HS. Space Systems

A Performance Expectations HS.ESS1.SS

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. HS.ESS1.1
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. HS.ESS1.2
3. Communicate scientific ideas about the way stars, over their life cycle, produce elements. HS.ESS1.3
4. Use mathematical or computational representations to predict the motion of orbiting objects in the solar system. HS.ESS1.4
5. Construct an explanation using evidence to support the claim that the phases of the moon, eclipses, tides and seasons change cyclically. HS.ESS1.7

B Science and Engineering Practices HS.SS.SEP

1 Developing and Using Models HS.SS.SEP.1

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

2 Using Mathematics and Computational Thinking HS.SS.SEP.2

- a Use mathematical or computational representations of phenomena to describe explanations. (HS-ESS1-4) HS.SS.SEP.2A

3 Constructing Explanations and Designing Solutions HS.SS.SEP.3

- a Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, 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),(HS-ESS1-7) HS.SS.SEP.3A

4 Obtaining, Evaluating, and Communicating Information HS.SS.SEP.4

- a 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) HS.SS.SEP.4A

5 Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena HS.SS.SEP.5

- a A scientific theory is a substantiated explanation of some aspect of the natural world, based on a body of facts that have been repeatedly confirmed through observation and experiment and the science community validates each theory before it is accepted. If new evidence is discovered that the theory does not accommodate, the theory is generally modified in light of this new evidence. (HS-ESS1-2) HS.SS.SEP.5A

C Disciplinary Core Ideas HS.SS.DCI

1. ESS1.A: The Universe and Its Stars HS.SS.DCI.ESS1.A
   - a. The star called the sun is changing and will burn out over a lifespan of approximately 10 billion years. (HS-ESS1-1) HS.SS.DCI.ESS1.A.1
   - b. 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) HS.SS.DCI.ESS1.A.2
   - c. 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. (HS-ESS1- 2) HS.SS.DCI.ESS1.A.3
   - d. 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),(HSESS1-3) HS.SS.DCI.ESS1.A.4
2. ESS1.B: Earth and the Solar System HS.SS.DCI.ESS1.B
   - a. 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) HS.SS.DCI.ESS1.B.1
   - b. (NYSED) Earth and celestial phenomena can be described by principles of relative motion and perspective. (HS-ESS1-7) HS.SS.DCI.ESS1.B.2
3. PS3.D: Energy in Chemical Processes and Everyday Life HS.SS.DCI.PS3.D
   - a. Nuclear Fusion processes in the center of the sun release the energy that ultimately reaches Earth as radiation. (secondary to HS-ESS1-1) HS.SS.DCI.PS3.D.1
4. PS4.B: Electromagnetic Radiation HS.SS.DCI.PS4.B
   - a. 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. (secondarytoHS-ESS1-2) HS.SS.DCI.PS4.B.1

D Crosscutting Concepts HS.SS.CC

1. Patterns HS.SS.CC.1
   - a. Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (HS-ESS1-7) HS.SS.CC.1A
2. Scale, Proportion, and Quantity HS.SS.CC.2
   - a. The significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs. (HS-ESS1-1) HS.SS.CC.2A
   - b. 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) HS.SS.CC.2B
3. Energy and Matter HS.SS.CC.3
   - a. 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) HS.SS.CC.3A
   - b. In nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved. (HS-ESS1-3) HS.SS.CC.3B
4. Interdependence of Science, Engineering, and Technology HS.SS.CC.4
   - a. Science and engineering complement each other in the cycle known as research and development (R&D). Many R&D projects may involve scientists, engineers, and others with wide ranges of expertise. (HS-ESS1- 2),(HS-ESS1-4) HS.SS.CC.4A
5. Scientific Knowledge Assumes an Order and Consistency in Natural Systems HS.SS.CC.5
   - a. 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. (HS-ESS1-2) HS.SS.CC.5A
   - b. Science assumes the universe is a vast single system in which basic laws are consistent. (HS-ESS1-2) HS.SS.CC.5B