

Earth & Space Science Unit 3

Astronomy

Essential Questions:

- How does our moon directly affect your life?
- What causes solar prominences, solar flares, solar wind, dark spots, the sun's magnetic field and our earth's aurora?
- How do we study the universe?
- What are the characteristics of the stars and galaxies?
- What are the characteristics of the sun and its solar system?
- What are the characteristics of the planets in the solar system?
- What are the characteristics of the moon and its effects on earth?
- What are the characteristics of earth's motions?
- How do the earth's position and motions influence the changing of seasons?

Big Ideas:

1. Earth-Moon System
2. Sun's characteristics
3. Solar System
4. Kepler's Laws of Planetary Motion
5. Space study tools: telescopes, probes & satellites
6. Electromagnetic Spectrum
7. Galaxy types
8. Star types
9. Stellar Evolution
10. Stellar Properties
11. What is the universe? Are there others?

Vocabulary: Astronomy, Gravity, Orbits, Rotation versus Revolution, Astronomical unit, Eclipse, Apogee versus Perigee, Phases, Moons, Tides, Heliocentric versus Geocentric, Telescopes, Planets, E.M. Spectrum, Doppler Effect, Sun's inner and outer structure, Nuclear Fusion, Aurora, Dark Spots, Sun's Magnetic Field/solar prominences & solar flares, Asteroid Belt & Kuiper Belt, Meteor, Comet, Constellation, Magnitude, Parallax, H-R diagram, Binary & variable, Stellar evolution, Nebula, Black hole, Big bang theory, Galaxy, Universe, Hubble's Law, Light Year, Dark Matter & Energy

NGSS Standards:

Students who demonstrate understanding can:

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.[Clarification Statement: Emphasis is on the energy transfer mechanisms that allow energy from nuclear fusion in the sun's core to reach Earth. Examples of evidence for the model include observations of the masses and lifetimes of other stars, as well as the ways that the sun's radiation varies due to sudden solar flares ("space weather"), the 11-year sunspot cycle, and non-cyclic variations over centuries.] [Assessment Boundary: Assessment does not include details of the atomic and sub-atomic processes involved with the sun's nuclear fusion.]

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.[Clarification Statement: Emphasis is on the astronomical evidence of the red shift of light from galaxies as an indication that the universe is currently expanding, the cosmic microwave background as the remnant radiation from the Big Bang, and the observed composition of ordinary matter of the universe, primarily found in stars and interstellar gases (from the spectra of electromagnetic radiation from stars), which matches that predicted by the Big Bang theory (3/4 hydrogen and 1/4 helium).]

HS-ESS1-3. Communicate scientific ideas about the way stars, over their life cycle, produce elements.[Clarification Statement: Emphasis is on the way nucleosynthesis, and therefore the different elements created, varies as a function of the mass of a star and the stage of its lifetime.] [Assessment Boundary: Details of the many different nucleosynthesis pathways for stars of differing masses are not assessed.]

HS-ESS1-4. Use mathematical or computational representations to predict the motion of orbiting objects in the solar system. [Clarification Statement: Emphasis is on Newtonian gravitational laws governing orbital motions, which apply to human-made satellites as well as planets and moons.] [Assessment Boundary: Mathematical representations for the gravitational attraction of bodies and Kepler's Laws of orbital motions should not deal with more than two bodies, nor involve calculus.]

HS-ESS1-5. Evaluate evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks.[Clarification Statement: Emphasis is on the ability of plate tectonics to explain the ages of crustal rocks. Examples include evidence of the ages oceanic crust increasing with distance from mid-ocean ridges (a result of plate spreading) and the ages of North American continental crust increasing with distance away from a central ancient core (a result of past plate interactions).]

HS-ESS1-6. Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth's formation and early history.[Clarification Statement: Emphasis is on using available evidence within the solar system to reconstruct the early history of Earth, which formed along with the rest of the solar system 4.6 billion years ago. Examples of evidence include the absolute ages of ancient materials (obtained by radiometric dating of meteorites, moon rocks, and Earth's oldest minerals), the sizes and compositions of solar system objects, and the impact cratering record of planetary surfaces.]

HS-ESS2-7. Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth.[Clarification Statement: Emphasis is on the dynamic causes, effects, and feedbacks between the biosphere and Earth's other systems, whereby geoscience factors control the evolution of life, which in turn continuously alters Earth's surface. Examples of include how photosynthetic life altered the atmosphere through the production of oxygen, which in turn increased weathering rates and allowed for the evolution of animal life; how microbial life on land increased the formation of soil, which in turn allowed for the evolution of land plants; or how the evolution of corals created reefs that altered patterns of erosion and deposition along coastlines and provided habitats for the evolution of new life forms.] [Assessment Boundary: Assessment does not include a comprehensive understanding of the mechanisms of how the biosphere interacts with all of Earth's other systems.]

ELA/Literacy -

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. (HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-5),(HS-ESS1-6)

RST.11-12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. (HS-ESS1-5),(HS-ESS1-6)

WHST.9-12.1 Write arguments focused on discipline-specific content. (HS-ESS1-6), (HS-ESS2-7)

WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-ESS1-2),(HS-ESS1-3),(HS-ESS1-5)

SL.11-12.4 Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation. (HS-ESS1-3)

Mathematics -

MP.2 Reason abstractly and quantitatively. (HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-3),(HS-ESS1-4),(HS-ESS1-5),(HS-ESS1-6)

MP.4 Model with mathematics. (HS-ESS1-1),(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),(HS-ESS1-5),(HS-ESS1-6)

HSN-Q.A.2 Define appropriate quantities for the purpose of descriptive modeling. (HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-4),(HS-ESS1-5),(HS-ESS1-6)

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),(HS-ESS1-5),(HS-ESS1-6)

HSA-SSE.A.1 Interpret expressions that represent a quantity in terms of its context. (HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-4)

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)

HSF-IF.B.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. (HS-ESS1-6)

HSS-ID.B.6 Represent data on two quantitative variables on a scatter plot, and describe how those variables are related. (HS-ESS1-6)