

GE 501 Earth and Space Science
Correlation to Next Generation Science Standards (NGSS)
High School Earth and Space Science

Course Objectives	NGSS Core Idea	NGSS Performance Expectations
1. Evaluate the differing theories that explain the structure, scale, composition, origin, and history of the universe.	HS-ESS1 Earth's Place in the Universe	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.
2. Describe the solar nebular accretionary disk model.	HS-ESS1 Earth's Place in the Universe	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-ESS1-6. 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. Cite evidence that shows how Earth's atmosphere, hydrosphere, and geosphere formed and changed through time.	HS-ESS1 Earth's Place in the Universe	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 Earth's Systems	HS-ESS2-7. Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth.
4. Explain how Earth's interior is differentiated chemically, physically, and thermally.	HS-ESS2 Earth's Systems	HS-ESS2-3. Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection.
5. Identify plate tectonics as the global mechanism for major geologic processes, and describe how heat transfer as governed by the principles of thermodynamics serves as the driving force for those processes.	HS-ESS2 Earth's Systems	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-ESS2-3. Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection.
6. Describe how the geosphere continuously changes over a range of time scales and the impact of dynamic and complex interactions among Earth's subsystems on that process.	HS-ESS2 Earth's Systems	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.
7. Explain the process of	HS-ESS1	HS-ESS1-5. Evaluate evidence of the past and

<p>scientific dating to determine the age of fossils and rock sequences and how that process is used to construct a chronology of Earth's history.</p>	<p>Earth's Place in the Universe</p>	<p>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. Also: MS-ESS1-4. Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history.</p>
<p>8. Identify the hydrosphere, cryosphere, and atmosphere subsystems of fluid Earth, and describe how the subsystems interact on various time scales with the biosphere and geosphere.</p>	<p>HS-ESS2 Earth's Systems</p>	<p>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-ESS2-5. 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.</p>
<p>9. Describe the process by which Earth's global ocean stores solar energy and serves as a driving force for weather and climate through complex atmospheric interactions.</p>	<p>HS-ESS2 Earth's Systems</p>	<p>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.</p>
<p>10. Explain how interactions among Earth's five subsystems influence climate and resource availability, which affect Earth's habitability.</p>	<p>HS-ESS2 Earth's Systems</p>	<p>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-ESS1-4. Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.</p>

	HS-ESS3 Earth and Human Activity	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-ESS3-5. 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 to Earth systems.
11. Describe how the use of energy, water, mineral, and rock resources impacts Earth's subsystems.	HS-ESS3 Earth and Human Activity	HS-ESS3-3. Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity. HS-ESS3-6. Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity. HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

Summary from Correlation

The Next Generation Science Standards for High School Earth and Space Science present 19 Performance Expectations. The above correlation demonstrates that GE 501 Earth and Space Science addresses 18 of those Performance Expectations. One performance Expectations that are not addressed are the following:

NGSS Core Idea	NGSS Performance Expectations
HS-ESS3 Earth and Human Activity	HS-ESS3-2. Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.

Correlation of Performance Objectives to NGSS Core Ideas and Performance Expectation

Performance Objectives	NGSS Core Idea	NGSS Performance Expectations
1. Recognize the value of aerial photographs and topographic maps as research tools.		4-ESS2-2. Analyze and interpret data from maps to describe patterns of Earth's features.
2. Examine the physical properties and motions of the planets and the various degrees of order and patterns exhibited in the solar system.	HS-ESS1 Earth's Place in the Universe	HS-ESS1-4. Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.

3. Explore the natural processes that shape Earth and other terrestrial planets.	HS-ESS1 Earth's Place in the Universe	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.
4. Use observation skills to examine the results of geologic processes at work on Earth and its moon.	HS-ESS1 Earth's Place in the Universe	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.
5. Use data to draw conclusions about patterns that exist in our solar system.		HS-ESS1-4 – Depending on context/content.
6. Examine evidence that has been used to verify the theory of plate tectonics.	HS-ESS1 Earth's Place in the Universe	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.
7. Identify techniques that are used by seismologists to determine the location of earthquakes and to investigate the structure of Earth's interior.	HS-ESS2 Earth's Systems	HS-ESS2-3. Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection.
8. Examine agents and processes that modify Earth's surface and the consequences of human interactions with these natural systems.	HS-ESS2 Earth's Systems	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-ESS2-5. Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.
	HS-ESS3 Earth and Human Activity	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.
9. Describe the landforms and processes that shaped Earth's arid and glacial landscapes.	HS-ESS2 Earth's Systems	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-ESS2-5. Plan and conduct an

		investigation of the properties of water and its effects on Earth materials and surface processes.
10. Describe the physical properties of minerals, and apply techniques to identify minerals as preparation for the study of rocks.		MS-ESS2-1. Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.
11. Classify the origins of rock as igneous, sedimentary, or metamorphic.		MS-ESS2-1. Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process
12. Investigate techniques and procedures used by scientists to interpret the geologic history of Earth.	HS-ESS1 Earth's Place in the Universe	MS-ESS1-4. Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history. 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.
13. Explain the relationships that exist between the density of seawater and salinity and temperature.	HS-ESS2 Earth's Systems	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.
14. Investigate the causes, mechanics, and results of ocean-water movements.	HS-ESS2 Earth's Systems	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.
15. Identify the reasons that the amount of solar radiation intercepted by Earth varies for different latitudes and changes	HS-ESS2 Earth's Systems	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

throughout the year at particular locations.		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.
16. Describe the journey of solar radiation and how it is influenced and modified by air, land, and water.	HS-ESS2 Earth's Systems	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.
17. Examine the impact of changes in atmospheric moisture, pressure, and wind on Earth's weather.	HS-ESS2 Earth's Systems	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.
18. Investigate world climates using a system of climate classification.	HS-ESS2 Earth's 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.