
Moving, Exploding Earth



Sixth-Grade Teacher Resource Guide

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Moving, Exploding Earth: Lesson Summary and Vocabulary

Lesson Summary: YSI's *Moving, Exploding Earth* program offers students a comprehensive overview of geological forces. Students will first work with the instructors to discuss the earth and identify its composition. A food-based model provides an early snack and helps students visualize the layers of the earth and how they move. From there, students split into two groups to cycle between 'plate tectonics' and 'rocks and minerals' stations. In the first, they recreate tectonic forces and discover the nature of different boundaries and the earthquakes they produce. In the second, they learn how minerals can be combined and form into rocks, and how one type of rock can transform into another. Lastly, programs scheduled at YSI facilities will go on an instructor-led hike to observe some of the features and forces of our local earth. Throughout the program, students will be challenged to address and respond to a wide range of open-ended questions and help their classmates build a better picture of the planet we live on.

Vocabulary: Below are words and concepts that relate to the *Moving, Exploding Earth* program.

Asthenosphere: the soft, flowing part of the mantle that is near the surface and higher in temperature but lower in pressure than the inner mantle

Convergent: a type of boundary where plates come together; colliding or merging

Core: the iron and nickel center of the earth; includes a solid inner core and liquid outer core

Crust: the solid outer layer of the earth, the crust is more dense under the ocean and less dense under the continents

Divergent: a type of boundary where plates move apart; splitting

Earthquake: strong vibrations in the lithosphere caused by motion at faults and boundaries

Erosion: the process by which the surface of the earth is worn away by wind, water, or other natural forces

Igneous: a type of rock produced by the heat of a volcano; literally "born in fire"

Lava: melted rock that has exited the surface of the earth

Lithosphere: cool layer of rigid rock that includes the cooler, outermost layer of the mantle

Magma: melted rock just below the surface of the earth's crust

Mantle: the semisolid portion of the earth between the crust and the core

Mesosphere: the dense lower rock layer between the asthenosphere and core; flows very slowly

Metamorphic: a type of rock that has changed forms due to extreme heat and pressure

Mineral: an inorganic crystalline solid

Rock: a substance composed of mineral matter put together under heat or pressure

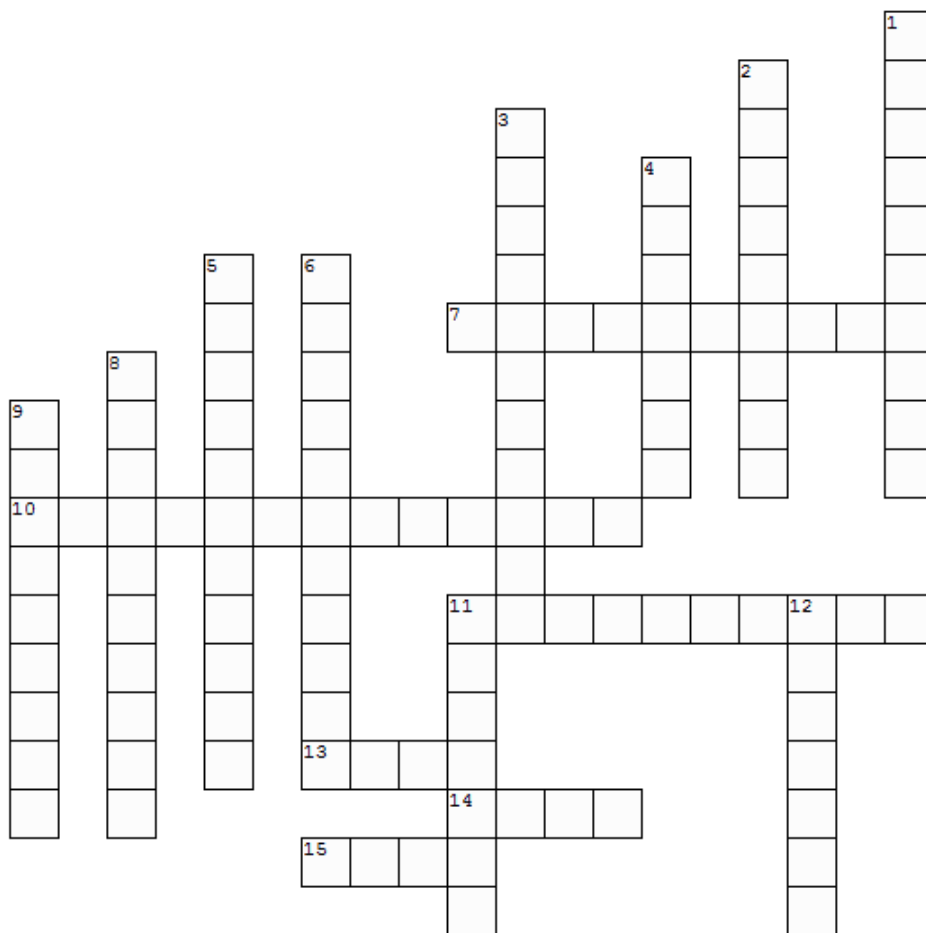
Sedimentary: a type of rock formed by small deposited particles that are compressed over time

Subduction: the process by which one tectonic plate is pushed or driven under another

Transform: a type of boundary where plates move sideways to each other; change

Definitions based on www.dictionary.reference.com

Moving, Exploding Earth Language Arts Crossword Puzzle



MINERAL	LAVA	CORE	ROCK	CONVERGENT	IGNEOUS	EROSION	ASTHENOSPHERE
LITHOSPHERE	SEDIMENTARY	METAMORPHIC	TRANSFORM	DIVERGENT	MESOSPHERE		
		EARTHQUAKE	SUBDUCTION				

Down

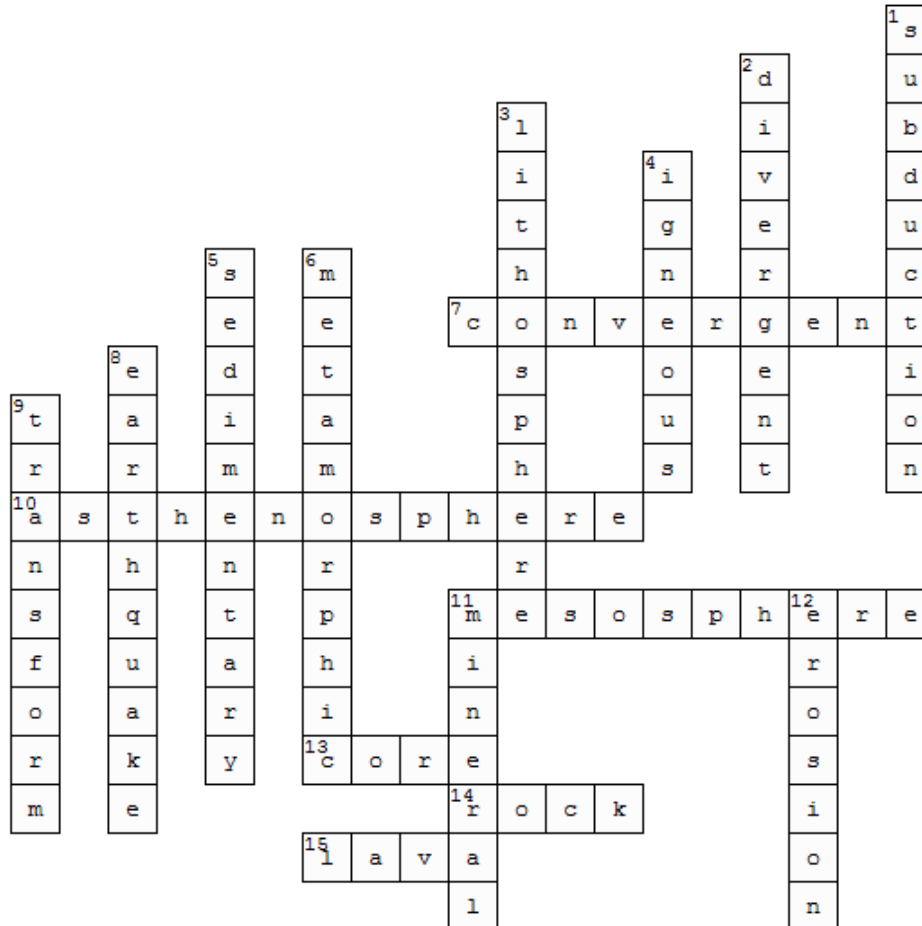
- The process by which one tectonic plate moves under another.
- A type of boundary where plates move apart.
- The outermost layer of the earth; includes everything we see.
- Rock produced by the heat of a volcano.
- Rock formed by small deposited particles that are compressed over time.
- Rock that changed forms due to heat and pressure.
- Strong vibrations in the earth's crust caused by motion at faults and boundaries.
- A type of boundary where plates slide sideways past each other.
- An inorganic crystalline solid.
- The process by which the surface of the earth is worn away by wind, water, or other natural forces.

Across

- A type of boundary where plates come together.
- The layer of fluid and semi-fluid rock just below the lithosphere.
- The dense semi-solid rock layer between the asthenosphere and core.
- The iron and nickel center of the earth; includes a solid inner part and liquid outer part.
- A substance composed of mineral matter put together under heat or pressure.
- Melted rock that has exited the surface of the earth.

Answer Key

Moving Exploding Earth Language Arts Crossword Puzzle



Down

1. The process by which one tectonic moves under another (**subduction**).
2. A type of boundary where plates move apart (**divergent**).
3. The outermost layer of the earth; includes everything we see (**lithosphere**).
4. Rock produced by the heat of a volcano (**igneous**).
5. Rock formed by small deposited particles that are compressed over time (**sedimentary**).
6. Rock that changed forms due to heat and pressure (**metamorphic**).
8. Strong vibrations in the earth's crust caused by motion at faults and boundaries (**earthquake**).
9. A type of boundary where plates move sideways past each other; change (**transform**).
11. An inorganic crystalline solid (**mineral**).
12. The process by which the surface of the earth is worn away by wind, water, or other natural forces (**erosion**).

Across

7. A type of boundary where plates come together (**convergent**).
10. The layer of fluid and semi-fluid rock just below the lithosphere (**asthenosphere**).
11. The dense semi-solid rock layer between the asthenosphere and core (**mesosphere**).
13. The iron and nickel center of the earth; includes a solid inner part and liquid outer part (**core**).
14. A substance composed of mineral matter put together under heat or pressure (**rock**).
15. Melted rock that has exited the surface of the earth (**lava**).

Language Arts Word Search

Moving, Exploding Earth

Circle the vocabulary in the word search below. Can you find all the earth-related words?

C C O N V E R G E N T D M C I F Y
 I Q I Q W P R L A V A U X G B M S
 B C T R A N S F O R M M N A X D N
 U S M Z J M T X C P S E X N L M P
 U C D N V Y B R N Y O H J O N A T
 O I I V B T O G E U B N D X E T L
 N H V U G C K X S M W F F G B X A
 W P E F K E S U B D U C T I O N I
 C R R Z S P J E B V J K L J U Q R
 V O G D G E A R T H Q U A K E V D
 V M E R E H P S O H T I L B O X C
 F A N G S E D I M E N T A R Y F I
 X T T W E C A I J R O Z Q E A M E
 N E D C E R E H P S O S E M I X K
 J M O M I N E R A L W O L S D L L
 G R X Z F N O I S O R E O P Z V F
 E P R A S T H E N O S P H E R E S

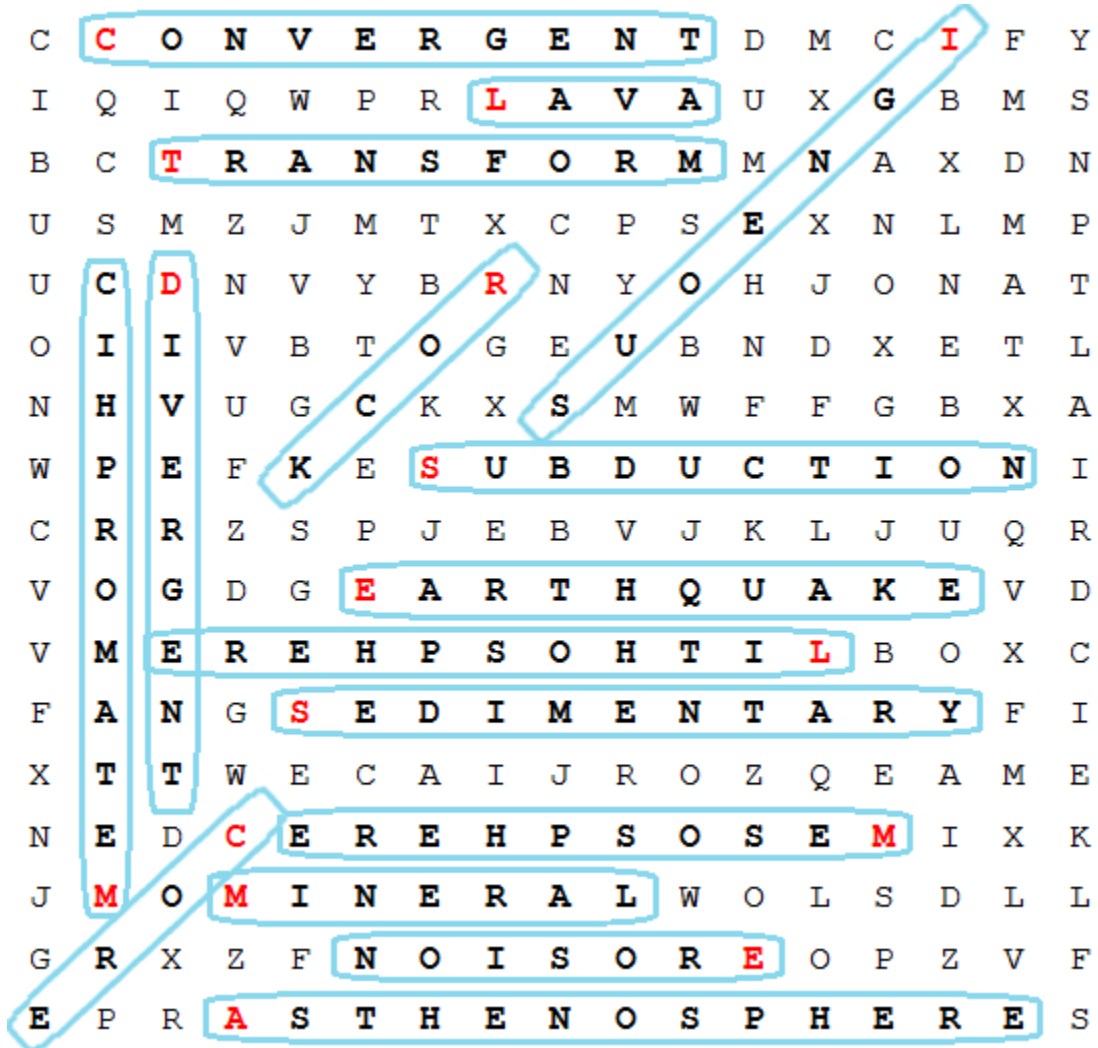
Word Bank

ASTHENOSPHERE
 CONVERGENT
 CORE
 DIVERGENT
 EARTHQUAKE
 EROSION

IGNEOUS
 LAVA
 LITHOSPHERE
 MESOSPHERE
 METAMORPHIC
 MINERAL

ROCK
 SEDIMENTARY
 SUBDUCTION
 TRANSFORM

Answer Key
Language Arts Word Search
Moving, Exploding Earth



Word Bank

ASTHENOSPHERE
 CONVERGENT
 CORE
 DIVERGENT
 EARTHQUAKE
 EROSION

IGNEOUS
 LAVA
 LITHOSPHERE
 MESOSPHERE
 METAMORPHIC
 MINERAL

ROCK
 SEDIMENTARY
 SUBDUCTION
 TRANSFORM

Moving, Exploding Earth: Extension Activities

The extension activities listed below are from RAFT (Resource Area For Teaching). RAFT educational content is available online (www.raftbayarea.org) at no cost and is aligned to California Science Standards and Next Generation Science Standards. Below is a selection of post-visit activities from RAFT to build on student learning about geology and the forces that make up our planet.

[RAFT Idea: Playing with the Rock Cycle - Resource Area For Teaching - RAFT Bay Area](#)

Grades Covered: 2 through 8

Subjects Covered: Physical Science, Earth/Space Science

Curriculum topics: Rocks and Minerals, Rock Cycle, Patterns of change

Description: Given enough time, everything changes...

<http://www.raftbayarea.org/ideas/Playing%20with%20the%20Rock%20Cycle.pdf>

[RAFT Idea: Foam Faults – Resource Area For Teaching – RAFT Bay Area](#)

Grades Covered: 4 through 12

Subjects Covered: Earth/Space Science

Curriculum topics: Earthquakes, Plate Tectonics, Faults

Description: In this activity, students will model the three main types of faults and examine the terrestrial movement that occurs along the fault lines.

<http://www.raftbayarea.org/ideas/Foam%20Faults.pdf>

[RAFT Idea: On A Roll With Geologic Time – Resource Area For Teaching – RAFT Bay Area](#)

Grades Covered: 2 through 12

Subjects Covered: Life Science, Earth/Space Science, Math

Curriculum topics: Geologic Time, Earth History, Scale

Description: Shrink billions of years and Earth's significant events...

<http://www.raftbayarea.org/ideas/On%20a%20Roll%20with%20Geologic%20Time.pdf>

[RAFT Idea: California Geographic Assembly - Resource Area For Teaching - RAFT Bay Area](#)

Grades Covered: 4 through 8.

Subjects Covered: Earth/Space Science, Social Studies.

Curriculum topics: Geology, Maps, California Land Features.

Description: Use transparent layers to diagram and represent different map details of California.

<http://www.raftbayarea.org/ideas/California%20Geographic%20Assembly.pdf>

Moving, Exploding Earth: Education Standards

Our Moving Exploding Earth program will contribute to students' ability to meet the California Science Content Standards, Common Core, and Next Generation Science Standards listed on the following pages.

California Science Content Standards Sixth Grade:

Plate Tectonics and the Earth's Structure: 1. Plate tectonics accounts for important features of Earth's surface and major geologic events. As a basis for understanding this concept:

- a. *Students know* evidence of plate tectonics is derived from the fit of the continents; the location of earthquakes, volcanoes, and midocean ridges; and the distribution of fossils, rock types, and ancient climatic zones.
- b. *Students know* Earth is composed of several layers: a cold, brittle lithosphere; a hot, convecting mantle; and a dense, metallic core.
- c. *Students know* lithospheric plates the size of continents and oceans move at rates of centimeters per year in response to movements in the mantle.
- d. *Students know* that earthquakes are sudden motions along breaks in the crust called faults and that volcanoes and fissures are locations where magma reaches the surface.
- e. *Students know* major geologic events, such as earthquakes, volcanic eruptions, and mountain building, result from plate motions.
- f. *Students know* how to explain major features of California geology (including mountains, faults, volcanoes) in terms of plate tectonics.
- g. *Students know* how to determine the epicenter of an earthquake and know that the effects of an earthquake on any region vary, depending on the size of the earthquake, the distance of the region from the epicenter, the local geology, and the type of construction in the region.

Shaping the Earth's Surface: 2. Topography is reshaped by the weathering of rock and soil and by the transportation and deposition of sediment. As a basis for understanding this concept:

- a. *Students know* water running downhill is the dominant process in shaping the landscape, including California's landscape.
- b. *Students know* earthquakes, volcanic eruptions, landslides, and floods change human and wildlife habitats.

Heat (Thermal Energy): 3. Heat moves in a predictable flow from warmer objects to cooler objects until all the objects are at the same temperature. As a basis for understanding this concept:

- a. *Students know* energy can be carried from one place to another by heat flow or by waves, including water, light and sound waves, or by moving objects.
- c. *Students know* that heat flows in solids by conduction (which involves no flow of matter) and in fluids by conduction and by convection (which involves flow of matter)

Moving, Exploding Earth: Education Standards

Energy in the Earth System: 4. Many phenomena on Earth’s surface are affected by the transfer of energy through radiation and convection currents. As a basis for understanding this concept:

- c. *Students know* heat from the earth’s interior reaches the surface primarily through convection.

Resources: 6. Sources of energy and materials differ in amounts, distribution, usefulness, and the time required for their formation. As a basis for understanding this concept:

- c. *Students know* the natural origin of the materials used to make common objects.

Excerpted from CA State Standards: <http://www.cde.ca.gov/>

Common Core Sixth Grade:

Speaking and Listening Standards: Students will...

1. Engage effectively in a range of collaborative discussions with diverse partners on *grade 6 topics, texts, and issues*, building on each others’ ideas and expressing their own clearly.
 - a. Come to discussions prepared, having read or studied required material; explicitly draw on that preparation by referring to evidence on the topic, text, or issue to probe and reflect on ideas under discussion.
 - b. Follow rules for collegial discussions, set specific goals and deadlines, and define individual roles as needed.
 - c. Pose and respond to specific questions with elaboration and detail by making comments that contribute to the topic, text, or issue under discussion.
 - d. Review the key ideas expressed and demonstrate understanding of multiple perspectives through reflection and paraphrasing.

Excerpted from Common Core Standards: <http://www.corestandards.org/>

Next Generation Science Standards Sixth Grade:

History of Earth

- **MS-ESS2-2:** Construct an explanation based on evidence for how geoscience processes have changed Earth’s surface at varying time and spatial scales.
 - **Science and Engineering Practices:**
 - **Constructing Explanations and Designing Solutions** Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.
 - Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students’ own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (MS-ESS2-2)
 - **Disciplinary core ideas:**

Moving Exploding Earth: Education Standards

- **ESS2.A: Earth’s Materials and Systems:** The planet’s systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to billions of years. These interactions have shaped Earth’s history and will determine its future. (MS-ESS2-2)
- **ESS2.C: The Roles of Water in Earth’s Surface Processes:** Water’s movements—both on the land and underground—cause weathering and erosion, which change the land’s surface features and create underground formations. (MS-ESS2-2)
- **Crosscutting Concepts**
 - **Scale Proportion and Quantity:** Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. (MS-ESS2-2)

Excerpted from NGSS: <http://www.nextgenscience.org/>