## Grades 9–12

**3.3.9-12.J Earth and Space Science:** History of Earth

**Students who demonstrate understanding can** *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.*

**Clarifying Statement:** Emphasis is on how the appearance of land features (such as mountains, valleys, and plateaus) and sea-floor features (such as trenches, ridges, and seamounts) are a result of both constructive forces (such as volcanism, tectonic uplift, and orogeny) and destructive mechanisms (such as weathering, mass wasting, and coastal erosion).

**Assessment Boundary:** Assessment does not include memorization of the details of the formation of specific geographic features of Earth's surface.

| Science and Engineering Practices (SEP) | Disciplinary Core Ideas (DCI) | Crosscutting Concepts (CCC) |
|---|---|---|
| **Developing and Using Models**<br>Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed world(s).<br>• Develop a model based on evidence to illustrate the relationships between systems or between components of a system. | **ESS2.A: Earth Materials and Systems**<br>• Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes.<br>**ESS2.B: Plate Tectonics and Large-Scale System Interactions**<br>• 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. Plate movements are responsible for most continental and ocean-floor features and for the distribution of most rocks and minerals within Earth's crust. | **Stability and Change**<br>• Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible. |

**Pennsylvania Context:** Examples of Pennsylvania context include but are not limited to the fact that Pennsylvania's physiographic provinces are the result of constructive forces and destructive mechanisms.

**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. |

| Standard Source | Possible Connections to Other Standard(s) or Practice(s) |
|---|---|
| **Science, Environmental Literacy and Sustainability (NAAEE)** | 9-12 Strand 2.1.A. Earth's physical systems: Learners describe the major processes and systems that form Earth and relate these processes, especially those that are large-scale and long-term to characteristics of Earth. They explain how changes in one system (hydrosphere, atmosphere, geosphere, and biosphere) result in changes to another. They describe how human sustainability depends on Earth systems. |
| **PA Core Standards: ELA** | CC.3.5.9-10.G: Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.<br>CC.3.5.11-12.G: Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. |
| **PA Core Standards and Practices: Math** | MP.2: Reason abstractly and quantitatively.<br>MP.4: Model with mathematics.<br>CC.2.1.HS.F.3: Apply quantitative reasoning to choose and interpret units and scales in formulas, graphs, and data display.<br>CC.2.1.HS.F.4: Use units as a way to understand problems and to guide the solution of multistep problems.<br>CC.2.1.HS.F.5: Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. |
| **PA Standards: Social Studies** | 7.1.9.A: Explain and illustrate how geographic tools are used to organize and interpret information about people, places, and environments. |
| **Educational Technology (ISTE)** | 1.6. Creative Communicator: Students communicate clearly and express themselves creatively for a variety of purposes using the platforms, tools, styles, formats and digital media appropriate to their goals. |
| **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. |