place, between objects and/or fields, or between systems. • In nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved. - *Connections to Engineering, Technology, and Applications of Science* **Interdependence of Science, Engineering, and Technology** • Science and engineering complement each other in the cycle known as research and development (R&D). Many R&D projects may involve scientists, engineers, and others with wide ranges of expertise. **Scale, Proportion, and Quantity** • 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). - *Connections to Engineering, Technology, and Applications of Science* **Interdependence of Science, Engineering, and Technology** • Science and engineering complement each other in the cycle known as research and development (R&D). Many R&D projects may involve scientists, engineers, and others with wide ranges of expertise.

world, based on a body of facts that have been repeatedly confirmed through observation and experiment and the science community validates each theory before it is accepted. If new evidence is discovered that the theory does not accommodate, the theory is generally modified in light of this new evidence.	collisions with, other objects in the solar system. **PS4.B: Electromagnetic Radiation** • Atoms of each element emit and absorb characteristic frequencies of light. These characteristics allow identification of the presence of an element, even in microscopic quantities. *(secondary)*	- *Connections to Nature of Science* **Scientific Knowledge Assumes an Order and Consistency in Natural Systems** • Scientific knowledge is based on the assumption that natural laws operate today as they did in the past and they will continue to do so in the future. • Science assumes the universe is a vast single system in which basic laws are consistent.

Essential Questions	Student Learning Objectives	Suggested Tasks/Activities	Evidence of Learning (Assessment)
- What is the structure of each outer planet? - How did the outer planets form? - If the outer planet has moons, what makes them unique? - How does each outer planet compare to the Earth?	- Students will learn to actively participate in group work - Students will research the outer planets history, structure and atmosphere and compare the information to the information about earth - Students will examine the diversity of the moons around the outer planets - Students will differentiate Pluto from the other 4 outer planets - Students will understand the difference between the outer 4 planets and the inner 4 planets (and the Kuiper Belt) - Students will present their findings to the class in a presentation format	- Group outer planets and Kuiper Belt research project (Poster/Pamphlet/Media Choice and Presentation) to collaborate to communicate the structure of the outer planets - “Starry Night” computer-based simulations to investigate the structure of the outer planets - Gizmo “Solar System Explorer” Activity to explore structure of the outer planets and how they compare to the Earth	- Assessment of gathering, evaluation, synthesis and communication of information about outer planets in project research, submissions and presentations - Laboratory investigation submissions assessed for analysis of the structure and function of the outer planets as compared to the Earth - Assess computer-based simulation submissions for understanding of the outer planets - Assess participation in class discussions for current and ongoing understanding of the structure and function of the outer planets
Resources/Materials	- Paper, Rulers, Tape, Art Supplies - Presentation Technology: Google Presentation, Prezi, PowerPoint - Starry Night Computer Program - Explorelearning.com Gizmo Work		

ELA Companion Standards	**RST.11-12.7-** Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. **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. **RST.11-12.9**- Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.
Interdisciplinary Connections	***Connections to NJSLS – English Language Arts*:** **SL.11-12.1**. Initiate and participate effectively in a range of collaborative discussions (one-on- one, in groups, and teacher-led) with peers on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively. **SL.11-12.2**. Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, qualitatively, orally) evaluating the credibility and accuracy of each source. **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. **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. ***Connections to NJSLS – Mathematics:*** **MP.2** - Reason abstractly and quantitatively. **MP.4**- Model with mathematics. **HSN.Q.A.1-**Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. **HSN.Q.A.2**- Define appropriate quantities for the purpose of descriptive modeling. **HSN.Q.A.3-** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
Career Readiness, Life Literacies, and Key Skills	9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas 9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice. 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving. 9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions. 9.2.12.CAP.8: Determine job entrance criteria (e.g., education credentials, math/writing/reading comprehension tests, drug tests) used by employers in various industry sectors. **Career Readiness, Life Literacies, and Key Skills Practices** Demonstrate creativity and innovation. Utilize critical thinking to make sense of problems and persevere in solving them. Model integrity, ethical leadership, and effective management. Use technology to enhance productivity, increase collaboration, and communicate effectively. Work productively in teams while using cultural/global competence.
Computer Science and Design Thinking	8.2.12.ED.6: Analyze the effects of changing resources when designing a specific product or system (e.g., materials,

	energy, tools, capital, labor). 8.2.12.ETW.4: Research historical tensions between environmental and economic considerations as driven by human needs and wants in the development of a technological product and present the competing viewpoints

Modifications			
English Language Learners	**Special Education**	**At-Risk**	**Gifted and Talented**
● Provide extended time for written responses and reports. ● When possible, modify assignments so the ELL student writes less, has simpler questions to answer, fewer spelling words, etc. ● Provide a variety of texts and resources on curriculum topics at a range of reading levels. ● Provide models of completed homework assignments, projects, etc. ● Assign a native language partner. ● Use sentence/paragraph frames to assist with writing reports.	● Use scaffolds, such as prompting to assist with the design process and with the writing process. ● Provide extended time for written responses and reports. ● Use a graphic organizer to categorize concepts. ● Get a written list of instructions ● Receive large project as smaller tasks with individual deadlines ● Work or take a test in a different setting, such as a quiet room with fewer distractions. ● Sit where they learn best (for example, near the teacher) ● Use an alarm to help with time management. ● Work with a partner.	● Use a graphic organizer to categorize concepts. ● Provide an outline for research and design tasks. ● Provide extended time for written responses and reports. ● Incorporate student choice ● Provide peer mentoring to improve techniques ● Use effort and achievement rubrics. ● Assure students they can be successful. ● Allow students many opportunities for practice and learning. ● Use scaffolding for complex tasks.	● Take on additional or more complex lesson activities and projects. . ● Interview someone in the field of astronomy about how they use their knowledge in their profession. ● Offer choices, once finished with the standard lesson activity, taking into consideration students' interests and goals.

Astronomy
Unit 5: Small Bodies Orbiting the Sun
Time Allotted: Approximately 1-2 Weeks
New Jersey Student Learning Standards (NJSLS)
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.
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-ESS1-4 Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.

Science & Engineering Practices	Disciplinary Core Ideas	Cross-Cutting Concepts
Constructing Explanations and Designing Solutions 1. Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. **Obtaining, Evaluating, and Communicating Information** 2. Communicate scientific ideas (e.g. about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). **Using Mathematical and Computational Thinking** 3. Use mathematical or computational representations of phenomena to describe explanations. - *Connections to Nature of Science* **Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena** 4. A scientific theory is a substantiated explanation of some aspect of the natural	**ESS1.A: The Universe and Its Stars** 1. The study of stars' light spectra and brightness is used to identify compositional elements of stars, their movements, and their distances from Earth. 2. 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. 3. 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. **ESS1.B: Earth and the Solar System** 4. 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	**Energy and Matter** 1. Energy cannot be created or destroyed–only moved between one place and another place, between objects and/or fields, or between systems. 2. In nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved. - *Connections to Engineering, Technology, and Applications of Science* **Interdependence of Science, Engineering, and Technology** 3. Science and engineering complement each other in the cycle known as research and development (R&D). Many R&D projects may involve scientists, engineers, and others with wide ranges of expertise. **Scale, Proportion, and Quantity** 4. 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). - *Connections to Engineering, Technology, and Applications of Science* **Interdependence of Science, Engineering, and Technology** 1. Science and engineering complement each other in the cycle known as research and development (R&D). Many R&D projects may involve scientists, engineers, and others with wide ranges of expertise.

world, based on a body of facts that have been repeatedly confirmed through observation and experiment and the science community validates each theory before it is accepted. If new evidence is discovered that the theory does not accommodate, the theory is generally modified in light of this new evidence.	effects from, or collisions with, other objects in the solar system. **PS4.B: Electromagnetic Radiation** 5. Atoms of each element emit and absorb characteristic frequencies of light. These characteristics allow identification of the presence of an element, even in microscopic quantities. *(secondary)*	- *Connections to Nature of Science* **Scientific Knowledge Assumes an Order and Consistency in Natural Systems** 1. Scientific knowledge is based on the assumption that natural laws operate today as they did in the past and they will continue to do so in the future. 2. Science assumes the universe is a vast single system in which basic laws are consistent.

Essential Questions	Student Learning Objectives	Suggested Tasks/Activities	Evidence of Learning (Assessment)
- What are meteors, meteorites, and meteoroids? - How might we predict the behavior of asteroids and comets? - How might we predict the movements of comets and meteor showers that are famous? - How do we know if the Earth has ever been hit by an asteroid? - What is the significance of the Oort Cloud?	- Students will investigate the difference between meteors, meteorites, meteoroids, comets, and asteroids. - Students will explore the comets and meteor showers that reappear in Earth's sky and understand how we can predict them. - Students understand the basic physics of a comet. - Students research the evidence of an asteroid collision with earth and make the connection to the dinosaur's extinction.	- Famous Comets research project to investigate the appearance and behavior of comets - "Starry Night" computer-based simulations to explore the behavior of the Earth's sky - Short Oort Cloud video observe the significance of the Oort Cloud	- Assessment of gathering, analysis, synthesis and communication of information in research, project - Assess computer-based simulation submissions for understanding the behavior of the Earth's sky

Resources/Materials	- Paper, Rulers, Tape, Art Supplies - Valid research sources - Presentation Technology: Google Presentation, Prezi, PowerPoint - Starry Night Computer Program
ELA Companion Standards	**RST.11-12.7-** Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. **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. **RST.11-12.9**- Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.
Interdisciplinary Connections	***Connections to NJSLS – English Language Arts*:**

	SL.11-12.1. Initiate and participate effectively in a range of collaborative discussions (one-on- one, in groups, and teacher-led) with peers on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively. **SL.11-12.2**. Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, qualitatively, orally) evaluating the credibility and accuracy of each source. **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. **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. ***<u>Connections to NJSLS – Mathematics:</u>*** **MP.2** - Reason abstractly and quantitatively. **MP.4**- Model with mathematics. **HSN.Q.A.1-**Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. **HSN.Q.A.2**- Define appropriate quantities for the purpose of descriptive modeling. **HSN.Q.A.3-** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
Career Readiness, Life Literacies, and Key Skills	9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas 9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice. 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving. 9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions. 9.2.12.CAP.8: Determine job entrance criteria (e.g., education credentials, math/writing/reading comprehension tests, drug tests) used by employers in various industry sectors. **Career Readiness, Life Literacies, and Key Skills Practices** Demonstrate creativity and innovation. Utilize critical thinking to make sense of problems and persevere in solving them. Model integrity, ethical leadership, and effective management. Use technology to enhance productivity, increase collaboration, and communicate effectively. Work productively in teams while using cultural/global competence.
Computer Science and Design Thinking	8.2.12.ED.6: Analyze the effects of changing resources when designing a specific product or system (e.g., materials, energy, tools, capital, labor). 8.2.12.ETW.4: Research historical tensions between environmental and economic considerations as driven by human needs and wants in the development of a technological product and present the competing viewpoints

Modifications			
English Language Learners	**Special Education**	**At-Risk**	**Gifted and Talented**
● Provide a template for documenting lesson content or	● Provide additional time for project development.	● Invite parents, neighbors, friends, the school principal and	● Offer choices, once finished with the standard lesson

project processes. ● When possible, modify assignments so the ELL student writes less, has simpler questions to answer, fewer spelling words, etc. ● Provide models of completed homework assignments, projects, etc. ● Assign a native language partner. ● Provide extended time for written responses and reports.	● Utilize graphics to support learning. ● Provide an outline of lessons ● Get a written list of instructions ● Receive large project as smaller tasks with individual deadlines ● Work or take a test in a different setting, such as a quiet room with few distractions. ● Sit where they learn best (for example, near the teacher) ● Use an alarm to help with time management.	other community members to attend class performances. ● Break the design process into smaller pieces. ● Conference with the teacher during the project planning process. ● Provide a detailed framework for the project design. ● Incorporate student choice. ● Provide peer mentoring to improve techniques. ● Assure students they can be successful. ● Allow students many opportunities for practice and learning. ● Use scaffolding for complex tasks	activity, taking into consideration students' interests and goals. ● Develop more complex projects based on extensive research both individually and in collaboration with peers.

Astronomy
Unit 6: The Sun
Time Allotted: Approximately 2 Weeks
New Jersey Student Learning Standards (NJSLS)
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.
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-ESS1-4 Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.

Science & Engineering Practices	Disciplinary Core Ideas	Cross-Cutting Concepts
Constructing Explanations and Designing Solutions 3. Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. **Obtaining, Evaluating, and Communicating Information** 4. Communicate scientific ideas (e.g. about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). **Using Mathematical and Computational Thinking** 5. Use mathematical or computational representations of phenomena to describe explanations. - *Connections to Nature of Science* **Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena** 6. A scientific theory is a substantiated explanation of some aspect of the natural	**ESS1.A: The Universe and Its Stars** 7. The study of stars' light spectra and brightness is used to identify compositional elements of stars, their movements, and their distances from Earth. 8. 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. 9. 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. **ESS1.B: Earth and the Solar System** 10. 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	**Energy and Matter** 12. Energy cannot be created or destroyed–only moved between one place and another place, between objects and/or fields, or between systems. 13. In nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved. - *Connections to Engineering, Technology, and Applications of Science* **Interdependence of Science, Engineering, and Technology** 14. Science and engineering complement each other in the cycle known as research and development (R&D). Many R&D projects may involve scientists, engineers, and others with wide ranges of expertise. **Scale, Proportion, and Quantity** 15. 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). - *Connections to Engineering, Technology, and Applications of Science* **Interdependence of Science, Engineering, and Technology** 16. Science and engineering complement each other in the cycle known as research and development (R&D). Many R&D projects may involve scientists, engineers, and others with wide ranges of expertise. - *Connections to Nature of Science*

world, based on a body of facts that have been repeatedly confirmed through observation and experiment and the science community validates each theory before it is accepted. If new evidence is discovered that the theory does not accommodate, the theory is generally modified in light of this new evidence.	effects from, or collisions with, other objects in the solar system. **PS4.B: Electromagnetic Radiation** 11. Atoms of each element emit and absorb characteristic frequencies of light. These characteristics allow identification of the presence of an element, even in microscopic quantities. *(secondary)*	**Scientific Knowledge Assumes an Order and Consistency in Natural Systems** 17. Scientific knowledge is based on the assumption that natural laws operate today as they did in the past and they will continue to do so in the future. 18. Science assumes the universe is a vast single system in which basic laws are consistent.

Essential Questions	Student Learning Objectives	Suggested Tasks/Activities	Evidence of Learning (Assessment)
- How large is the sun when compared to the planets and other stars in our solar system? - What is the significance of the structure of the sun? - How does the sun produce heat? - What are sunspots, flares, and prominences and how are they different?	- Students will explore the sun's size relative to planets and other stars. - Students will research the layers of the sun and what elements are present. - Students will investigate the energy producing nuclear reactions that keep the sun hot and hypothesize what will happen when the sun uses all its fuel. - Students will learn about the different types of observable actions produced by the sun.	- "Size of the Sun" research and comparison activity - Image comparisons of solar flares, spots, and prominences (include gifs and videos) - Labeling activity for the "anatomy of the sun"to communicate and understanding of the structure of the sun - "The Amazing Sun" Documentary to explore the structure and behavior of the sun - Starry Night Activities to investigate the structure and behavior of the sun	- Assessment of gathering, analysis, synthesis and communication of information in a research project/activity - Assess computer-based simulation submissions for understanding the behavior of the Sun - Assess comparisons of Solar flare, spots, and prominence discussions for the construction of explanations and arguments based upon evidence - Assess written reflections for the analysis and communication of information pertaining to the structure and function of the sun
Resources/Materials	- Paper, Rulers, Tape, Art Supplies - Presentation Technology: Google Presentation, Prezi, PowerPoint - Starry Night Computer Program - Explorelearning.com (Gizmos)		
ELA Companion Standards	**RST.11-12.7-** Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.		

	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. **RST.11-12.9**- Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.
Interdisciplinary Connections	***Connections to NJSLS – English Language Arts*:** **SL.11-12.1**. Initiate and participate effectively in a range of collaborative discussions (one-on- one, in groups, and teacher-led) with peers on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively. **SL.11-12.2**. Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, qualitatively, orally) evaluating the credibility and accuracy of each source. **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. **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. ***Connections to NJSLS – Mathematics:*** **MP.2** - Reason abstractly and quantitatively. **MP.4**- Model with mathematics. **HSN.Q.A.1-**Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. **HSN.Q.A.2**- Define appropriate quantities for the purpose of descriptive modeling. **HSN.Q.A.3-** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
Career Readiness, Life Literacies, and Key Skills	9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas 9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice. 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving. 9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions. 9.2.12.CAP.8: Determine job entrance criteria (e.g., education credentials, math/writing/reading comprehension tests, drug tests) used by employers in various industry sectors. **Career Readiness, Life Literacies, and Key Skills Practices** Consider the environmental, social, and economic impacts of decisions. Demonstrate creativity and innovation. Utilize critical thinking to make sense of problems and persevere in solving them. Model integrity, ethical leadership, and effective management. Use technology to enhance productivity, increase collaboration, and communicate effectively. Work productively in teams while using cultural/global competence.
Computer Science and Design Thinking	8.2.12.ED.6: Analyze the effects of changing resources when designing a specific product or system (e.g., materials, energy, tools, capital, labor).

	8.2.12.ETW.4: Research historical tensions between environmental and economic considerations as driven by human needs and wants in the development of a technological product and present the competing viewpoints

Modifications			
English Language Learners	**Special Education**	**At-Risk**	**Gifted and Talented**
● Provide a template for documenting new learning and the project design process. ● When possible, modify assignments so the ELL student writes less, has simpler questions to answer, fewer spelling words, etc. ● Provide models of completed homework assignments, projects, etc. ● Assign a native language partner. ● Provide extended time for written responses and reports.	● Provide additional time for project development. ● Work with a peer to develop a simpler design. ● Utilize graphics to support learning. ● Provide an outline of lessons. ● Get a written list of instructions ● Receive large project as smaller tasks with individual deadlines ● Work or take a test in a different setting, such as a quiet room with few distractions ● Sit where they learn best (for example, near the teacher) ● Use an alarm to help with time management.	● Invite parents, neighbors, friends, the school principal and other community members to attend class performances. ● Break the design process into smaller pieces. ● Conference with the teacher during the project planning process. ● Provide a detailed framework for the project design. ● Incorporate student choice ● Provide peer mentoring to improve techniques ● Use effort and achievement rubrics ● Assure students they can be successful ● Promote mastery or challenging tasks ● Allow students many opportunities for practice and learning ● Use scaffolding for complex tasks ● Evaluate students on the basis of mastery and not one another. Classroom activities should be noncompetitive	● Offer choices, once finished with basic task, with personal interest being the key. ● Develop more complex designs based on extensive research both individually and in collaboration with peers.

Astronomy
Unit 7: Stars and Constellations
Time Allotted: Approximately 2 Weeks
New Jersey Student Learning Standards (NJSLS)
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.
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-ESS1-4 Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.

Science & Engineering Practices	Disciplinary Core Ideas	Cross-Cutting Concepts
Constructing Explanations and Designing Solutions 19. Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. **Obtaining, Evaluating, and Communicating Information** 20. Communicate scientific ideas (e.g. about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). **Using Mathematical and Computational Thinking** 21. Use mathematical or computational representations of phenomena to describe explanations. - *Connections to Nature of Science*	**ESS1.A: The Universe and Its Stars** 23. The study of stars' light spectra and brightness is used to identify compositional elements of stars, their movements, and their distances from Earth. 24. 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. 25. 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. **ESS1.B: Earth and the Solar System** 26. 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	**Energy and Matter** 28. Energy cannot be created or destroyed–only moved between one place and another place, between objects and/or fields, or between systems. 29. In nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved. - *Connections to Engineering, Technology, and Applications of Science* **Interdependence of Science, Engineering, and Technology** 30. Science and engineering complement each other in the cycle known as research and development (R&D). Many R&D projects may involve scientists, engineers, and others with wide ranges of expertise. **Scale, Proportion, and Quantity** 31. 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). - *Connections to Engineering, Technology, and Applications of Science* **Interdependence of Science, Engineering, and Technology** 32. Science and engineering complement each other in the cycle known as research and development (R&D). Many R&D projects may involve scientists, engineers, and others with wide ranges of expertise. -

Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena 22. A scientific theory is a substantiated explanation of some aspect of the natural world, based on a body of facts that have been repeatedly confirmed through observation and experiment and the science community validates each theory before it is accepted. If new evidence is discovered that the theory does not accommodate, the theory is generally modified in light of this new evidence.	effects from, or collisions with, other objects in the solar system. **PS4.B: Electromagnetic Radiation** 27. Atoms of each element emit and absorb characteristic frequencies of light. These characteristics allow identification of the presence of an element, even in microscopic quantities. *(secondary)*	*Connections to Nature of Science* **Scientific Knowledge Assumes an Order and Consistency in Natural Systems** 33. Scientific knowledge is based on the assumption that natural laws operate today as they did in the past and they will continue to do so in the future. 34. Science assumes the universe is a vast single system in which basic laws are consistent.

Essential Questions	Student Learning Objectives	Suggested Tasks/Activities	Evidence of Learning (Assessment)
- What are the traditional zodiac constellations and where are they located in the night sky? - Is the night sky the same for the entire year and in every place on earth? - How can the stars and constellations be used to navigate the globe?	- Students will explore the night sky and identify different constellations. - Students will understand the dynamic nature of the night sky and the differences between the northern and southern night skies. - Students will investigate the methods used by explorers to navigate the globe by using the stars and constellations.	- Starry Night Activities and Simulations to investigate and compare the night sky and various constellations in different parts of the world - Teacher-led presentations using the simulations to promote student questions and thinking about how the stars and constellations can be used to navigate the globe	- Assess computer-based simulation submissions for understanding of the night sky - Assess participation in class discussions for current and ongoing understanding of how the star and constellations can be used to navigate the globe

Resources/Materials	- Paper, Rulers, Tape, Art Supplies - Presentation Technology: Google Presentation, Prezi, PowerPoint - Starry Night Computer Program - Explorelearning.com Gizmo Work
ELA Companion Standards	**RST.11-12.7-** Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. **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. **RST.11-12.9**- Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.
Interdisciplinary Connections	***Connections to NJSLS – English Language Arts*:**

	SL.11-12.1. Initiate and participate effectively in a range of collaborative discussions (one-on- one, in groups, and teacher-led) with peers on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively. **SL.11-12.2**. Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, qualitatively, orally) evaluating the credibility and accuracy of each source. **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. **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. ***Connections to NJSLS – Mathematics:*** **MP.2** - Reason abstractly and quantitatively. **MP.4**- Model with mathematics. **HSN.Q.A.1-**Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. **HSN.Q.A.2**- Define appropriate quantities for the purpose of descriptive modeling. **HSN.Q.A.3-** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
Career Readiness, Life Literacies, and Key Skills	9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas 9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice. 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving. 9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions. 9.2.12.CAP.8: Determine job entrance criteria (e.g., education credentials, math/writing/reading comprehension tests, drug tests) used by employers in various industry sectors. **Career Readiness, Life Literacies, and Key Skills Practices** Demonstrate creativity and innovation. Utilize critical thinking to make sense of problems and persevere in solving them. Model integrity, ethical leadership, and effective management. Use technology to enhance productivity, increase collaboration, and communicate effectively. Work productively in teams while using cultural/global competence.
Computer Science and Design Thinking	8.2.12.ED.6: Analyze the effects of changing resources when designing a specific product or system (e.g., materials, energy, tools, capital, labor). 8.2.12.ETW.4: Research historical tensions between environmental and economic considerations as driven by human needs and wants in the development of a technological product and present the competing viewpoints

Modifications			
English Language Learners	**Special Education**	**At-Risk**	**Gifted and Talented**
● Provide a template for documenting the design	● Provide additional time for project development.	● Invite parents, neighbors, friends, the school principal and	● Offer choices, once finished with basic task, with personal

process. ● When possible, modify assignments so the ELL student writes less, has simpler questions to answer, fewer spelling words, etc. ● Provide models of completed homework assignments, projects, etc. ● Assign a native language partner. ● Provide extended time for written responses and reports.	● Work with a peer to develop a simpler design. ● Utilize graphics to support learning. ● Provide an outline of lessons ● Get a written list of instructions ● Receive large project as smaller tasks with individual deadlines ● Work or take a test in a different setting, such as a quiet room with few distractions ● Sit where they learn best (for example, near the teacher) ● Use an alarm to help with time management	other community members to attend class performances. ● Break the design process into smaller pieces. ● Conference with the teacher during the project planning process. ● Provide a detailed framework for the project design. ● Incorporate student choice ● Provide peer mentoring to improve techniques ● Use effort and achievement rubrics ● Assure students they can be successful ● Promote mastery or challenging tasks ● Allow students many opportunities for practice and learning ● Use scaffolding for complex tasks	interest being the key. ● Develop more complex designs based on extensive research both individually and in collaboration with peers.

Astronomy
Unit 8: "Bad Astronomy" Myths
Time Allotted: Approximately 2 Weeks
New Jersey Student Learning Standards (NJSLS)
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.
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-ESS1-4 Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.

Science & Engineering Practices	Disciplinary Core Ideas	Cross-Cutting Concepts
Constructing Explanations and Designing Solutions 35. Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. **Obtaining, Evaluating, and Communicating Information** 36. Communicate scientific ideas (e.g. about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). **Using Mathematical and Computational Thinking** 37. Use mathematical or computational representations of phenomena to describe explanations. - *Connections to Nature of Science*	**ESS1.A: The Universe and Its Stars** 39. The study of stars' light spectra and brightness is used to identify compositional elements of stars, their movements, and their distances from Earth. 40. 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. 41. 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. **ESS1.B: Earth and the Solar System** 42. 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	**Energy and Matter** 44. Energy cannot be created or destroyed–only moved between one place and another place, between objects and/or fields, or between systems. 45. In nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved. - *Connections to Engineering, Technology, and Applications of Science* **Interdependence of Science, Engineering, and Technology** 46. Science and engineering complement each other in the cycle known as research and development (R&D). Many R&D projects may involve scientists, engineers, and others with wide ranges of expertise. **Scale, Proportion, and Quantity** 47. 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). - *Connections to Engineering, Technology, and Applications of Science* **Interdependence of Science, Engineering, and Technology** 48. Science and engineering complement each other in the cycle known as research and development (R&D). Many R&D projects may involve scientists, engineers, and others with wide ranges of expertise.

Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena 38. A scientific theory is a substantiated explanation of some aspect of the natural world, based on a body of facts that have been repeatedly confirmed through observation and experiment and the science community validates each theory before it is accepted. If new evidence is discovered that the theory does not accommodate, the theory is generally modified in light of this new evidence.	effects from, or collisions with, other objects in the solar system. **PS4.B: Electromagnetic Radiation** 43. Atoms of each element emit and absorb characteristic frequencies of light. These characteristics allow identification of the presence of an element, even in microscopic quantities. *(secondary)*	- *Connections to Nature of Science* **Scientific Knowledge Assumes an Order and Consistency in Natural Systems** 49. Scientific knowledge is based on the assumption that natural laws operate today as they did in the past and they will continue to do so in the future. 50. Science assumes the universe is a vast single system in which basic laws are consistent.

Essential Questions	Student Learning Objectives	Suggested Tasks/Activities	Evidence of Learning (Assessment)
- Where do we see Astronomy in popular culture? - What are some Astronomy Myths in our society and how can they be explained?	- Students will relate astronomy to popular culture - Students will debate myths that are related to astronomy.	- "Bad Astronomy" (by Phil Plait) reading and presentation to class which students will use to construct arguments about astronomical myths	- Assess construction of arguments in presentations, peer review and student discussions

Resources/Materials	- Paper, Rulers, Tape, Art Supplies - Presentation Technology: Google Presentation, Prezi, PowerPoint - Starry Night Computer Program - Explorelearning.com (Gizmos)
ELA Companion Standards	**RST.11-12.7-** Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. **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. **RST.11-12.9**- Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.
Interdisciplinary Connections	***Connections to NJSLS – English Language Arts*:** **SL.11-12.1**. Initiate and participate effectively in a range of collaborative discussions (one-on- one, in groups, and teacher-led) with peers on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively. **SL.11-12.2**. Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, qualitatively, orally) evaluating the credibility and accuracy of each source. **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. **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.

	Connections to NJSLS – Mathematics: **MP.2** - Reason abstractly and quantitatively. **MP.4**- Model with mathematics. **HSN.Q.A.1-**Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. **HSN.Q.A.2**- Define appropriate quantities for the purpose of descriptive modeling. **HSN.Q.A.3-** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
Career Readiness, Life Literacies, and Key Skills	9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas 9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice. 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving. 9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions. 9.2.12.CAP.8: Determine job entrance criteria (e.g., education credentials, math/writing/reading comprehension tests, drug tests) used by employers in various industry sectors. **Career Readiness, Life Literacies, and Key Skills Practices** Act as a responsible and contributing community member and employee Consider the environmental, social, and economic impacts of decisions. Demonstrate creativity and innovation. Utilize critical thinking to make sense of problems and persevere in solving them. Model integrity, ethical leadership, and effective management. Use technology to enhance productivity, increase collaboration, and communicate effectively. Work productively in teams while using cultural/global competence.
Computer Science and Design Thinking	8.2.12.ED.6: Analyze the effects of changing resources when designing a specific product or system (e.g., materials, energy, tools, capital, labor). 8.2.12.ETW.4: Research historical tensions between environmental and economic considerations as driven by human needs and wants in the development of a technological product and present the competing viewpoints

Modifications

English Language Learners	Special Education	At-Risk	Gifted and Talented
● Provide a template for documenting the design process. ● When possible, modify assignments so the ELL student writes less, has simpler questions to answer, fewer spelling words, etc.	● Provide additional time for project development. ● Work with a peer to develop a simpler design. ● Utilize graphics to support learning. ● Provide an outline of lessons ● Get a written list of instructions	● Invite parents, neighbors, friends, the school principal and other community members to attend class performances. ● Break the design process into smaller pieces. ● Conference with the teacher during the project planning	● Offer choices, once finished with the standard lesson activity, taking into consideration students' interests and goals. ● Engage in more complex projects designs based on extensive research both

● Provide models of completed homework assignments, projects, etc. ● Assign a native language partner. ● Provide extended time for written responses and reports.	● Receive large project as smaller tasks with individual deadlines ● Work or take a test in a different setting, such as a quiet room with few distractions ● Sit where they learn best (for example, near the teacher) ● Use an alarm to help with time management	process. ● Provide a detailed framework for the project design. ● Incorporate student choice. ● Provide peer mentoring to improve techniques. ● Assure students they can be successful. ● Allow students many opportunities for practice and learning. ● Use scaffolding for complex tasks.	individually and in collaboration with peers.

Astronomy
Unit 9: Modern Astronomical Technology (ISS and Hubble)
Time Allotted: Approximately 2 Weeks
New Jersey Student Learning Standards (NJSLS)
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.
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-ESS1-4 Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.

Science & Engineering Practices	Disciplinary Core Ideas	Cross-Cutting Concepts
Constructing Explanations and Designing Solutions 51. Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. **Obtaining, Evaluating, and Communicating Information** 52. Communicate scientific ideas (e.g. about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). **Using Mathematical and Computational Thinking** 53. Use mathematical or computational representations of phenomena to describe explanations. - *Connections to Nature of Science* **Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena** 54. A scientific theory is a substantiated explanation of some aspect of the natural	**ESS1.A: The Universe and Its Stars** 55. The study of stars' light spectra and brightness is used to identify compositional elements of stars, their movements, and their distances from Earth. 56. 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. 57. 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. **ESS1.B: Earth and the Solar System** 58. 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** 60. Energy cannot be created or destroyed–only moved between one place and another place, between objects and/or fields, or between systems. 61. In nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved. - *Connections to Engineering, Technology, and Applications of Science* **Interdependence of Science, Engineering, and Technology** 62. Science and engineering complement each other in the cycle known as research and development (R&D). Many R&D projects may involve scientists, engineers, and others with wide ranges of expertise. **Scale, Proportion, and Quantity** 63. 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). - *Connections to Engineering, Technology, and Applications of Science* **Interdependence of Science, Engineering, and Technology** 64. Science and engineering complement each other in the cycle known as research and development (R&D). Many R&D projects may involve scientists, engineers, and others with wide ranges of expertise.

world, based on a body of facts that have been repeatedly confirmed through observation and experiment and the science community validates each theory before it is accepted. If new evidence is discovered that the theory does not accommodate, the theory is generally modified in light of this new evidence.	**PS4.B: Electromagnetic Radiation** 59. Atoms of each element emit and absorb characteristic frequencies of light. These characteristics allow identification of the presence of an element, even in microscopic quantities. *(secondary)*	- *Connections to Nature of Science* **Scientific Knowledge Assumes an Order and Consistency in Natural Systems** 65. Scientific knowledge is based on the assumption that natural laws operate today as they did in the past and they will continue to do so in the future. 66. Science assumes the universe is a vast single system in which basic laws are consistent.

Essential Questions	Student Learning Objectives	Suggested Tasks/Activities	Evidence of Learning (Assessment)
- What is the significance of the International Space Station? - Why is the Hubble Telescope important? - What is the significance of the James Webb Space Telescope?	- Students will understand the importance of the International Space Station and the Hubble Telescope in present day astronomy - Students will articulate the significance of the James Webb Space Telescope	- "International Space Station" Documentary to analyze the significance of International Space Station - Hubble picture presentations and research to investigate the significance of the Hubble telescope - Case Study: "Building Hubble" to analyze and construct arguments about the significance of the Hubble telescope	- Assess ability to evaluate and communicate information about the importance of the Hubble Telescope - Case Studies/Discussions will be assessed for the quality of arguments based upon evidence

Resources/Materials	- Paper, Rulers, Tape, Art Supplies - Presentation Technology: Google Presentation, Prezi, PowerPoint - Starry Night Computer Program - Explorelearning.com (Gizmos)
ELA Companion Standards	**RST.11-12.7-** Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. **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. **RST.11-12.9**- Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.
Interdisciplinary Connections	***Connections to NJSLS – English Language Arts*:** **SL.11-12.1**. Initiate and participate effectively in a range of collaborative discussions (one-on- one, in groups, and teacher-led) with peers on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.

	SL.11-12.2. Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, qualitatively, orally) evaluating the credibility and accuracy of each source. **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. **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. ***Connections to NJSLS – Mathematics:*** **MP.2** - Reason abstractly and quantitatively. **MP.4**- Model with mathematics. **HSN.Q.A.1-**Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. **HSN.Q.A.2**- Define appropriate quantities for the purpose of descriptive modeling. **HSN.Q.A.3-** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
Career Readiness, Life Literacies, and Key Skills	9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas 9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice. 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving. 9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions. 9.2.12.CAP.8: Determine job entrance criteria (e.g., education credentials, math/writing/reading comprehension tests, drug tests) used by employers in various industry sectors. **Career Readiness, Life Literacies, and Key Skills Practices** Act as a responsible and contributing community member and employee Consider the environmental, social, and economic impacts of decisions. Demonstrate creativity and innovation. Utilize critical thinking to make sense of problems and persevere in solving them. Model integrity, ethical leadership, and effective management. Use technology to enhance productivity, increase collaboration, and communicate effectively. Work productively in teams while using cultural/global competence.
Computer Science and Design Thinking	8.2.12.ED.6: Analyze the effects of changing resources when designing a specific product or system (e.g., materials, energy, tools, capital, labor). 8.2.12.ETW.4: Research historical tensions between environmental and economic considerations as driven by human needs and wants in the development of a technological product and present the competing viewpoints

Modifications			
English Language Learners	**Special Education**	**At-Risk**	**Gifted and Talented**
● Provide a template for documenting the project design process or new learning.	● Provide additional time for project development. ● Work with a peer to develop a	● Invite parents, neighbors, friends, the school principal and other community members to	● Offer choices, once finished with the standard lesson activity, taking into

● When possible, modify assignments so the ELL student writes less, has simpler questions to answer, fewer spelling words, etc. ● Provide models of completed homework assignments, projects, etc. ● Assign a native language partner. ● Provide extended time for written responses and reports.	simpler design. ● Utilize graphics to support learning. ● Provide an outline of lessons ● Get a written list of instructions ● Receive large project as smaller tasks with individual deadlines ● Work or take a test in a different setting, such as a quiet room with few distractions ● Sit where they learn best (for example, near the teacher) ● Use an alarm to help with time management	attend class performances. ● Break the design process into smaller pieces. ● Conference with the teacher during the project or presentation-planning process. ● Provide a detailed framework for the project design. ● Incorporate student choice. ● Provide peer mentoring to improve techniques. ● Allow students many opportunities for practice and learning. ● Use scaffolding for complex tasks.	consideration students' interests and goals. ● Engage in more complex projects based on extensive research both individually and in collaboration with peers.

Additional Resources to promote DEI:

- Structure Matters: Twenty-One Teaching Strategies to Promote Student Engagement and Cultivate Classroom Equity
- Race Matters
- Inclusive Teaching