Space Science: Space Systems

Stage 1 Desired Results

ESTABLISHED GOALS:

Competencies:

- ***Scale, Proportion, & Quantity Students will demonstrate the ability to describe and represent the significance of changes in observable and non-observable phenomena in terms of relative scale, proportion, and quantity.***
- ***Energy & Matter in Systems Students will demonstrate the ability to analyze evidence from a variety of sources (investigations, models) to predict, connect and/or evaluate the cycling of matter and flow of energy within and between systems in order to understand, describe, or predict possibilities and limitations of systems.***
- ***Structure & Function Students will demonstrate the ability to use evidence to support claims about the relationship among structure and function of natural and human designed objects.***
- ***Stability & Change in Systems Students will demonstrate the ability to investigate and analyze static and dynamic conditions of natural and human designed systems in order to explain and predict changes over time.***
- ***Students will demonstrate the ability to analyze and summarize text and integrate knowledge to make meaning of discipline-specific materials.***
- ***Students will demonstrate the ability to produce coherent and supported writing in order to communicate effectively for a range of discipline-specific tasks, purposes, and audiences.***
- ***Students will demonstrate the ability to speak purposefully and effectively by strategically making decisions about content, language use, and discourse style.***

Content Standards:

- 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 in the form of radiation.
- HS-ESS1-3. Communicate scientific ideas about the way stars, over their life cycle, produce elements.
- HS-ESS1-4. Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.

Transfer

*Students will be able to independently use their learning to **explain and predict properties of complex structures.***

Meaning

ENDURING UNDERSTANDINGS

Students will understand that…

- the significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs.
- 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).
- energy cannot be created or destroyed—it only moves between one place and another place, between objects and/or fields, or between systems.
- science assumes the universe is a vast single system in which basic laws are consistent.
- 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.

ESSENTIAL QUESTIONS

- *Should society care about space?*

Acquisition

Students will know…

- that nuclear fusion processes in the center of the sun release the energy that ultimately reaches Earth as radiation.
- that 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.
- that the star called the sun is changing and will burn out over a lifespan of approximately 10 billion years.

Students will be skilled at…

- developing models based on evidence.
- communicating scientific ideas.
- using mathematical/computational representations as a means for predicting.

	● that the study of stars' light spectra and brightness is used to identify compositional elements of stars, their movements, and their distances from Earth. ● that the Big Bang theory is supported by observations of distant galaxies receding from our own, of the measured composition of stars and non stellar gasses, and of the maps of spectra of the primordial radiation (cosmic microwave background) that still fills the universe. ● that 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. ● that 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. <u>*vocabulary*</u>: solar cycle, solar wind, plasma, CME, Solar flare, magnetic field, reconnection, sun spot, aurora, nuclear fusion, spectra, Big Bang, Kepler's laws, cosmic microwave background, supernova, orbit, elliptical	
Content Area Literacy Standards		***21st Century Skills***
• RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. • RST.11-12.2 Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. • RST.11-12.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 11-12 texts and topics*. • 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.11-12.9 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. • WHST.11-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments,		• *reason effectively* • *use systems thinking* • *access and evaluate information* • *solve problems*

or technical processes. • WHST.11-12.6 Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information. • WHST.11-12.9 Draw evidence from informational texts to support analysis, reflection, and research.	

Stage 2 - Evidence

Evaluative Criteria	*Assessment Evidence*
	PERFORMANCE TASK(S):
	OTHER EVIDENCE:

Stage 3 – Learning Plan

Summary of Key Learning Events and Instruction

Language Arts Integration	*Mathematics Integration*
● 1.OA.1 Use	**HSA-CED.A.2** - Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. (HS-ESS1-1), (HS-ESS1-2), (HS-ESS1-4) **HSA-CED.A.4** - Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. (HS-ESS1-1), (HS-ESS1-2), (HS-ESS1-4) **HSA-SSE.A.1** - Interpret expressions that represent a quantity in terms of its context. (HS-ESS1-1), (HS-ESS1-2), (HS-ESS1-4) **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. (HS-ESS1-1), (HS-ESS1-2), (HS-ESS1-4) **HSN-Q.A.2** - Define appropriate quantities for the purpose of descriptive modeling. (HS-ESS1-1), (HS-ESS1-2), (HS-ESS1-4)

	HSN-Q.A.3 - Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-ESS1-1), (HS-ESS1-2), (HS-ESS1-4) **MP.2** - Reason abstractly and quantitatively. (HS-ESS1-1), (HS-ESS1-2), (HS-ESS1-3), (HS-ESS1-4) **MP.4** - Model with mathematics. (HS-ESS1-1), (HS-ESS1-4)
Technology Integration	***District Materials***
• 1.OA.1 Use	
Science and Engineering Practices	
S&EP 2. Developing and using models S&EP 4. Analyzing and interpreting data S&EP 5. Using mathematics and computational thinking S&EP 6. Constructing explanations (for science) and designing solutions (for engineering) S&EP 8. Obtaining, evaluating, and communicating information	