OpenSciEd Massachusetts Standards Guidance
6th Grade: Plate Tectonics & Rock Cycling

This document is to provide guidance to Massachusetts 6th grade teachers who are implementing OpenSciEd. This guidance assumes the OpenSciEd curriculum is being implemented across grades 6-8, following the MA coherent sequence by grade level *(download)*. The following guidance identifies the MA standards addressed in the *Plate Tectonics & Rock Cycling* unit, and the most effective use of the OpenSciEd materials for 6th grade teachers.

Scope and Sequence Recommendation

Implement the *Plate Tectonics & Rock Cycling* unit in 6th grade after the *Earth in Space* unit, and before the *Cells & Systems* unit. *Plate Tectonics & Rock Cycling* addresses three 6th grade earth & space and life science standards, one 7th grade earth & space science standard, and one 8th grade earth & space science standard. Refer to the MA coherent sequence by grade level *(download)* for the complete scope and sequence recommendation.

6th Grade Standards in *Plate Tectonics & Rock Cycling*

Standards in unit	Lessons building towards standards
6.MS-ESS1-4. Analyze and interpret rock layers and index fossils to determine the relative ages of rock formations that result from processes occurring over long periods of time. Clarification Statements: Analysis includes laws of superposition and crosscutting relationships limited to minor displacement faults that offset layers. Processes that occur over long periods of time include changes in rock types through weathering, erosion, heat, and pressure.	Lessons 10, 13-14
6.MS-ESS2-3. Analyze and interpret maps showing the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence that Earth's plates have moved great distances, collided, and spread apart. Clarification Statement: Maps may show similarities of rock and fossil types on different continents, the shapes of the continents (including continental shelves), and the locations of ocean structures (such as ridges, fracture zones, and trenches), similar to Wegener's visuals.	Lessons 1-12
6.MS-LS4-1. **[Partial]** Analyze and interpret evidence from the fossil record to describe organisms and their environment, extinctions, and changes to life forms throughout the history of Earth. Clarification Statement: Examples of evidence include sets of fossils that indicate a specific type of environment, anatomical structures that indicate the function of an organism in the environment, and fossilized tracks that indicate behavior of organisms. • **Why partial?** This unit uses evidence from the fossil record to describe changes in specific environments, but does not explore changes in organisms over time.	Lesson 10, 14

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• The standard is addressed to completion in the *Natural Selection & Ancestry* unit in 8th grade, therefore no changes are needed for this unit.	

Additional Standards in *Plate Tectonics & Rock Cycling*

Standards in unit	Lessons building towards standards
7.MS-ESS2-2. Construct an explanation based on evidence for how Earth's surface has changed over scales that range from local to global in size. Clarification Statements: Examples of processes occurring over large, global spatial scales include plate motion, formation of mountains and ocean basins, and ice ages. Examples of changes occurring over small, local spatial scales include earthquakes and seasonal weathering and erosion.	Lessons 1-14
8.MS-ESS2-1. Use a model to illustrate that energy from Earth's interior drives convection that cycles Earth's crust, leading to melting, crystallization, weathering, and deformation of large rock formations, including generation of ocean sea floor at ridges, submergence of ocean sea floor at trenches, mountain building, and active volcanic chains. Clarification Statement: The emphasis is on large-scale cycling resulting from plate tectonics.	Lessons 8-9

See recommendations below for addressing these 7th & 8th grade standards.

Recommendations for Addressing Standards in *Plate Tectonics & Rock Cycling*

Include, and teach 7.MS-ESS2-2 and 8.MS-ESS2-1 with *Plate Tectonics & Rock Cycling* as planned in the unit. These standards are integral to the understanding of other standards in the unit and are critical to include for students' coherent development of understanding of the anchoring phenomenon. Depending on your students' prior knowledge of this standard, support for students should be adjusted to increase the support for students in constructing an evidence-grounded explanation for changes in Earth's surface, or in using a model to explain how Earth's interior processes drive its surface changes. **Excluding these standards would require substantial redesign of the unit, which is not recommended.**

Changes may be necessary throughout to support coherence between units**.** This lesson was originally written to follow ***Thermal Energy*** and ***Weather***, which were written to introduce and reinforce ideas about energy transfer between particles of different temperatures and densities. However, if the units are taught following the recommended sequence

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for Massachusetts, these foundational units will come after ***Plate Tectonics & Rock Cycling***. Suggestions for how to provide just-in-time supports for students are listed below:

Lesson	Support for maintaining content coherence
Lesson 8: What is occurring at locations where two plates are moving away from each other?	Add to the Learning Plan in the Teacher Guide: **Part 10 – Determine the Reason for Magma Movement** • When you project slide L, allow students to generate ideas about what could be causing magma inside the Earth. You can encourage them to think about other situations in their own lives where they have seen something rising to the top or to the surface – what makes things do this? *You should not project slides M and N which refer to models developed in the Thermal Energy and Weather units.* • Students may draw on ideas about floating objects in water, hot air balloons, other experiences they have had. • It might be useful to point to students that the magma and lava coming out of the volcanoes is very hot – hotter than anything normally on the surface of the Earth. Could that have something to do with the movement? • At this point, you have discretion on how to introduce the idea that when liquids are heated unevenly, they move around. You might use a lab or demonstration that shows the convection process, or use simulation. The goal is for students to understand that when a liquid like magma is heated in one area, it is caused to move. • Students will come to understand what is happening at the particle level when they experience the Thermal Energy and Weather units.