Astronomy Unit 4 - How Many?

Content Area: **Science**
Course(s): **Astronomy**
Time Period: **Full Year**
Length: **18 days**
Status: **Published**

NJSLS - Science

SCI.HS-ESS1-1	Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun's core to release energy that eventually reaches Earth in the form of radiation.
SCI.HS-ESS1-2	Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe.
SCI.HS-ESS1-3	Communicate scientific ideas about the way stars, over their life cycle, produce elements.
SCI.HS-ESS1-4	Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.

Science and Engineering Practices

Developing and Using Models

Develop a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-ESS1-1) Using

Mathematical and Computational Thinking

Use mathematical or computational representations of phenomena to describe explanations. (HS-ESS1-4)

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. (HS-ESS1-2)

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). (HS-ESS1-3)

Disciplinary Core Ideas

ESS1.A: The Universe and Its Stars

The star called the sun is changing and will burn out over a lifespan of approximately 10 billion years. (HS-ESS1-1)

The study of stars' light spectra and brightness is used to identify compositional elements of stars, their movements, and their distances from Earth. (HS-ESS1- 2),(HS-ESS1-3)

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. (HSESS1-2)

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. (HS-ESS1- 2),(HS-ESS1-3)

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. (HS-ESS1-4)

Crosscutting Concepts

Scale, Proportion, and Quantity

The significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs. (HS-ESS1-1)

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). (HS-ESS1-4)

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. (HS-ESS1-2) In nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved. (HS-ESS1-3)

Rationale and Transfer Goals

Estimation may be all we have to use. Estimations must be based on testable evidence. It is difficult to appreciate how much is 1 million, let alone 1 billion.

Enduring Understandings

There are more stars in the sky than anyone can easily count.

Essential Questions

How can we estimate the number of stars we can see in one night?

How can we estimate the number of stars in the universe?

Is it reasonable to be able to ‘imagine” a billion of something?

If there are billions and billions of stars, why is the sky dark at night?

What can we do to see more stars?

Content - What will students know?

- There are more stars in the sky than anyone can easily count.
- Much of what we see with telescopes, and even with the naked eye, are galaxies, not stars.
- The Hubble telescope reveals approximately 100 billion galaxies.
- The Milky Way Galaxy contains approximately 250 billion +/- 150 billion stars -

Skills - What will students be able to do?

- Count stars using the star window.
- How to write the number: 250,000,000,000

Activities - How will we teach the content and skills?

- Star Window Nighttime Count
- Among the Stars (Astro)
- How Many Stars (Astro)
- Counting to a Billion (Astro)

Evidence/Assessments - How will we know what students have learned?

- **Assessments can be reviewed for each course in this folder.**
- Analysis questions after making and using models
- Quizzes
- Tests
- Astronomy Benchmark #2

Spiraling for Mastery

Content or Skill for this Unit	Spiral Focus from Previous Unit	Instructional Activity
• Cross multiplying proportions/ratios • Scientific notation	• Cross multiplying proportions/ratios • Definition of galaxy, star	• Notes for scientific notation

Key Resources

TOPS Learning Systems

Project Astro https://www.astrosociety.org/education/hands-on-astronomy-activities/

https://www.astro.princeton.edu/~dns/teachersguide/website.pdf

https://www.astrocappella.com/activities/how_many_stars.html

activity: https://astroedu.iau.org/en/activities/1501/how-many-stars-can-you-see-at-night/

counting stars: https://mainweb-v.musc.edu/cando/auast/makeasta.html

count stars (alternative): https://www.physics.byu.edu/faculty/christensen/Physics%20127/Observing%20Projects/Counting%20the%20Stars.htm

Article: How many? https://www.theatlantic.com/technology/archive/2013/11/how-many-stars-are-there-in-the-sky/281641/

Article: How many? https://www.esa.int/Our_Activities/Space_Science/Herschel/How_many_stars_are_there_in_the_Universe

21st Century Life and Careers

WRK.9.2.12.CAP.3	Investigate how continuing education contributes to one's career and personal growth.
WRK.9.2.12.CAP.4	Evaluate different careers and develop various plans (e.g., costs of public, private, training schools) and timetables for achieving them, including educational/training requirements, costs, loans, and debt repayment.
WRK.9.2.12.CAP.5	Assess and modify a personal plan to support current interests and post-secondary plans.
WRK.9.2.12.CAP.6	Identify transferable skills in career choices and design alternative career plans based on those skills.

Career Readiness, Life Literacies, & Key Skills

TECH.9.4.12.CT.3	Enlist input from a variety of stakeholders (e.g., community members, experts in the field) to design a service learning activity that addresses a local or global issue (e.g., environmental justice).
TECH.9.4.12.TL.2	Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.
TECH.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 (e.g., SL.11-12.1., HS-ETS1-1, HS-ETS1-2, HS-ETS1-4, 6.3.12.GeoGI.1, 7.1.IH.IPERS.6, 7.1.IL.IPERS.7, 8.2.12.ETW.3).
TECH.9.4.12.IML.3	Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.IH.IPRET.8).
TECH.9.4.12.IML.4	Assess and critique the appropriateness and impact of existing data visualizations for an intended audience (e.g., S-ID.B.6b, HS-LS2-4).
TECH.9.4.12.IML.5	Evaluate, synthesize, and apply information on climate change from various sources appropriately (e.g., 2.1.12.CHSS.6, S.IC.B.4, S.IC.B.6, 8.1.12.DA.1, 6.1.12.GeoHE.14.a, 7.1.AL.PRSNT.2).
TECH.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 (e.g., NJSLSA.SL5).
TECH.9.4.12.IML.7	Develop an argument to support a claim regarding a current workplace or societal/ethical issue such as climate change (e.g., NJSLSA.W1, 7.1.AL.PRSNT.4).

Interdisciplinary Connections/Companion Standards