

Structure of the Earth

Activity Description and Estimated Class Time

In this 2-day activity, students try to place subterranean events at appropriate depths within the Earth. Each team has a diagram of Earth's interior with a scale indicating depth. On the diagram, the team places cards describing events such as: "temperatures reach 9,800 degrees Fahrenheit," "where diamonds form," "maximum depth of earthquakes," "where liquid iron is found," etc. Students speculate about depths of these events and record their reasoning in notebooks. At this point, students read about the structures of the earth to reveal where the events occur.

Throughout the guide, teaching tips are in red.

North Carolina Essential Science Standards

6.E.2.1 Summarize the structure of the earth, including the layers, the mantle and core based on the relative position, composition and density.

Brief Science Background

If we moved downward from the surface of the Earth toward its center, we would go through a series of layers with different properties. First, we would go through a solid, brittle, rocky outer crust. Under that would be molten rock ranging in consistency from syrup to something that barely flows. Below that, we would come to an outer core that is much more fluid. At the center would be a solid inner core. Because scientists cannot observe these layers directly, they have built this picture by exploring topography, the ocean floor, rock outcrops, material brought up by volcanoes, and seismic waves passing through the Earth. They also measure gravitational and magnetic fields, and test rocks at pressures and temperatures found deep in the Earth.

Materials for the Whole Class

- ability to project Support Document 1 (SD-1), Earth's Interior Diagram, and Support Document 2 (SD-2), Earth's Interior Answer Key
- scissors
- transparent tape
- event strips from SD-3, Earth's Interior Events, 1 per pair of students.

Materials for groups of 2 students

- one 11" x 17" Earth's Interior Diagram
- 1 event strip of 10 Earth's Interior Events
- enough transparent tape to share among 2 pairs of students
- enough scissors to share among 2 pairs of students
- science notebooks (supplied by the teacher)

Preparation

1. Prepare to project Earth's Interior Diagram, SD-1, and Earth's Interior Answer Key, SD-2. **Landscape versions of these documents are available online. Follow the directions on page 2 to access this guide.**
2. Be ready to give each pair of students an 11" x 17" Earth's Interior Diagram, SD-1.
3. Copy SD-3, Earth's Interior Events and cut into strips, 1 strip per pair of students.

Procedure Part 1 – 50 minutes

Exploration – 10 minutes

1. Ask students to speculate what they think happens under the ground and deeper inside the Earth. Accept all answers. Record the list on a piece of chart paper. **Explorations are for students to engage with materials or concepts, ask questions, and share what they notice. Avoid teaching content at this time, even during discussions.**

Throughout the guide, teaching tips are in red.

2. If no one mentions temperature, ask students to speculate how hot or cold it gets deep inside Earth.
3. Explain that the class will explore some events that happen inside the Earth.

Activity – 40 minutes

1. Form pairs of students. Give each pair one 11" x 17" Earth's Interior diagram and some transparent tape.
2. Project SD-1. Explain that it shows the Earth as if a wedge were removed. Depth is marked in miles on one side and kilometers on the other. Familiarize students with the distances shown by comparing them to familiar distances such as a distance to a nearby town.

3. Give out the event strips from SD-3, Earth's Interior Events, and scissors. Ask pairs to cut the strip into 10 individual cards. Point out that each card is an event or condition occurring inside the Earth. Challenge students to tape the cards to the diagram at the depth where they think that event or condition occurs. Ask both members of the pair to write their own reasons for card placement in their notebooks. If a pair disagrees, tell them to choose a depth, but write their individual ideas in their notebooks. Students do not have to worry about being wrong, but need to think it through and write down their thoughts.
4. Circulate and look in notebooks at students' reasons for placing cards. Try to learn how students currently understand the Earth's interior. Don't answer questions or explain at this time.

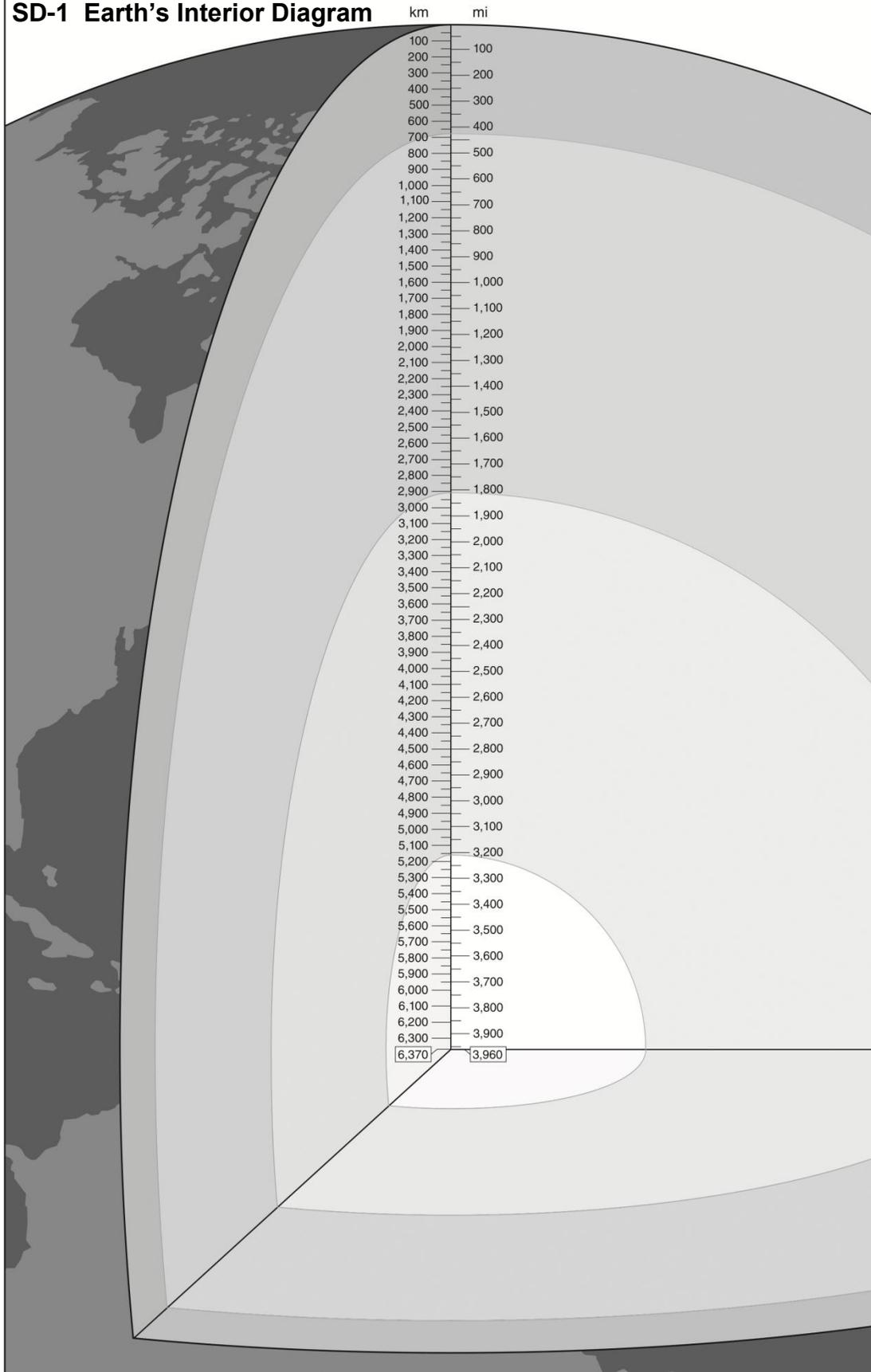
Procedure Part 2 – 50 minutes

1. Have students take out their diagram with the cards taped to it.
2. Assign readings that address the layers of the Earth.
3. Have students keep track of the layers that make up the Earth, the depth where each layer is located, and interesting facts about each layer. Have students record this information on the diagram and in their notebooks. According to the information they have from readings, ask them to move as many cards as they can to correct places.
4. Hold a discussion with the class to share students' ideas.
5. Project SD-2 to show the correct placement of the cards.

Wrap-up

1. Ask students to list interesting facts about the Earth and questions they have about the Earth's interior. For example, students might wonder why rocks don't form any deeper than 43.5 mi. **It's because that's the maximum depth of the crust before you reach the upper mantle, and the upper mantle is semi liquid.**
2. Be sure students understand the different layers that make up the Earth and the different qualities, properties and events that occur in each layer.

SD-1 Earth's Interior Diagram



SD-2 Earth's Interior Answer Key

Depth from surface Fact

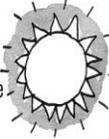
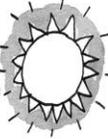
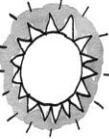
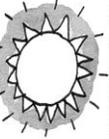
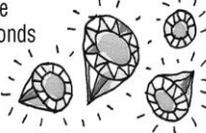
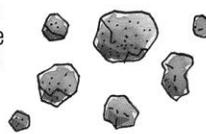
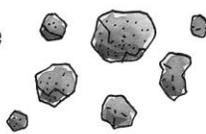
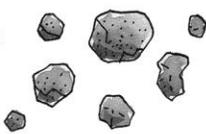
- 1,800 - 3,200 mi.....liquid iron is found, creates Earth's magnetic field
- 3,200 - 3960 mi.....temperature 9,800° F, as hot as the surface of the sun
- 6.8 milesbottom of the Pacific Ocean, Mariana Trench
- 93 mileswhere diamonds form
- 1.5 milesdeepest mineral mine in the world
- 434 milesmaximum depth of earthquakes
- 1,800 milesmaximum depth of magma
- 1,800 miles 1.35 million atmospheres of pressure or 17,800 elephants balancing on your head
- 3,960 miles3.6 million atmospheres of pressure or 47,700 elephants balancing on your head
- 0 - 43.5 mi.....where rocks form

Sources:

<http://www.bbc.com/future/bspoke/story/20150306-journey-to-the-centre-of-earth/>

<http://news.nationalgeographic.com/news/2010/09/100923-science-early-earth-core-magma-liquid-molten-layer/>

SD-3 Earth's Interior Event Cards

<p>Liquid iron is found, creates Earth's magnetic field</p> 	<p>Liquid iron is found, creates Earth's magnetic field</p> 	<p>Liquid iron is found, creates Earth's magnetic field</p> 	<p>Liquid iron is found, creates Earth's magnetic field</p> 
<p>Temperatures reach 9,800 degrees F (as hot as the surface of the Sun!)</p> 	<p>Temperatures reach 9,800 degrees F (as hot as the surface of the Sun!)</p> 	<p>Temperatures reach 9,800 degrees F (as hot as the surface of the Sun!)</p> 	<p>Temperatures reach 9,800 degrees F (as hot as the surface of the Sun!)</p> 
<p>Bottom of the Pacific Ocean, Mariana Trench</p> 	<p>Bottom of the Pacific Ocean, Mariana Trench</p> 	<p>Bottom of the Pacific Ocean, Mariana Trench</p> 	<p>Bottom of the Pacific Ocean, Mariana Trench</p> 
<p>Where diamonds form</p> 	<p>Where diamonds form</p> 	<p>Where diamonds form</p> 	<p>Where diamonds form</p> 
<p>Deepest mine in the world</p> 	<p>Deepest mine in the world</p> 	<p>Deepest mine in the world</p> 	<p>Deepest mine in the world</p> 
<p>Maximum depth of earthquakes</p> 	<p>Maximum depth of earthquakes</p> 	<p>Maximum depth of earthquakes</p> 	<p>Maximum depth of earthquakes</p> 
<p>Maximum depth of magma</p> 	<p>Maximum depth of magma</p> 	<p>Maximum depth of magma</p> 	<p>Maximum depth of magma</p> 
<p>1.35 million atmospheres of pressure or 17,800 elephants balancing on your head</p> 	<p>1.35 million atmospheres of pressure or 17,800 elephants balancing on your head</p> 	<p>1.35 million atmospheres of pressure or 17,800 elephants balancing on your head</p> 	<p>1.35 million atmospheres of pressure or 17,800 elephants balancing on your head</p> 
<p>3.6 million atmospheres of pressure or 47,700 elephants balancing on your head</p> 	<p>3.6 million atmospheres of pressure or 47,700 elephants balancing on your head</p> 	<p>3.6 million atmospheres of pressure or 47,700 elephants balancing on your head</p> 	<p>3.6 million atmospheres of pressure or 47,700 elephants balancing on your head</p> 
<p>Place where rocks form</p> 	<p>Place where rocks form</p> 	<p>Place where rocks form</p> 	<p>Place where rocks form</p> 