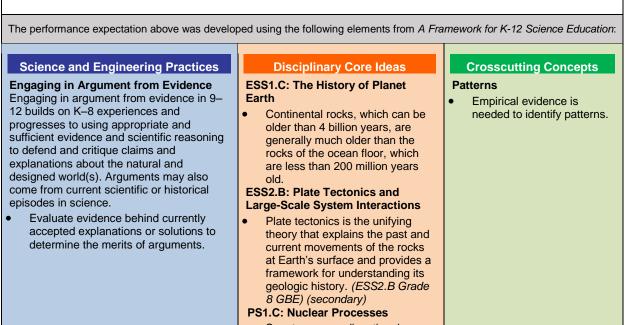


## HS-ESS1-5

Students who demonstrate understanding can:

HS-ESS1-5. 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. [Clarification Statement: Emphasis is on the ability of plate tectonics to explain the ages of crustal rocks. Examples include evidence of the ages of 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).]



• 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. (secondary)

Students identify the given explanation, which includes the following idea: that crustal materials

of different ages are arranged on Earth's surface in a pattern that can be attributed to plate

## tectonic activity and formation of new rocks from magma rising where plates are moving apart. b Students identify the given evidence to be evaluated.

Identifying the given explanation and the supporting evidence

 2
 Identifying any potential additional evidence that is relevant to the evaluation

 a
 Students identify and describe\* additional relevant evidence (in the form of data, information, models, or other appropriate forms) that was not provided but is relevant to the explanation and to evaluating the given evidence, including:

 i. Measurement of the ratio of parent to daughter atoms produced during radioactive decay as a means for determining the ages of rocks;
 ii. Ages and locations of continental rocks;
 iii. Ages and locations of rocks found on opposite sides of mid-ocean ridges; and

Observable features of the student performance by the end of the course:

1

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		iv. The type and location of plate boundaries relative to the type, age, and location of	
		crustal rocks.	
3	Eva	Evaluating and critiquing	
	а	Students use their additional evidence to assess and evaluate the validity of the given	
		evidence.	
	b	Students evaluate the reliability, strengths, and weaknesses of the given evidence along with	
		its ability to support logical and reasonable arguments about the motion of crustal plates.	
4	Re	Reasoning/synthesis	
	а	Students describe* how the following patterns observed from the evidence support the	
		explanation about the ages of crustal rocks:	
		i. The pattern of the continental crust being older than the oceanic crust;	
		ii. The pattern that the oldest continental rocks are located at the center of continents,	
		with the ages decreasing from their centers to their margin; and	
		iii. The pattern that the ages of oceanic crust are greatest nearest the continents and	
		decrease in age with proximity to the mid-ocean ridges.	
	b	Students synthesize the relevant evidence to describe* the relationship between the motion of	
		continental plates and the patterns in the ages of crustal rocks, including that:	
		i. At boundaries where plates are moving apart, such as mid-ocean ridges, material from	
		the interior of the Earth must be emerging and forming new rocks with the youngest	
		ages.	
		ii. The regions furthest from the plate boundaries (continental centers) will have the	
		oldest rocks because new crust is added to the edge of continents at places where	
		plates are coming together, such as subduction zones.	
		iii. The oldest crustal rocks are found on the continents because oceanic crust is	
		constantly being destroyed at places where plates are coming together, such as	
		subduction zones.	