

2019 Minnesota Academic Standards in Science

9th Grade-12th Grade Earth and Space Science		
Strand	Code	Benchmark
Exploring Phenomena or Engineering Problems	9E.1.1.1.1	Ask questions to clarify how seismic energy traveling through Earth's interior can provide evidence for Earth's internal structure.
	9E.1.2.1.1	Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.
Looking at data and empirical evidence to understand phenomena or solve problems	9E.2.1.1.1	Analyze data to make a valid scientific claim about the way stars, over their life cycle, produce elements.
	9E.2.1.1.2	Analyze geoscience data to make a claim that one change to the Earth's surface can create feedbacks that cause changes to other Earth systems.
	9E.2.1.1.3	Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth's systems and human infrastructure.
	9E.2.2.1.1	Use mathematical and computational representations to predict the motion of natural and human-made objects that are in orbit in the solar system.
	9E.2.2.1.2	Develop a computational model, based on observational data, experimental evidence, and chemical theory, to describe the cycling of carbon among Earth's systems.
	9E.2.2.1.3	Develop or use an algorithmic representation, based on investigations of causes and effects in complex Earth systems, to illustrate the relationships within some part of the Earth system and how human activity might affect those relationships.

Developing possible explanations of phenomena or designing solutions to engineering problems	9E.3.1.1.1	Develop and use 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.
	9E.3.1.1.2	Develop and use a model based on evidence to explain how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features.
	9E.3.1.1.3	Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.
	9E.3.1.1.4	Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.
	9E.3.2.1.1	Construct an explanation that links astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe to the Big Bang.
	9E.3.2.1.2	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.
	9E.3.2.2.1	Evaluate or refine a technological solution to reduce the human impacts on a natural system and base the evaluations or refinements on evidence and analysis of pertinent data.
Communicating reasons, arguments and ideas to others	9E.4.1.1.1	Evaluate the 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.
	9E.4.1.1.2	Evaluate the evidence and reasoning for the explanatory model that Earth's interior is layered and that thermal convection drives the cycling of matter.
	9E.4.1.1.3	Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.

	9E.4.2.1.1	Compare, integrate and evaluate sources of information in order to determine how specific factors, including human activity, impact the groundwater system of a region.
	9E.4.2.2.1	Apply place-based evidence, including those from Minnesota American Indian Tribes and communities and other cultures, to construct an explanation of how a warming climate impacts the hydrosphere, geosphere, biosphere, or atmosphere.