Unit 6: The Sun and Stars

Content Area: **Science**
Course(s):
Time Period: **Marking Period 2**
Length: **2 weeks**
Status: **Published**

Summary

This unit is concerned with the life cycle of stars. The Sun is a star. It is the largest feature of our solar system and is essential to life on Earth. Solar flares, sunspots, and other solar phenomena influence human activities on Earth. Stellar birth, evolution, and death are also examined in detail. Additionally, a brief analysis of how a star works. Other stars are similar in some ways to our Sun, but stellar comparisons reveal dramatic effects on the appearance and life cycles of those other stars.

Revision Date: July 2024

MATH.K-12.1	Make sense of problems and persevere in solving them
MATH.K-12.2	Reason abstractly and quantitatively
MATH.K-12.3	Construct viable arguments and critique the reasoning of others
MATH.K-12.4	Model with mathematics
MATH.K-12.5	Use appropriate tools strategically
MATH.K-12.6	Attend to precision
MATH.K-12.7	Look for and make use of structure
MATH.K-12.8	Look for and express regularity in repeated reasoning
ELA.RI.MF.9–10.6	Analyze, integrate, and evaluate multiple interpretations (e.g., charts, graphs, diagrams, videos) of a single text or text/s presented in different formats (visually, quantitatively) as well as in words in order to address a question or solve a problem.
ELA.W.IW.9–10.2	Write informative/explanatory texts (including the narration of historical events, scientific procedures/experiments, or technical processes) to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.
SCI.HS-PS1-8	Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.
SCI.HS-PS2-1	Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.
SCI.HS-PS2-2	Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system.
SCI.HS-PS2-4	Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects.
SCI.HS-PS3-1	Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.
SCI.HS-PS3-2	Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative position of particles (objects).
SCI.HS-PS3-5	Develop and use a model of two objects interacting through electric or magnetic fields to

	illustrate the forces between objects and the changes in energy of the objects due to the interaction.
SCI.HS-PS4-1	Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.
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.
SCI.HS-ESS1-4	Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.
WRK.9.1.2.CAP.1	Make a list of different types of jobs and describe the skills associated with each job.
WRK.K-12.P.1	Act as a responsible and contributing community members and employee.
WRK.K-12.P.3	Consider the environmental, social and economic impacts of decisions.
WRK.K-12.P.4	Demonstrate creativity and innovation.
WRK.K-12.P.5	Utilize critical thinking to make sense of problems and persevere in solving them.
WRK.K-12.P.6	Model integrity, ethical leadership and effective management.
WRK.K-12.P.7	Plan education and career paths aligned to personal goals.
WRK.K-12.P.8	Use technology to enhance productivity increase collaboration and communicate effectively.
TECH.9.4.12.CI	Creativity and Innovation
TECH.9.4.12.CT	Critical Thinking and Problem-solving

Essential Questions/Enduring Understandings

Essential Questions:

How is our star, the Sun, different from other stars? How is it similar?

How is the sun such an integral part of the existence and evolution of life on Earth?

How does the sun affect physical and biological activity on Earth, as well as other planets in our solar system?

Enduring Understandings:

Our sun is an enormous mass of hydrogen gas that provides our planet with essential energy for life.

Stars are nuclear fusion reactors that burn for billions of years.

The end of a star's life provides the necessary ingredients for a new star's birth.

Objectives

Students will know the structure of a typical star.
Students will know how the Hertzsprung-Russell [H-R] Diagram is used to measure the properties of stars.
Students will know how stars produce energy and light.
Students will know how stellar-mass controls stellar luminosity and death of a star.
Students will know how stellar temperatures control stellar color.
Students will know how stellar luminosities are calculated.
Students will know the properties of white dwarfs, neutron stars, and black holes.
Students will know that there is enormous energy generated in nuclear fusion.
Students will know why massive stars end their lives in a supernova explosion or a black hole.
Students will know how to measure a star's distance in parsecs and use the standard-candles method.

Students will be skilled at calculating stellar distances based on luminosity.
Students will be skilled at sequencing the life cycle of an average star.
Students will be skilled at the analysis of the various types of stars.
Students will be skilled at the analysis of the electromagnetic spectrum.
Students will be skilled at using the spectroscope to determine the spectral signature of elements.
Students will be skilled at studying the nature of light and Kirchoff's Laws.

Learning Plan

Investigation: Measuring how far away the stars are using parallax.

Star in a Box Activity

Graphing activity: H-R Diagram and interpretations.

Classifying stars activity

Video: Cosmos Episode 8 - Sisters of the Sun about Annie Jump Cannon and Cecilia Payne

Assessment

Formative Assessment:

Do Now &/or Start-Up Questions, Discussions

Understanding during ISLE Cycle activities

Diagram labeling on parts of a star

Illustrate the proton-proton chain process of nuclear fusion

Using properties of stars to determine surface temperature and size categorization

Interpretation of the Hertzsprung-Russell Diagram

Exit Ticket Submission

Alternative Assessment:

Mathematical calculation of mass conversion into energy

Analysis of the inverse square law: luminosity & size v. distance

Spectral signature of stars

Summative Assessment:

Topic & Vocabulary Quizzes

Unit Tests

Benchmark Assessment:

Final Exam

Materials

quantitative/qualitative lab equipment for activities, experiments
related astronomy maps, charts
supplementary interactive multimedia, internet websites, videos

Textbook: The Cosmic Perspective - 10th Edition

Integrated Accommodation and Modifications

https://docs.google.com/spreadsheets/d/1VPJNV9-GTZxi5VPcYkvEMPdHR8D8wTBI7zIj1BWYpek/edit?usp=drive_link