Task Template

Grade 11 Overall Claim Students demonstrate a sophisticated understanding of the core ideas and applications of practices and crosscutting concepts in the disciplines of science.		
Explanatory Statements	Students integrate disciplinary core ideas and crosscutting concepts with scientific practices to investigate and explain how and why phenomena occur, and to design and refine solutions to problems.	Students connect knowledge across the disciplines of science to ask questions, plan and carry out investigations, and analyze and interpret data to support an argument about phenomena in a variety of contexts.
Measurement Target 1 (Topic 1 Bundle): Students are able to evaluate evidence and apply scientific reasoning related to Earth's geologic processes and the dynamic feedback between the biosphere and other Earth systems to support an argument about the continual co-evolution of Earth's systems and life on Earth.		
Summary (Topic 1 Bundle): The bundle organizes performance expectations with a focus on helping students build understanding of the changes to Earth over time. Instruction developed from this bundle should always maintain the three-dimensional nature of the standards and recognize that instruction is not limited to the practices and concepts directly linked with any of the bundle performance expectations. • 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. • 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. • Construct an argument based on evidence about the simultaneous co-evolution of Earth's systems and life on Earth.		
Focal Knowledge, Skills, and Abilities (fKSAs)	**11.1a** Students are able to investigate how Earth's internal and surface processes operate at different spatial and temporal scales to explain the ages of crustal rocks.	**Rationale** • Students will use empirical evidence of patterns to evaluate the merits of an argument. • Students will recognize and interpret patterns in systems at different scales. • Students construct an argument for why the principle that scientific knowledge is based on the assumption that natural laws operate today as they did in the past and that they will continue to do so in the future helps us understand that plate tectonics provides a framework for understanding Earth's geologic history.
Student Model	(*One overall summary variable of proficiency*) Not yet defined.	
Task Model	Given a brief real-world scenario describing a phenomenon, the student applies scientific concepts appropriately to describe how patterns observed from the evidence support his or her explanation (e.g., oceanic crust grows asymmetrically). Example: The student is asked to show what is happening inside Earth to explain the movement of plates and to use a drawing/model to support his or her explanation about why the oldest rock was further away from the plate boundary.	

Work Product Summary	• Students are provided an opportunity to explore and examine geological processes and phenomena and explain global features and events in terms of geological processes and timescales. • Students provide critiques of arguments about how the relationship between the motion of continental plates and the patterns in the ages of crustal rocks. • Students construct an argument for why some system changes are irreversible, using as evidence that spontaneous radioactive decays follow a characteristic exponential decay law. • Students use observations and measurements to provide the empirical evidence necessary to support their argument.		
Task Model Variables	• How phenomena are presented • The scale of the phenomena • Which plate boundary types are provided • Which components of internal and surface processes are provided • Temporal and spatial scales • What is the format and nature of empirical evidence	**Notes on Task Features and Task Variables**	Whether or not the students are asked to evaluate others' methods and explanations from a scientific perspective and use appropriate language and representations when communicating their findings
Example Phenomena	• Oceanic crust grows asymmetrically. • Earth looks different than it used to (e.g., changes in ozone, depletion of glaciers).		
Measurement Model	Univariate Rasch partial-credit psychometric model		
Evaluation Model	• Is appropriate evidence used to support the explanation? • Is the explanation logical and complete?		
Focal Knowledge, Skills, and Abilities (fKSAs)	**11.1b** Students are able to apply scientific reasoning and evidence to construct an account of Earth's formation and early history.	**Rationale**	• Students will describe that Earth's history can be understood through the study of other objects in the solar system, such as asteroids and meteorites, that have changed minimally over billions of years. • Students will use explanations of how things change and how they remain stable in assessing the extent to which the reasoning and data support the explanation or conclusion.
Student Model	(*One overall summary variable of proficiency*) Not yet defined.		
Task Model	Given a brief real-world scenario describing a phenomenon, the student applies scientific concepts appropriately to construct an explanation of how things change and/or how they remain stable using evidence to support his or her explanation. Example: The student identifies accurate similarities and differences between Mars and Earth's surface/interior/geologic processes to reconstruct the early history of Earth.		
Work Product Summary	• Students make directional hypotheses that specify what happens to the rock record on Earth when active geologic processes occur. • Students analyze data using tools, technologies, and/or models to make valid and reliable scientific claims that objects in the solar system, such as lunar rocks, asteroids, and meteorites have changed little over billions of years. • Students use reasoning to connect the evidence to construct the explanation of Earth's formation and early history.		

Task Model Variables	• How phenomena are presented • Which Earth processes are included • Which objects in the solar system are included • Which measurement tool(s) are given • What is the format and nature of empirical evidence	**Notes on Task Features and Task Variables**	Whether or not the student communicates information about the idea that scientific investigations use a variety of methods, tools, and techniques to revise and produce new knowledge, including knowledge about Earth's formation and early history
Example Phenomena	• Pictures of Mars appear to show canyons similar to those on Earth. • Earth looks different than it used to.		
Measurement Model	Univariate Rasch partial-credit psychometric model		
Evaluation Model	• How is evidence used to support an explanation? • Does the explanation provide evidence that students can apply their knowledge and skills appropriately?		
Focal Knowledge, Skills, and Abilities (fKSAs)	**11.1c** Students are able to construct an argument, using causal links and feedback mechanisms between changes in the biosphere and changes in Earth's other systems, that there is simultaneous co-evolution of Earth's systems and life on Earth.	**Rationale**	• Students will describe the dynamic causes, effects, and feedbacks between the biosphere and Earth's other systems. • Students will use explanations of how things change and how they remain stable in constructing an argument or counter-argument based on data and evidence.
Student Model	(*One overall summary variable of proficiency*) Not yet defined.		
Task Model	Given a brief real-world scenario describing a phenomenon, the student applies scientific concepts appropriately to construct an argument that supports the claim for why the phenomenon occurs. Example: The student constructs and supports an argument that supports the claim that over billions of years, the simultaneous co-evolution of Earth's systems and life on Earth produced both the ozone layer and current climatic conditions with feedback from life that evolved.		
Work Product Summary	• Students use a model to predict the relationships between the biosphere and other Earth systems, including the feedbacks that cause a continual co-evolution of Earth's surface and the life that exists on it. • Students construct an explanation based on valid and reliable evidence obtained from a variety of sources about how the many dynamic and delicate feedbacks between the biosphere and other Earth systems cause a continual co-evolution of Earth's surface and the life that exists on it. • Students evaluate scientific and/or technical information about how gradual atmospheric changes were due to plants and other organisms capturing carbon dioxide and releasing oxygen, assessing the evidence and usefulness of each source. • Students identify and describe different patterns at each of the scales at which the continual co-evolution of Earth's surface and the life that exists on it is studied.		

Task Model Variables	• How phenomena are presented • The scale of the phenomena • Which relationships between systems or between components of a system are provided • The Earth processes included • The Earth systems included • Atmospheric composition over time • Role of photosynthetic organisms • The causal links or feedback mechanisms addressed • Which measurement tool(s) are given • What is the format and nature of empirical evidence	**Notes on Task Features and Task Variables**	Whether or not the student communicates information about the idea that scientific investigations use a variety of methods, tools, and techniques to revise and produce new knowledge, including knowledge about how the biosphere and other Earth systems cause a continual co-evolution of Earth's surface and the life that exists on it
Example Phenomena	• Free oxygen is present in Earth's atmosphere. • Compost helps plants grow. • Earth's surface contains considerably greater amounts of ferric iron oxide than it used to.		
Measurement Model	Univariate Rasch partial-credit psychometric model		
Evaluation Model	• How is evidence used to support an argument? • Does the argument provide evidence that students can apply interpretations, explanations, and/or conclusions from evidence?		