Example Proficiency Scale: HS-ESS-1.1 Sun and Energy Transfer

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.

Grade: 9 Earth and Space Science

Score 4.0	In addition to score 3.0 performance, in-depth inferences and applications that go beyond what was taught. ● Apply principles of energy transfer in the sun to a novel situation. Examples may include: – Path of a red dwarf or blue/white giant. – Model a supernova including fusion occurring. – Alterations to the sun.
3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.
Score 3.0	Target Goal/Learning Intention: ● Develop a model and use it to explain the following: ○ the process of fusion in the main sequence of the sun; ○ heat transfer mechanisms within the sun and to the earth; ○ relative proportions of hydrogen and helium in the sun change throughout the sun's life cycle. ● Develop a model of the sun's life span. Including the following: ○ stages in the sun's life cycle; ○ phases of fusion in the life cycle of the sun. *(HS-ESS-1.3)*
2.5	No major errors or omissions regarding 2.0 content, skills and/or processes and partial success of 3.0 content, skills and/or processes.
Score 2.0	Simpler Goal/Intention: ● Recognize and recall specific vocabulary such as nuclear fusion, star, core, elements, gravity, orbit, main sequence, sunspots, solar flares, and radiation. ● Analyze the scale of energy released by different star types. ● Give evidence that explains the energy from the sun cannot be from a chemical process. ● List causes for cyclic and non-cyclic variation in radiation coming from the sun to the earth. ● Recognize how a star's initial mass and stage determines the elements created. *(HS-ESS-1.3)* ● Identify the stages of a life cycle of a star, including the sun. *(HS-ESS-1.3)* ● Describe the relationship between gravity and mass. *(HS-ESS-1.4)*
1.5	Partial demonstration of the 2.0 content, processes and/or skills but major errors or omissions regarding the 3.0 content, processes and/or skills.
Score 1.0	With help, partial demonstration of the 2.0 and 3.0 content, processes and/or skills.
0.5	With help, partial demonstration of the 2.0 content, processes and/or skills but not the 3.0 content, processes and/or skills.
Score 0.0	Even with help, no demonstration of content, processes and/or skills.

Example Proficiency Scale: HS-ESS-1.2 Origin of the Universe

Construct an explanation of the current model of the origin of the universe based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe.

Grade: 9 Earth and Space Science

Score 4.0	In addition to score 3.0 performance, in-depth inferences and applications that go beyond what was taught. ● Apply principles of theories of the origin of the universe to a novel situation. Examples may include: – Open/closed universe predictions. – Support or refute alternative theories.
3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.

Score 3.0	Target Goal/Learning Intention:
	● Construct an explanation of the idea that the universe is expanding.
	● Support the explanation with evidence:
	  ○ Cosmic Background Radiation;
	  ○ Doppler Effect/Redshift;
	  ○ Relative abundance of H and He in the universe.

2.5	No major errors or omissions regarding 2.0 content, skills and/or processes and partial success of 3.0 content, skills and/or processes.
Score 2.0	Simpler Goal/Intention: ● Recognize and recall specific vocabulary such as CMB (cosmic microwave background), wavelength, frequency, Big Bang, Doppler effect, and electromagnetic spectrum. ● Summarize the concept of the expanding universe. ● Describe red-shift/blue-shift and the motions associated with each. ● Identify how matter and energy are conserved in reference to the Big Bang. ● Identify the predicted ratio of H:He in the early universe.
1.5	Partial demonstration of the 2.0 content, processes and/or skills but major errors or omissions regarding the 3.0 content, processes and/or skills.
Score 1.0	With help, partial demonstration of the 2.0 and 3.0 content, processes and/or skills.
0.5	With help, partial demonstration of the 2.0 content, processes and/or skills but not the 3.0 content, processes and/or skills.
Score 0.0	Even with help, no demonstration of content, processes and/or skills.

Example Proficiency Scale: HS-ESS-1.5 Plate Tectonics

Evaluate evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the age of crustal rocks.

Grade: 9 Earth and Space Science

Score 4.0	In addition to score 3.0 performance, in-depth inferences and applications that go beyond what was taught. ● Apply principles of plate tectonics and movements of plates to a novel situation and predict what results would occur. Examples may include: – Create a future map based on patterns of past and current movement. – Evaluate an alternate planet's plate movements.
3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.
Score 3.0	Target Goal/Learning Intention: ● Evaluate evidence of past and current plate movements. (e.g., composition, density, magnetic stripes, fossils, glacial striations, land shape, landforms, volcanic activity, earthquakes, GPS tracking, hot spots, estimated age, etc.) ● Use evidence to identify patterns in the ages of rocks on continents and ocean floors in relation to plate boundaries and to each other. ● Explain how the mechanisms of plate tectonics account for the observed evidence and patterns in relative ages of continental and oceanic crust.
2.5	No major errors or omissions regarding 2.0 content, skills and/or processes and partial success of 3.0 content, skills and/or processes.
Score 2.0	Simpler Goal/Intention: ● Recognize and recall specific vocabulary such as convection current, fault, tectonic plate, subduction, hot spot, seafloor spreading, mid-ocean ridge, and oceanic trench. ● Compare characteristics of oceanic and continental crust. ● Identify evidence of past plate movements. ● Identify how convection drives the movements of plates. (Theory of Plate Tectonics) ● Describe the relative movement of plates at each type of plate boundary. (i.e., convergent, divergent, transform) ● Describe features found on oceanic and/or continental crust at each type of plate boundary. *(HS-ESS-2.1)* ● Summarize how the ages of rocks change moving away from a mid-ocean ridge, and from continental centers to their edges. ● Identify the relationships between plate boundaries and the occurrence of earthquakes and volcanoes. *(HS-ESS-3.1)*
1.5	Partial demonstration of the 2.0 content, processes and/or skills but major errors or omissions regarding the 3.0 content, processes and/or skills.
Score 1.0	With help, partial demonstration of the 2.0 and 3.0 content, processes and/or skills.
0.5	With help, partial demonstration of the 2.0 content, processes and/or skills but not the 3.0 content, processes and/or skills.
Score 0.0	Even with help, no demonstration of content, processes and/or skills.

Example Proficiency Scale: HS-ESS-2.1 Earth's Changing Surface

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.

Grade: 9 Earth and Space Science

Score 4.0	In addition to score 3.0 performance, in-depth inferences and applications that go beyond what was taught. ● Apply principles of surface processes to a novel situation. Examples may include: – Develop ways to mitigate erosion. – Design a way to protect against weathering. – Predict results of changes to contributing factors.
3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.
Score 3.0	Target Goal/Learning Intention: ● Develop a model that illustrates how internal forces and/or surface processes operate to form a feature on Earth's surface. ● Explain the processes in your model on different time and spatial scales.
2.5	No major errors or omissions regarding 2.0 content, skills and/or processes and partial success of 3.0 content, skills and/or processes.
Score 2.0	Simpler Goal/Intention: ● Recognize and recall specific vocabulary such as mechanical weathering, chemical weathering, erosion, deposition, scale ● Describe the properties of water. (*HS-ESS-2.5*) ● Describe agents of weathering: gravity, biosphere, wind, and water (solid and liquid). ● Explain the factors that affect the rates of mechanical and chemical weathering. ● Identify surface features caused by internal forces like faults, uplifts, folding, subsidence, volcanos. ● Identify processes as constructive or destructive. ● Identify the time scale of different processes (gradual or catastrophic). ● Identify the spatial scale of different processes (local, regional, global).
1.5	Partial demonstration of the 2.0 content, processes and/or skills but major errors or omissions regarding the 3.0 content, processes and/or skills.
Score 1.0	With help, partial demonstration of the 2.0 and 3.0 content, processes and/or skills.
0.5	With help, partial demonstration of the 2.0 content, processes and/or skills but not the 3.0 content, processes and/or skills.
Score 0.0	Even with help, no demonstration of content, processes and/or skills.

Example Proficiency Scale: HS-ESS-2.2 Earth's Systems and Energy

Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.

Grade: 9 Earth and Space Science

Score 4.0	In addition to score 3.0 performance, in-depth inferences and applications that go beyond what was taught. ● Apply principles of systems interactions and feedback to analyze a novel situation. Examples may include: – Given a new phenomenon, identify cause, effect, and possible feedbacks.
3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.

Score 3.0	Target Goal/Learning Intention:
	● Analyze data of interacting systems to identify relationships.
	● Make a claim that describes how changes to one of Earth's systems causes changes to another system.
	  ○ Identify the feedback mechanisms.
	  ○ Describe how the feedback affects the interaction (positive/destabilizing and negative/stabilizing).
	  ○ Support the claim with evidence and reasoning.

2.5	No major errors or omissions regarding 2.0 content, skills and/or processes and partial success of 3.0 content, skills and/or processes.
Score 2.0	Simpler Goal/Intention: ● Recognize and recall specific vocabulary such as hydrosphere, atmosphere, geosphere, biosphere, system, interaction, and feedback. ● Identify basic components of the four "spheres". ● List examples of how Earth's systems interact. ● Identify examples of system feedbacks. ● Describe ways that energy is transferred in and out of Earth's systems (i.e., convection, conduction, radiation). *(HS-ESS-2.4)* ● Identify ways that relationships among Earth systems are being influenced by human activity. *(HS-ESS-3.6)*
1.5	Partial demonstration of the 2.0 content, processes and/or skills but major errors or omissions regarding the 3.0 content, processes and/or skills.
Score 1.0	With help, partial demonstration of the 2.0 and 3.0 content, processes and/or skills.
0.5	With help, partial demonstration of the 2.0 content, processes and/or skills but not the 3.0 content, processes and/or skills.
Score 0.0	Even with help, no demonstration of content, processes and/or skills.

Example Proficiency Scale: HS-ESS-2.3 Earth's Interior

Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection.

Grade: 9 Earth and Space Science

Score 4.0	In addition to score 3.0 performance, in-depth inferences and applications that go beyond what was taught.
	    ● Apply principles of convection to a novel situation.
	
	Examples may include:
	    – Predict what would happen to the layers of the interior if the Earth cooled or warmed in the future.
	    – Analyze evidence to determine the layers on an alien planet

3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.

Score 3.0	Target Goal/Learning Intention:
	    ● Create a model based on evidence that shows:
	        ○ Layers of Earth's interior
	        ○ Sources of energy
	        ○ Thermal convection
	    ● Use the model to describe:
	        ○ The cycling of matter by thermal convection (including resulting surface movement).
	        ○ How the Earth's magnetic field is generated.
	    ● Utilize patterns in evidence to determine the composition and cycling of matter in the Earth's interior.

2.5	No major errors or omissions regarding 2.0 content, skills and/or processes and partial success of 3.0 content, skills and/or processes.

Score 2.0	Simpler Goal/Intention:
	    ● Recognize and recall specific vocabulary such as magnetic field, radioactive decay, seismic wave, density, convection, p-wave, and s-wave.
	    ● Identify evidence used to study Earth's interior.
	    ● Describe how changes in density create convection currents.
	    ● Identify sources of heat in Earth's interior.
	    ● List and describe the layers of the Earth's interior including core, inner core, outer core, mantle, crust, mesosphere, asthenosphere, and lithosphere.

1.5	Partial demonstration of the 2.0 content, processes and/or skills but major errors or omissions regarding the 3.0 content, processes and/or skills.
Score 1.0	With help, partial demonstration of the 2.0 and 3.0 content, processes and/or skills.
0.5	With help, partial demonstration of the 2.0 content, processes and/or skills but not the 3.0 content, processes and/or skills.
Score 0.0	Even with help, no demonstration of content, processes and/or skills.

Example Proficiency Scale: HS-ESS-2.4 Energy and Climate

Use a model to describe how variations in the flow of energy into and out of Earth's systems result in variations in climate.

Grade: 9 Earth and Space Science

Score 4.0	In addition to score 3.0 performance, in-depth inferences and applications that go beyond what was taught. ● Apply principles of energy flow in the Earth's system to analyze a novel situation and predict what changes would occur in the climate as a result. Examples may include: – Predict results of given scenario. – Choose a factor and determine how it could affect climate in the future.
3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.
Score 3.0	Target Goal/Learning Intention: ● Use a model to describe how changes in the input, output, storage, and distribution of energy in Earth's systems result in climate variations.
2.5	No major errors or omissions regarding 2.0 content, skills and/or processes and partial success of 3.0 content, skills and/or processes.
Score 2.0	Simpler Goal/Intention: ● Recognize and recall specific vocabulary such as insolation, albedo, circulation, convection, conduction, radiation. ● Describe how incoming energy fluctuates (e.g., meteors, solar flares, tilt, orbit change). ● Describe how surface features affect the absorption and distribution of energy (e.g., mountains, continent configuration, ice/glaciers, vegetation, water). ● Describe how atmospheric composition affects the input, output, storage, and distribution of energy. ● Describe how energy moves through the layers of the atmosphere. ● Describe how wind and ocean currents distribute energy.
1.5	Partial demonstration of the 2.0 content, processes and/or skills but major errors or omissions regarding the 3.0 content, processes and/or skills.
Score 1.0	With help, partial demonstration of the 2.0 and 3.0 content, processes and/or skills.
0.5	With help, partial demonstration of the 2.0 content, processes and/or skills but not the 3.0 content, processes and/or skills.
Score 0.0	Even with help, no demonstration of content, processes and/or skills.

Example Proficiency Scale: HS-ESS-2.7 Coevolution of Earth's Systems

Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth.

Grade: 9 Earth and Space Science

Score 4.0	In addition to score 3.0 performance, in-depth inferences and applications that go beyond what was taught. ● Apply principles of coevolution to a novel situation and predict what results would be expected. Examples may include: – Predict what differences would exist if a change happened in the past. – Predict what could happen in the future based on a given change. – Extend the timeline and explain what could happen.
3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.
Score 3.0	Target Goal/Learning Intention: ● Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth.
2.5	No major errors or omissions regarding 2.0 content, skills and/or processes and partial success of 3.0 content, skills and/or processes.
Score 2.0	Simpler Goal/Intention: ● Recognize and recall specific vocabulary such as index fossil, relative age, absolute age, photosynthesis, cyanobacteria, and coevolution. ● Describe the differences between early earth and modern earth. ● Describe the role of oxygen in changes to Earth's systems (e.g., iron banding, ozone, life) ● Describe evidence used to interpret events in Earth's history. *(HS-ESS-1.6)* ● Describe the geologic time scale. *(HS-ESS-1.6)* ● Give examples of coevolution in Earth's systems. ● Identify examples of correlation and causation.
1.5	Partial demonstration of the 2.0 content, processes and/or skills but major errors or omissions regarding the 3.0 content, processes and/or skills.
Score 1.0	With help, partial demonstration of the 2.0 and 3.0 content, processes and/or skills.
0.5	With help, partial demonstration of the 2.0 content, processes and/or skills but not the 3.0 content, processes and/or skills.
Score 0.0	Even with help, no demonstration of content, processes and/or skills.

Example Proficiency Scale: HS-ESS-3.2 Natural Resources

Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.

Grade: 9 Earth and Space Science

Score 4.0	In addition to score 3.0 performance, in-depth inferences and applications that go beyond what was taught. ● Discuss and analyze ways that cost-benefit ratios could shift as situations and circumstances change, given a novel situation. Examples may include: – When we run out of oil. – If the wind patterns change. – When a mineral is depleted. – If trade stops. – Asteroid mining – Future Advancements
3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.

Score 3.0	Target Goal/Learning Intention:
	● Make an argument supporting a solution that improves development and management of **energy sources**:
	  ○ Use a cost benefit analysis to determine the best solution to allow for future sustainability (include social, environmental, and economic effects)
	● Make an argument supporting a solution that improves development and management of **mineral sources**:
	  ○ Use a cost benefit analysis to determine the best solution to allow for future sustainability (include social, environmental, and economic effects)

2.5	No major errors or omissions regarding 2.0 content, skills and/or processes and partial success of 3.0 content, skills and/or processes.
Score 2.0	Simpler Goal/Intention: ● Recognize and recall specific vocabulary such as natural resource, nonrenewable, renewable, sustainable, mining, reclamation, mineral, and cost-benefit analysis. ● Understand the current energy and mineral uses of society. (HS-ESS-3.4). ● Establish the importance of managing natural resources for the sustainability of human populations. (HS-ESS-3.3) *Energy Resources* ● List and describe the energy resources available (renewable and nonrenewable). ● Identify potential costs and benefits of energy resources (economic, social, and environmental factors) ● Identify scientific or technological solutions to potential problems related to energy resources. (HS-ESS-3.4) *Mineral Resources* ● List and describe types of mineral resources available and processes for extraction. ● Identify potential costs and benefits of mineral extraction (economic, social, and environmental factors) ● Identify scientific or technological solutions to potential problems related to mineral extraction. (HS-ESS-3.4)
1.5	Partial demonstration of the 2.0 content, processes and/or skills but major errors or omissions regarding the 3.0 content, processes and/or skills.
Score 1.0	With help, partial demonstration of the 2.0 and 3.0 content, processes and/or skills.
0.5	With help, partial demonstration of the 2.0 content, processes and/or skills but not the 3.0 content, processes and/or skills.
Score 0.0	Even with help, no demonstration of content, processes and/or skills.

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Example Proficiency Scale: HS-ESS-3.5 Effects of Climate Variation

Analyze geoscience data and the results from global climate models to make an evidence-based explanation of how climate variability can affect Earth's systems on a global and regional scale.

Grade: 9 Earth and Space Science

Score 4.0	In addition to score 3.0 performance, in-depth inferences and applications that go beyond what was taught. ● Apply principles of climate science to predict if the effects on the system are preventable, reversible or irreversible. Examples may include: – Design solutions to prevent or reverse. – Argument with evidence. – Write a short story.
3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.
Score 3.0	Target Goal/Learning Intention: ● Analyze data and climate models to create an evidence-based explanation of how climate variability can affect Earth's systems globally and regionally.
2.5	No major errors or omissions regarding 2.0 content, skills and/or processes and partial success of 3.0 content, skills and/or processes.
Score 2.0	Simpler Goal/Intention: ● Recognize and recall specific vocabulary such as climate change, atmosphere, geosphere, biosphere, hydrosphere, and carbon reservoirs. ● Describe the effects of climate variability on the biosphere, geosphere, hydrosphere, atmosphere, and anthroposphere. ● Describe how the carbon cycle affects climate variability (*HS-ESS-2.6*) ● Use geoscience data to find trends. (e.g., atmospheric composition, ice coverage, trapped gases, temperature, ocean pH, weather events, solar radiation, etc.) ● Recognize the limitations and biases of scientific models.
1.5	Partial demonstration of the 2.0 content, processes and/or skills but major errors or omissions regarding the 3.0 content, processes and/or skills.
Score 1.0	With help, partial demonstration of the 2.0 and 3.0 content, processes and/or skills.
0.5	With help, partial demonstration of the 2.0 content, processes and/or skills but not the 3.0 content, processes and/or skills.
Score 0.0	Even with help, no demonstration of content, processes and/or skills.