

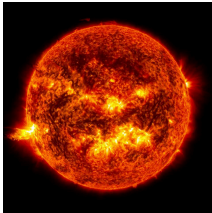
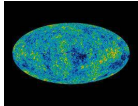
HS GRC Lessons- Earth and Space Science

Brett Moulding has a new email - BrettDMoulding@gmail.com



[CSSS Guidance Document for Investigation Beyond the Classroom](#)

[Link to GRC Professional Development](#)

HS Earth and Space Science (ESS) Standard	Link to Lesson	State	Lesson Topic	Phenomenon	Type of Lesson	Notes
HS-ESS1-1 The lifespan of the sun and the role of nuclear fusion in the sun's core in releasing energy	From the Sun's Core to Earth's Shores	CA	Life Span of the Sun 	Phenomenon 1: A birthday candle is lit and begins to convert its fuel into light and heat until all of the fuel is gone. Phenomenon 2: A star ignites and begins to convert its fuel into light and heat until all of the fuel is gone.	GRC PIP	This investigation provides students with an understanding of the differences between chemical and nuclear reactions and how a star produces energy. <i>Includes formative assessment</i>
HS-ESS1-2 The Big Bang theory is based on astronomical evidence of light spectra, the motion of distant galaxies, and the composition of matter in the universe	Big Bang for Beginners	GA	Evidence for Big Bang 	Phenomenon: Cosmic microwave background radiation (CMBR) can be measured everywhere on Earth.	GRC PIP	This investigation focuses on the evidence that supports the big bang theory. <i>Includes formative assessment</i>
HS-ESS1-2 Big Bang theory is based on astronomical evidence of light spectra, the motion of distant galaxies, and the composition of matter in the universe	Deep Dive the Big Bang Part 1	CA	Light Spectra as Evidence for the Big Bang	Phenomenon: When sunlight passes through a glass prism, it comes out in an array (or spectrum) of colors.	GRC PIP	The investigation focuses on light spectra as evidence. <i>Includes formative assessment</i>
	Deep Dive the Big Bang Part 2	CA	Motion of Galaxies as Evidence for the Big Bang	Phenomenon: When an ambulance with its siren blaring approaches me, the sound of the siren changes as it passes.	GRC PIP	This investigation focuses on the Red Shift of light spectra as evidence. <i>Includes formative assessment</i>
	Deep Dive the Big Bang Part 3	CA	Expansion of Everything Everywhere as Evidence for the Big Bang	Phenomenon: The light produced by a candle radiates into the space that surrounds it.	GRC PIP	The investigation focuses on the origin and significance of the CMB <i>Includes formative assessment</i>

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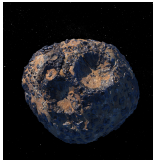




HS-ESS1-2 Big Bang theory is based on astronomical evidence of light spectra, the motion of distant galaxies, and the composition of matter in the universe	It Started with a Bang	AZ	Big Bang 	Phenomenon: <i>The universe is expanding.</i>	GRC PIP	Straightforward look at the Big Bang Theory <i>Includes formative assessment</i>
HS-ESS1-3 Scientific ideas about the way stars, over their life cycle, produce elements.	We are Made of Stardust	MN	Element Formation 	Phenomenon: <i>The spectrum of light from the Sun is not a continuous rainbow.</i>	GRC PIP	<i>The investigation uses a simulation and several resources to gather information.</i> <i>Includes formative assessment</i>
HS-ESS1-4 Mathematical or computational representations to predict the motion of orbiting objects in the solar system.	Patterns, Observations, Models, and Predictions	CA	Kepler's 1st law of planetary motion	Phenomenon 1: <i>The Moon orbits the Earth. The Earth orbits the Sun. The Sun orbits the center of the Milky Way Galaxy.</i> Phenomenon 2: <i>Sometimes the full moon appears larger than at other times.</i>	GRC PIP	The investigation engages students in observing phenomena and using a simulation. <i>Includes formative assessment</i>
HS-ESS1-5 Evaluate evidence of past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks.	Paleomagnetism Juan de Fuca Plate & Seafloor Spreading	CA	Plate Tectonics 	Phenomenon: <i>A pattern exists in seafloor rock found off the coast of the Pacific Northwest.</i>	GRC PIP	The investigation includes excellent resources for students to learn about plate tectonics. <i>Includes formative assessment</i>
HS-ESS1-5 Evaluate evidence of past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks.	Looking for HS Earth Science Teachers to help write this lesson		https://dinosaurpictures.org/ancient-earth#0	This is a simulation of continental movement and serves as a lesson.		

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HS-ESS1-5 Evaluate evidence of past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rock.s	Looking for HS Earth Science Teachers to help write this lesson		https://drive.google.com/file/d/1A4GQ6M6117YFDpoZz_aVvh7pFSbHgb58/view	This is an interesting article that could become a lesson on plate tectonics		
HS-ESS1-6 Ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth's formation and early history	Planet Earth: As Old As The Stuff It Is Made Of!	CA	Meteororites 	Phenomenon: Extraterrestrial matter continually enters the Earth's geosphere through meteors, meteorites, micrometeorites, and cosmic dust.	GRC PIP	The investigation has students searching for small meteorites <i>Includes formative assessment</i>
HS-ESS2-1 Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features	Sideling Hill Road Cut	MD		Phenomenon: The road cut on Sideling Hill, MD, contains an unusual rock structure.	GRC	This investigation uses a local phenomenon to discuss and instruct the Earth Process.
HS-ESS2-1 Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features	Fire and Iceland	MD		Phenomenon: Iceland has over 500 earthquakes per week.	GRC PIP	This investigation applies the phenomenon to other examples of plate movement. <i>Includes formative assessment</i>
HS-ESS2-2 Geoscience data that changes to Earth's surface can create feedback that causes changes to other Earth systems.						

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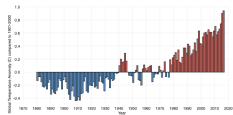


HS-ESS2-3 Evidence of Earth's interior to describe the cycling of matter by thermal convection	Cycling of Earth Materials Under Flagstaff, AZ	AZ NE	Convection in the Interior and Volcanism 	<i>Phenomenon: San Francisco Peak near Flagstaff, Arizona, is a darker color than the surrounding rocks.</i>	GRC PIP	This investigation uses a simulation and two readings. <i>Includes formative assessment</i>
HS-ESS2-4						
HS-ESS2-5 Properties of water and its effects on Earth's materials and surface	Rock Type and the Effects of Water on Landforms	GA	Water and Rates of Change	<i>Phenomenon: The rock formations are made of different types of rocks.</i>	GRC PIP	The lesson focuses on how the type of rock affects weathering rates. <i>Includes formative assessment</i>
HS-ESS2-6						
HS-ESS2-7 Simultaneous co-evolution of Earth's systems and life on Earth.	Co-Evolution of Earth Systems		Changes in Earth Systems and Life on Earth	<i>Phenomenon: Islands with coral reefs weather and erode more slowly than islands without coral reefs.</i>	GRC	This lesson focuses on how changes to Earth's Systems at different scales affect life on Earth differently.
HS-ESS3-1						
HS-ESS3-2						
HS-ESS3-3						
HS-ESS3-4						

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HS-ESS3-5 Geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change rate.	It's Hot Here	GA	Uses a Simulation	<i>Phenomenon: Since the beginning of the 20th century, the warmest consecutive 5-year interval in Georgia was from 2016 to 2020.</i>	GRC PIP	The phenomenon can be adapted for your state.
HS-ESS3-5 Geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change rate.	Humans' Role in Global Climate Change		ESS Climate Change 	<i>Phenomenon: In the past 100 years, the Earth's average temperature has increased by about 2 degrees Fahrenheit.</i>	5E-GRC Lesson	This lesson engages students in considering the causes of climate change
HS-ESS3-5 Geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change rate.	Tornadoes					

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GRADES 9-12 - EARTH AND SPACE SCIENCE DRAFT		
MN BENCHMARK	NGSS PE	Minnesota Benchmarks Core Idea
9E.1.1.1.1	Unique	Data from seismic waves can be used to develop a scientifically accurate model of Earth's interior.
9E.1.2.1.1	HS-ESS2-5	The chemical and physical properties of water affect the Earth's materials and processes.
9E.1.2.1.2	Unique	Human activities affect the properties of soil and the usefulness of soil as a resource to sustain human society.
9E.2.1.1.1	HS-ESS1-3	Nuclear fusion within stars produces the atomic nuclei lighter than and including iron, heavier elements are produced in supernovas.
9E.2.1.1.2	HS-ESS2-2	Geoscience processes that change Earth's surface can create feedbacks that cause changes to other Earth systems.
9E.2.1.1.3	HS-ESS3-5	Global climate models can be used to make evidence-based forecasts of the rate of human-caused climate change.
9E.2.2.1.1	HS-ESS1-4	The motion of orbiting objects around the sun can be described using Kepler's laws.
9E.2.2.1.2	HS-ESS2-6	The carbon cycle describes the movement of carbon among Earth systems.
9E.2.2.1.3	Unique	Humans cause changes in the near-surface Earth systems that cause changes in other Earth systems.
9E.3.1.1.1	HS-ESS1-1	The sun produces energy through nuclear fusion. The sun is approximately 4.6 billion years old and will burn out after approximately 10 billion years.
9E.3.1.1.2	HS-ESS2-1	Earth's internal and surface systems can effect change on specific continental and ocean features at various time scales.
9E.3.1.1.3	Unique	Uneven heating of the Earth's surface causes atmospheric circulation that results in regional weather and climate.
9E.3.1.1.4	HS-ESS2-4	Changes to the global and regional climate are caused by multiple factors and occur on a variety of time scales.
9E.3.2.1.1	HS-ESS1-2	The Big Bang Theory is supported by empirical evidence from light spectra, the motion of galaxies, and the composition of matter in the universe
9E.3.2.1.2	HS-ESS1-6	Objects in the solar system have changed little over billions of years and the study of these objects provides information about Earth's formation and early history.
9E.3.2.2.1	HS-ESS3-4	Scientists and engineers make major contributions by developing technologies that help to prevent ecosystem degradation.
9E.4.1.1.1	HS-ESS1-5	Continental rocks are much older than the rocks of the ocean floor due to subduction and extrusion at the boundary of tectonic plates.
9E.4.1.1.2	HS-ESS2-3	Thermal energy from nuclear fission and the motion of material within the mantle due to gravity cause convection currents that cycle Earth materials and move tectonic plates.
9E.4.1.1.3	Unique	Resource extraction and land use have associated economic, social, environmental, and geopolitical costs and risks, as well as benefits.
9E.4.2.1.1	Unique	Interactions between natural systems and human activity can impact groundwater systems regionally.
9E.4.2.2.1	Unique	important discoveries are still being made on how a warming climate impacts the hydrosphere, geosphere, biosphere, or atmosphere.



STEELS 3.3 EARTH AND SPACE SCIENCE CROSSWALK WITH NGSS

STEELS CODE	NGSS CODE	PA STANDARD/PERFORMANCE EXPECTATION DESCRIPTION
3.3.9-12.A	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.
3.3.9-12.B	HS-ESS1-2	Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, the motion of distant galaxies, and the composition of matter in the universe.
3.3.9-12.C	HS-ESS1-3	Communicate scientific ideas about the way stars, over their life cycle, produce elements.
3.3.9-12.D	HS-ESS1-4	Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.
3.3.9-12.E	HS-ESS2-4	Use a model to describe how variations in the flow of energy into and out of Earth's systems result in climate changes.
3.3.9-12.F	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.
3.3.9-12.G	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.
3.3.9-12.H	HS-ESS2-2	Analyze geoscience data to make a claim that one change to the Earth's surface can create feedback that causes changes to other Earth systems.
3.3.9-12.I	HS-ESS2-3	Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection.
3.3.9-12.J	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.
3.3.9-12.K	HS-ESS2-5	Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.
3.3.9-12.L	HS-ESS2-6	Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.
3.3.9-12.M	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.
3.3.9-12.N	HS-ESS2-7	Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth.

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3.3.9-12.O	HS-ESS3-1	Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and climate changes have influenced human activity.
3.3.9-12.P	HS-ESS3-2	Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.
3.3.9-12.Q	HS-ESS3-3	Create a computational simulation to illustrate the relationships among the management of natural resources, the sustainability of human populations, and biodiversity.
3.3.9-12.R	HS-ESS3-4	Evaluate or refine a technological solution that reduces the impacts of human activities on natural systems.
3.3.9-12.S	HS-ESS3-5	Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts on Earth systems.



Resources for HS ESS	
Astronomy	https://noirlab.edu/public/education/journey-through-the-universe/ https://maunakeascholars.com/ http://www.ifa.hawaii.edu/ifa2/outreach.shtml http://www.mkaoc.org/ https://www.bishopmuseum.org/planetarium/ https://imiloahawaii.org/
Geology	