

Unit 4 - Exploring the Universe

Content Area: **Science**
Course(s): **Introduction to Astronomy**
Time Period: **4th Marking Period**
Length: **~16 Days (2 days per week)**
Status: **Published**

Unit Overview

In this Unit, students will learn the history of astronomical study, current exploration proposals, and why space exploration and exploration of the universe should continue for the benefit of humanity and scientific advancement.

[Sequence and Pacing Guide](#)

Transfer

What role do future generations of scientists, like us, play in the exploration of the universe, and how can our findings impact humanity?

Meaning

Understandings

Students will understand that...

The historical accomplishments of astronomers and scientists relate to what we already know about space.

Space exploration is a relatively modern science and the Universe is vast enough that there is still plenty of room for discovery.

The Solar System and all planets have a finite life-span and for the benefits of all humanity, space exploration should be appreciated.

Essential Questions

Students will keep considering...

Why did space exploration start and how motivations for it changed over time?

What sorts of discoveries, innovations or considerations are necessary to aid humanity in space exploration?

What can future generations of astronomy students and scientists focus their time and energy into achieving?

Application of Knowledge and Skill

Students will know...

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Early astronomers held vastly different views of space as we know it today.

Historical missions to space by humans and equipment have greatly impacted the knowledge we have today.

There are many challenges and limitations to space travel and discovery and humanity needs to overcome these somewhat to continue our quest for knowledge.

Students will be skilled at...

Students will be skilled at...

Evaluating the parameters for sustained human activity in space.

Evaluate the effectiveness of space missions - both historical and present-day.

Analyze the abilities of current equipment and design solutions for future space exploration.

Academic Vocabulary

Artificial Satellite

Heliocentric

Lander

Microgravity

Orbiter

Payload

Rocket

Rover

Telescope

Learning Goal 1

Connect historical perspectives of astronomy to space exploration.

Proficiency Scale

- Connect historical perspectives of astronomy to space exploration.
- Learning Goal includes instruction to satisfy requirements of N.J. Stat. § 18A:35-4.35

SCI.HS-ESS3-3	Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.
SCI.HS-ESS3-2	Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.
SCI.HS-ETS1-3	Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
SCI.HS-ETS1-1	Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
SCI.HS-LS2-7	Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
SCI.HS-LS4-6	Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.
SCI.HS-PS2-3	Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.
SCI.HS-PS3-3	Design, build, and refine a device that works within given constraints to convert one form

of energy into another form of energy.

Target 1

SWBAT create a timeline of early space exploration prior to the invention of the rocket.

- SWBAT create a timeline of early space exploration prior to the invention of the rocket.

Target 2

SWBAT evaluate the effectiveness of prior space missions and investigate their findings.

- SWBAT evaluate the effectiveness of prior space missions and investigate their findings.

Learning Goal 2

Investigate the need for future space exploration and the societal gain from achieving said exploration.

Proficiency Scale

- 9.4.12.GCA.1: Collaborate with individuals to analyze a variety of potential solutions to climate change effects and determine why some solutions (e.g., political, economic, cultural) may work better than others
- 9.4.12.IML.7: Develop an argument to support a claim regarding a current workplace or societal/ethical issue such as climate change
- 9.4.2.CT.1: Gather information about an issue, such as climate change, and collaboratively brainstorm ways to solve the problem
- Investigate the need for future space exploration and the societal gain from achieving said exploration.

SCI.HS-ESS3-2	Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.
SCI.HS-ESS3-4	Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.
SCI.HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
SCI.HS-ETS1-3	Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
SCI.HS-LS2-7	Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

SCI.HS-LS4-6	Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.
SCI.HS-PS1-6	Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.
SCI.HS-PS2-3	Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.

Target 1

SWBAT analyze processes used to discover exoplanets.

- SWBAT analyze processes used to discover exoplanets

Target 2

SWBAT compile information to decide whether sustained human life in space is feasible.

- SWBAT compile information to decide whether sustained human life in space is feasible.

Target 3

SWBAT create their own mission or exploratory project of a space based object.

- SWBAT create their own mission or exploratory project of a space based object.

Formative Assessment and Performance Opportunities

Checking for Understanding by creating a timeline of historical events in space exploration, in-class discussions of the merits of space exploration, presentations based on modern day missions and planned future missions, research and differentiate between different types of astronomical equipment, both Earth-based and Space-based.

Summative Assessment

This Summative Assessment will include students analyzing historical and present day space missions in order to come up with their own, while keeping in mind, cost, human toll, and whether or not the knowledge gained will impact humanity in a positive way.

21st Century Life and Careers

- 9.4.12.IML.5: Evaluate, synthesize, and apply information on climate change from various sources appropriately
- 9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice
- 9.4.12.GCA.1: Collaborate with individuals to analyze a variety of potential solutions to climate change effects and determine why some solutions (e.g., political, economic, cultural) may work better than others
- 9.4.12.IML.6: Use various types of media to produce and store information on climate change for different purposes and audiences with sensitivity to cultural, gender, and age diversity
- 9.4.12.IML.8: Evaluate media sources for point of view, bias, and motivations

CRP.K-12.CRP1	Act as a responsible and contributing citizen and employee.
CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP5	Consider the environmental, social and economic impacts of decisions.
CRP.K-12.CRP6	Demonstrate creativity and innovation.
CRP.K-12.CRP7	Employ valid and reliable research strategies.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.K-12.CRP9	Model integrity, ethical leadership and effective management.
CRP.K-12.CRP10	Plan education and career paths aligned to personal goals.
CRP.K-12.CRP11	Use technology to enhance productivity.
CRP.K-12.CRP12	Work productively in teams while using cultural global competence.
CAEP.9.2.12.C.3	Identify transferable career skills and design alternate career plans.
CAEP.9.2.12.C.4	Analyze how economic conditions and societal changes influence employment trends and future education.
CAEP.9.2.12.C.7	Examine the professional, legal, and ethical responsibilities for both employers and employees in the global workplace.

Accommodations/Modifications

All instruction, labs, activities, and assessments will be modified and enhanced to adhere to individual student's IEPs and 504s.

Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.

Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).

Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).

Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).

Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.

Use project-based science learning to connect science with observable phenomena.

Structure the learning around explaining or solving a social or community-based issue.

Provide ELL students with multiple literacy strategies.

Collaborate with after-school programs or clubs to extend learning opportunities, specifically ROTC and the Rocket Building Club.

Tutorial on Space Mission Design: <http://swe.ssa.esa.int/TECEES/spweather/Alpbach2002/Marsden-basic%20steps%20in%20designing%20a%20space%20mission.pdf>

Space Exploration and Organizer: <https://www.brainpop.com/games/sortifyspaceexploration/>

Unit Resources

Astronomy: A Self-Teaching Guide, 8th ed. Dinah L. Moche, Wiley and Sons

Nat Geo Space History: <https://www.nationalgeographic.org/article/history-space-exploration/12th-grade/>

NASA Space Mission History/Current/Future: <https://www.nasa.gov/missions>

In Space We Trust: <http://inspacewetrust.org/en/>

Global Exploration Roadmap: https://www.nasa.gov/sites/default/files/atoms/files/ger_2018_small_mobile.pdf

NASA Space Mission Design Tools: <https://www.nasa.gov/smallsat-institute/space-mission-design-tools>

Rowan University Edelman

Planetarium: <https://sites.rowan.edu/planetarium/schoolprograms/listofshows.html#mshs>

NASA Creating a Mission Infrastructure: https://www.nasa.gov/pdf/475492main_HEP_II_MS_7.pdf

Interdisciplinary Connections

LA.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.

LA.RST.11-12.8	Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.
LA.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.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.4	Model with mathematics.
TECH.8.1.12	Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.
TECH.8.2.12	Technology Education, Engineering, Design, and Computational Thinking - Programming: All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.