Earth and Space Science

Course Description: Earth and Space Science: This course will offer insight into the environment on earth and the earth's environment in space. While presenting the concepts and principles essential to students' understanding of the dynamics and history of the earth, the course will explore geology, astronomy and meteorology. The course will also investigate how humans both affect and are affected by earth's systems.

Adopted Course Primary Resource	Supplementary Resources
• American Geological Institute., National Science Foundation (U.S.), & It's About Time (Firm). (2012). *EarthComm: Project-based space and earth system science*. Armonk, NY: It's About Time, Inc.	• N/A

Standards Addressed In The Course (Note Essential Standards)			
Earth and Space Science 1 (ESS1) — Earth's Place in the Universe Standard SCI.ESS1: Students use science and engineering practices, crosscutting concepts, and an understanding of earth's place in the universe to make sense of phenomena and solve problems.	SCI.ESS1.A: The Universe and Its Stars	SCI.ESS1.A.h	Light spectra from stars are used to determine their characteristics, processes, and life cycles. Solar activity creates the elements through nuclear fusion. The development of technologies has provided the astronomical data that provide the empirical evidence for the Big Bang theory.
	SCI.ESS1.B: Earth and the Solar System	SCI.ESS1.B.h	Kepler's laws describe common features of the motions of orbiting objects. Observations from astronomy and space probes provide evidence for explanations of solar system formation. Cyclical changes in Earth's tilt and orbit, occurring over tens to hundreds of thousands of years, cause cycles of ice ages and other gradual climate changes.
	SCI.ESS1.C: The History of Planet Earth	SCI.ESS1.C.h	The rock record resulting from tectonic and other geoscience processes as well as objects from the solar system can provide evidence of Earth's early history and the relative ages of major geologic formations.
Earth and Space Science 2 (ESS2) — Earth's Systems	SCI.ESS2.A: Earth Materials	SCI.ESS2.A.h	Feedback effects exist within and among Earth's systems.

Standard SCI.ESS2: Students use science and engineering practices, crosscutting concepts, and an understanding of earth's systems to make sense of phenomena and solve problems.	and Systems		
	SCI.ESS2.B: Plate Tectonics and Large-Scale System Interactions	SCI.ESS2.B.h	Radioactive decay within Earth's interior contributes to thermal convection in the mantle.
	SCI.ESS2.C: The Roles of Water in Earth's Surface Processes	SCI.ESS2.C.h	The planet's dynamics are greatly influenced by water's unique chemical and physical properties.
Earth and Space Science 3 (ESS3) — Earth and Human Activity Standard SCI.ESS3: Students use science and engineering practices, crosscutting concepts, and an understanding of earth and human activity to make sense of phenomena and solve problems	SCI.ESS3.A: Natural Resources	SCI.ESS3.A.h	Resource availability has guided the development of human society and use of natural resources has associated costs, risks, and benefits.
	SCI.ESS3.B: Natural Hazards	SCI.ESS3.B.h	Natural hazards and other geological events have shaped the course of human history at local, regional, and global scales.
	SCI.ESS3.C: Human Impacts on Earth Systems	SCI.ESS3.C.h	Sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources, including the development of technologies.
	SCI.ESS3.D: Global Climate Change	SCI.ESS3.D.h	Global climate models used to predict changes continue to be improved, although discoveries about the global climate system are ongoing and continually needed.
BDHS Science Department Priority Standard #1 (SDPS.1)	Students can plan and carry-out investigations to seek answers to questions and problems.		

BDHS Science Department Priority Standard #2 (SDPS.2)	Students can analyze and evaluate information critically and computationally in order to ask questions, draw conclusions and solve problems.
BDHS Science Department Priority Standard #3 (SDPS.3)	Students can communicate ideas effectively through writing, speaking, and modeling for a specific audience using appropriate vocabulary and evidence.
BDHS Science Department Priority Standard #4 (SDPS.4)	Students will be able to find patterns and use as evidence in their arguments to explain phenomena
BDHS Science Department Priority Standard #5 (SDPS.5)	Students will be able to use cause and effect relationships to explain and predict phenomena
BDHS Science Department Priority Standard #6 (SDPS.6)	Students will be able to create, revise and use models to explain phenomena

Units of Study (Sequenced)	**Standards Associated**	**Key Learning Targets & Essential Vocabulary**	**Essential Question(s)**	**Common Assessment**	**Pacing**
Space Systems	SCI.ESS1.A.h SCI.ESS1.B.h SDPS.1 SDPS.2 SDPS.3 SDPS.4 SDPS.5 SDPS.6	Key Learning Targets: • 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. • 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. • 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	What is the universe, and what is Earth's place in it? What is the universe, and what goes on in the stars? What are the predictable patterns caused by Earth's movement in the solar system?	Section 1.1 Quiz Section 1.2 Quiz Section 1.3 Quiz Unit 1 Exam Course Midterm Exam	9 Weeks

		the motion of orbiting objects in the solar system. Vocabulary: wave, frequency, amplitude, wavelength, electromagnetic spectrum, radio waves, microwaves, infrared, visible light, ultraviolet, x-rays, gamma rays, Doppler effect, red shift, blue shift, spectroscopy, universe, cosmology, protostar, nebula, star, planet, dwarf planet, supernova, black hole, neutron star, perihelion, aphelion, geocentric, heliocentric, Big Bang, cosmic microwave background, nuclear fusion, proton-proton chain reaction, CNO cycle, triple alpha process, core, radiative zone, Hertzsprung-Russell diagram, main sequence, giant stars, dwarf stars, accretion, planetesimals, nebular theory, Kepler's laws of planetary motion, orbit(al period), rotation(al period)			
Earth's History and Plate Tectonics	SCI.ESS1.C.h SCI.ESS2.B.h SCI.ESS3.B.h SDPS.1 SDPS.2 SDPS.3 SDPS.4 SDPS.5 SDPS.6	Key Learning Targets: ● 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. ● 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. ● HS-ESS2-1. Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features. ● HS-ESS2-2. Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems. ● HS-ESS2-3. Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection. ● HS-ESS3-1. Construct an explanation	How do people reconstruct and date events in Earth's planetary history? How and why is Earth constantly changing? Why do the continents move, and what causes earthquakes and volcanoes?	Section 2.1 Quiz Section 2.2 Quiz Unit 2 Exam Course Midterm Exam	9 Weeks

		based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity. Vocabulary: geologic time scale, Precambrian, Paleozoic Era, Mesozoic Era, Cenozoic Era, Cambrian Period, Ordovician Period, Silurian Period, Devonian Period, Carboniferous Period, Permian Period, Triassic Period, Jurassic Period, Cretaceous Period, Paleogene Period, Neogene Period, Quaternary Period, stratigraphy, superposition, lateral continuity, correlation, index fossil, regolith, crater, ray, maria, terra/highlands, giant impact theory, gibbous, crescent, waxing, waning, eclipse, relative dating, absolute dating, half life, inner core, outer core, lower mantle, upper mantle, crust, lithosphere, asthenosphere, transition zone, Mohorovičić discontinuity (Moho), convection, geothermal gradient, seismic waves, P-waves, S-waves, continental drift, Pangaea, plate tectonics, tectonic plate, seafloor spreading, earthquake, volcano, convergent boundary, divergent boundary, transform boundary, rift, ridge, fault, craton, epicenter, focus, tsunami			
Earth Systems	SCI.ESS2.A.h SCI.ESS2.C.h SCI.ESS3.A.h SDPS.1 SDPS.2 SDPS.3 SDPS.4 SDPS.5 SDPS.6	Key Learning Targets: ● HS-ESS2-2. Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems. ● HS-ESS2-5. Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes. ● HS-ESS2-6. Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere. HS-ESS2-7. Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth. Vocabulary: carbon, carbon cycle, decomposition,	How and why is Earth constantly changing? How do Earth's major systems interact? How do the properties and movements of water shape Earth's surface and affect its systems? How do living organisms alter Earth's processes and structures?	Section 3.1 Quiz Section 3.2 Quiz Unit 3 Exam Course Final Exam	9 Weeks

		respiration, photosynthesis, calcium carbonate, chemical weathering, mechanical/physical weathering, biological weathering, oxidation, hydrolysis, dissolution, frost action, abrasion, combustion, deforestation, sequestration, reservoir, biosphere, atmosphere, hydrosphere, rock cycle, sediment, sedimentary rock, igneous rock, metamorphic rock, erosion, deposition, water cycle, precipitation, evaporation, transpiration, deposition, sublimation, condensation, transportation, groundwater, aquifer, aquiclude, saturated zone, unsaturated zone, glacier, drumlin, moraine, kettle (lake), drift, till, driftless area, river, discharge, gradient, watershed, geobiology, Great Oxygenation Event			
Weather and Climate	SCI.ESS2.A.h SCI.ESS3.B.h SCI.ESS3.C.h SCI.ESS3.D.h SDPS.1 SDPS.2 SDPS.3 SDPS.4 SDPS.5 SDPS.6	Key Learning Targets: • HS-ESS2-2. Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems. • HS-ESS2-4. Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate. • HS-ESS3-1. Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity. • HS-ESS3-2. Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios. • HS-ESS3-3. Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity. • HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems. • HS-ESS3-5. Analyze geoscience data and the results from global climate models to	What regulates weather and climate? How do living organisms alter Earth's processes and structures? How do humans depend on Earth's resources? How do natural hazards affect individuals and societies? How do humans change the planet? How do people model and predict the effects of human activities on Earth's climate?	Section 4.1 Quiz Section 4.2 Quiz Unit 4 Exam Course Final Exam	9 Weeks

		make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems. • HS-ESS3-6. Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity. Vocabulary: weather, climate, convection, cold front, warm front, stationary front, high pressure, low pressure, cyclone, hurricane, thunderstorm, tornado, temperature, humidity, wind, circulation, intertropical convergence zone, Hadley cell, Ferrel cell, Polar cell, equatorial low, subtropical high, subpolar low, polar high, Coriolis effect, salinity, isobar, isotherm, air mass (tropical, polar, continental, maritime), current, climograph, rain shadow, seasons, paleoclimatology, proxy, greenhouse effect, fossil fuel, climate change, carbon dioxide, fossil fuel alternative, solar power, wind power, geothermal, hydropower, nuclear fission, hydrogen fuel cell, biofuel			