



Grades 9–12

3.3.9-12.K Earth and Space Science: Earth's Systems

Students who demonstrate understanding can plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.

Clarifying Statement: Emphasis is on mechanical and chemical investigations with water and a variety of solid materials to provide the evidence for connections between the hydrologic cycle and system interactions commonly known as the rock cycle. Examples of mechanical investigations include stream transportation and deposition using a stream table, erosion using variations in soil moisture content, or frost wedging by the expansion of water as it freezes. Examples of chemical investigations include chemical weathering and recrystallization (by testing the solubility of different materials) or melt generation (by examining how water lowers the melting temperature of most solids).

Assessment Boundary: N/A

Science and Engineering Practices (SEP)	Disciplinary Core Ideas (DCI)	Crosscutting Concepts (CCC)
<p>Planning and Carrying Out Investigations</p> <p>Planning and carrying out investigations in 9–12 builds on K–8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models.</p> <ul style="list-style-type: none"> Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. 	<p>ESS2.C: The Roles of Water in Earth's Surface Processes</p> <ul style="list-style-type: none"> The abundance of liquid water on Earth's surface and its unique combination of physical and chemical properties are central to the planet's dynamics. These properties include water's exceptional capacity to absorb, store, and release large amounts of energy, transmit sunlight, expand upon freezing, dissolve and transport materials, and lower the viscosities and melting points of rocks. 	<p>Structure and Function</p> <ul style="list-style-type: none"> The functions and properties of natural and designed objects and systems can be inferred from their overall structure, the way their components are shaped and used, and the molecular substructures of its various materials.

Pennsylvania Context: Examples of Pennsylvania context include but are not limited to how Pennsylvania's waterways dissolve, transport, and deposit sediment.

PA Career Ready Skills: Analyze adverse situations for the purpose of identifying and selecting healthy coping skills.

Connections to Other Standards Content and Practices

Standard Source	Possible Connections to Other Standard(s) or Practice(s)
Agriculture (AFNR)	CS.06.01.01.a: Research and explain the foundational cycles in AFNR (e.g., water cycle, nutrient cycle, carbon cycle, etc.).



Standard Source	Possible Connections to Other Standard(s) or Practice(s)
Science, Environmental Literacy and Sustainability (NAEE)	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. 9-12 Strand 3.1.B. Sorting out the consequences of issues: Learners evaluate the consequences of a broad range of environmental changes, conditions, and issues on environmental quality and long-term sustainability. They identify environmental justice and social equity implications.
PA Core Standards: ELA	CC.3.6.9-12.F: Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
PA Core Standards and Practices: Math	CC.2.1.HS.F.5: Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
PA Standards: Social Studies	N/A
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.