Grades 9–12

3.3.9-12.F Earth and Space Science: History of Earth

Students who demonstrate understanding can *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.*

Clarifying Statement: Emphasis is on the ability of plate tectonics to explain the ages of crustal rocks. Examples include evidence of the ages oceanic crust increasing with distance from mid-ocean ridges (a result of plate spreading) and the ages of North American continental crust decreasing with distance away from a central ancient core of the continental plate (a result of past plate interactions).

Assessment Boundary: N/A

Science and Engineering Practices (SEP)	Disciplinary Core Ideas (DCI)	Crosscutting Concepts (CCC)
Engaging in Argument From Evidence Engaging in argument from evidence in 9–12 builds on K–8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current scientific or historical episodes in science. • Evaluate evidence behind currently accepted explanations or solutions to determine the merits of arguments.	• **ESS1.C: The History of Planet Earth** Continental rocks, which can be older than 4 billion years, are generally much older than the rocks of the ocean floor, which are less than 200 million years old. **ESS2.B: Plate Tectonics and Large-Scale System Interactions** • Plate tectonics is the unifying theory that explains the past and current movements of the rocks at Earth's surface and provides a framework for understanding its geologic history. **PS1.C: Nuclear Processes** • Spontaneous radioactive decays follow a characteristic exponential decay law. Nuclear lifetimes allow radiometric dating to be used to determine the ages of rocks and other materials.	**Patterns** • Empirical evidence is needed to identify patterns.

Pennsylvania Context: Examples of Pennsylvania context include but are not limited to geoscience processes that form and result from Pennsylvania contexts such as flowing water, glacial impacts, and plate collisions.

PA Career Ready Skills: Advocate for oneself in education, employment, and within the community.

Connections to Other Standards Content and Practices

Standard Source	Possible Connections to Other Standard(s) or Practice(s)
Agriculture (AFNR)	CS.02.01.01.a: Research and describe different types of geographic data used in AFNR systems.
Science, Environmental Literacy and Sustainability (NAAEE)	9-12 Strand 1.G. Drawing conclusions and developing explanations: Learners propose explanations that address their initial environmental questions using quantitative and qualitative data and evidence that has been collected and analyzed.
PA Core Standards: ELA	CC.3.5.9-12.A: Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. CC.3.5.11-12.A: Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. CC.3.5.9-10.H: Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem. CC.3.5.11-12.H: Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. CC.3.6.9-12.B: Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
PA Core Standards and Practices: Math	MP.2: Reason abstractly and quantitatively. CC.2.1.HS.F.3: Apply quantitative reasoning to choose and interpret units and scales in formulas, graphs, and data displays. CC.2.1.HS.F.4: Use units as a way to understand problems and to guide the solution of multistep problems. CC.2.1.HS.F.5: Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
PA Standards: Social Studies	7.2.9.B: Explain the dynamics of the fundamental processes that underlie the operation of Earth's physical systems. 7.2.12.A: Analyze the physical characteristics of places and regions, including the interrelationships among the components of Earth's physical systems.
Educational Technology (ISTE)	1.3. Knowledge Constructor: Students critically curate a variety of resources using digital tools to construct knowledge, produce creative artifacts and make meaningful learning experiences for themselves and others.
Technology and Engineering (ITEEA)	STEL-10: Assess how similarities and differences among scientific, mathematical, engineering, and technological knowledge and skills contributed to the design of a product or system.