Unit 2 - Origin and Nature of the Stars and Galaxies

Content Area: **Science**
Course(s): **Introduction to Astronomy**
Time Period: **2nd Marking Period**
Length: **~18 Days (2 Days per Week)**
Status: **Published**

Unit Overview

In this Unit, the origin of galaxies and stars will be observed, as well as their life cycles and their eventual deaths.

Sequence and Pacing Guide

Transfer

Students will be exposed to the challenges that future generations will experience as our sun, solar system, and galaxy evolves.

Meaning

Understandings

Students will understand that...

Stars are born, have a life, and then ultimately die when elements needed for fusion run out.

Stars lives are drastically different depending on the amount of matter present at stellar birth.

The naturally occuring elements on the periodic table are a result of stellar evolution.

Essential Questions

Students will keep considering...

How can we determine what stars are made of?

What is the eventual fate of our sun, and the planet we call home?

What are the main differences between naturally occuring elements and synthesized elements?

Application of Knowledge and Skill

Students will know...

Students will know...

A stars spectra tells us what it is made out of.

Fusion of elements powers stars and when there is no possible elements that will fuse together a star will die.

A stars mass determines the evolutionary path it proceeds down.

Students will be skilled at...

Students will be skilled at...

Modelling Nuclear Fusion reactions.

Analyzing Stellar Spectra to determine what elements a star is made of.

Diagram the Life Cycles of stars with varying masses

Compare and Contrast Stars using an H-R Diagram.

Academic Vocabulary

H-R Diagram

Luminosity

Nuclear Fusion

Mass

Temperature

Spectra

Nebula

Protostar

Main sequence

Red giant

Supergiant

Supernova,

White dwarf

Black dwarf

Neutron star

Black hole

Learning Goal 1

Describe Nuclear Fusion and how it produces elements necessary for life.

Proficiency Scale

- Describe Nuclear Fusion and how it produces elements necessary for life.

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-ESS1-3	Communicate scientific ideas about the way stars, over their life cycle, produce elements.
9-12.HS-PS1-1.PS1.A.1	Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons.
9-12.HS-PS1-1.PS1.A.3	Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects.

9-12.HS-PS1-8.PS1.C.1	Nuclear processes, including fusion, fission, and radioactive decays of unstable nuclei, involve release or absorption of energy. The total number of neutrons plus protons does not change in any nuclear process.
9-12.HS-PS3-2.PS3.A.1	Energy is a quantitative property of a system that depends on the motion and interactions of matter and radiation within that system. That there is a single quantity called energy is due to the fact that a system's total energy is conserved, even as, within the system, energy is continually transferred from one object to another and between its various possible forms.

Target 1

SWBAT define Nuclear Fusion and its role in the core of stars.

- SWBAT define Nuclear Fusion and its role in the core of stars.

Target 2

SWBAT create a model that demonstrates how larger elements are made from fusion of smaller elements.

- SWBAT create a model that demonstrates how larger elements are made from fusion of smaller elements.

Learning Goal 2

Create a model for the life of a star.

Proficiency Scale

- Create a model for the life of a star.

SCI.HS-ESS1-3	Communicate scientific ideas about the way stars, over their life cycle, produce elements.
9-12.HS-PS1-1.PS1.A.1	Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons.
9-12.HS-PS1-1.PS1.A.3	Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects.
9-12.HS-PS1-8.PS1.C.1	Nuclear processes, including fusion, fission, and radioactive decays of unstable nuclei, involve release or absorption of energy. The total number of neutrons plus protons does not change in any nuclear process.

Target 1

SWBAT relate life cycle of a star to its mass.

- SWBAT relate life cycle of a star to its mass

Target 2

SWBAT describe life cycle for stars.

- SWBAT describe life cycle for stars

Target 3

SWBAT analyze spectra to determine composition of stars.

- SWBAT analyze spectra to determine composition of stars

Formative Assessment and Performance Opportunities

Activities include but are not limited to: Diagramming Fusion Reactions, Creating a timeline of a Star's life, Reading and Interpretting H-R Diagrams, reading spectra and relating to periodic table, in-class discussions, worksheets and lab activities such as online star spectal labs.

Summative Assessment

Unit Summative Assessment will involve students plotting data on an H-R Diagram, mapping the sequence of stellar evolution and comparing spectra signatures to that of periodic table elements.

21st Century Life and Careers

- 9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions.
- 9.4.12.IML.4: Assess and critique the appropriateness and impact of existing data visualizations for an intended audience.
- 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities and utility for accomplishing a specified task

12.9.3.ST.2	Use technology to acquire, manipulate, analyze and report data.
12.9.3.ST-ET.2	Display and communicate STEM information.
12.9.3.ST-SM.4	Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data.

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.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.CRP11	Use technology to enhance productivity.
CRP.K-12.CRP12	Work productively in teams while using cultural global competence.

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.

Provide copies of example star emission spectras

Provide examples of fusion reactions in addition to what happens in stars

Contrast fission and fusion reactions

Provide an example timeline for the Sun's life.

Take students outside to observe Sun using eclipse glasses.

Interactive Star Chart: https://mrnussbaum.com/interactive-star-classification-chart

Life Cycle Interactive: https://mrnussbaum.com/star-life-cycle-chart

HR Diagrams Online Interactive Tool: https://astro.unl.edu/naap/hr/animations/hrExplorer.html

Unit Resources

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

Teacher Generated Presentations

Student Generated Discussion Questions

NAAP Labs: https://astro.unl.edu/naap/

Interactive Sun Lab - https://www.pbslearningmedia.org/resource/nvsl.sci.int.sun/sun-lab-interactive/

Life Cycle of a Star - https://www.ck12.org/earth-science/life-cycles-of-stars/lesson/The-Life-Cycle-of-a-Star-PHYS/

Emission Spectrum of the Sun - https://www.ck12.org/chemistry/Wavelength-and-Frequency-Calculations/rwa/Deciphering-the-Sun/

Supernova - https://www.nasa.gov/audience/forstudents/5-8/features/nasa-knows/what-is-a-supernova.html

Interactive H-R Diagram: https://astro.unl.edu/mobile/HRdiagram/HRdiagramStable.html

Starchitect Game: https://www.starchitect.net/game/

HR Diagram
Activity: https://docs.google.com/document/d/1rDAwiMoHERGC3vWyjiPsYNDyN_mmnir0gGqBcbtxyAw/edit?usp=sharing

Spectral Class Online
Lab: http://www.glencoe.com/sites/common_assets/science/virtual_labs/ES24/ES24.html

Interdisciplinary Connections

MA.A-SSE.A.1	Interpret expressions that represent a quantity in terms of its context.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.4	Model with mathematics.
MA.N-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.

MA.N-Q.A.2	Define appropriate quantities for the purpose of descriptive modeling.
MA.N-Q.A.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
LA.RST.11-12.1	Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise details for explanations or descriptions.
LA.WHST.11-12.1	Write arguments focused on discipline-specific content.
MA.A-CED.A.2	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
MA.A-CED.A.4	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.
LA.SL.11-12.4	Present information, findings and supporting evidence clearly, concisely, and logically. The content, organization, development, and style are appropriate to task, purpose, and audience.
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.