

## Session 3: Earth's Interior

### Part One Earthquake Waves

#### Materials:

- 2 Slinkys® per group of three students
- 1 timer (a stop watch or watch with a second hand) per group of three students
- String

#### Procedure:

1. Pose this question to the class: How do we know about the Earth's interior? Accept all ideas and record them. Tell the students that they will be using Slinkys® to learn about the waves caused by earthquakes—seismic waves. Ask the students to think while they work about how understanding earthquake waves might help us know something about Earth's interior.
2. Arrange the students into groups of three. Distribute two Slinkys® and one timer to each group. Tell the groups to assign one of the following roles to each group member: timer, P wave pusher, S wave pusher. Before starting the Slinky® activity, ask the groups to discuss their ideas about what happens during an earthquake and what is the nature of the motion that is felt.
3. After the groups complete their discussions, demonstrate how to attach one end of the slinky to a desk leg (tie the 2 outer coils of the Slinky® to the leg with string). Have the students extend the Slinky® approximately 10 feet away from the desk. Explain how each wave pusher should move their Slinky®. P wave pushers “push” their end of the Slinky® straight toward the end that is tied to the chair, thereby compressing it. S wave pushers slide the end of their “slinky” side to side, creating waves that look like an “S.” Monitor student technique, making sure that it is correct.
4. Ask the groups to determine which travels faster, P waves or S waves. Have the timer group member set up trials for the wave race. Have each group conduct three trials, write up the results of their trials, and write a description of what happened.
5. Reconvene the whole group. Have each group report on their experiences. Ask the group how the motions of earthquakes might provide scientists information about the Earth's interior. Lead this discussion.
6. Choose 10 volunteers. Line them up in two groups of five. Have each line link arms. Simulate P and S wave movement through each line, like the demonstration in the video. This represents seismic waves moving through solids. Have the students describe what happened. Next, have the students stand in line and move one arm's length away from each other. Simulate P and S waves through each line. This represents seismic waves moving through a liquid. Have the students describe what happened.

7. As a whole group, discuss the results of the simulation and the Slinky® experience. Help the students understand that P waves will move through both solids and liquids, and that S waves will move solids but not liquids. Draw a map of the Earth's interior on the board. Incorporate the knowledge of how seismic waves move through different densities into the map. Guide the students to the understanding that the Earth's crust, the mantle, and the inner core are solid, and that the outer core is liquid. Talk about how this was discovered by tracking seismic waves through the Earth.

## **Part Two**

### **Nature of the Earth's Upper Mantle**

Adapted from Project Earth Science: Geology

(See *“Instructional Materials Appearing in the Course”* section of your course manual.)

This activity may take more than one class session to complete.

#### **Materials:**

- 1 container of Silly Putty® per pair of students
- 1 5x8 or larger index card per pair of students

#### **Procedure:**

1. Arrange the students into pairs. Give one container of Silly Putty® to each pair of students. Instruct them to manipulate the sample and become familiar with it: stretch it, compress it, roll it, and so on. When they have finished, have the students take their sample, form it into a ball, and flatten the ball slightly. Instruct them to push it onto a large index card, and then have them trace the outline of the edge of the Silly Putty ball onto the card with a pen. Ask the students to put aside their cards and to consider the following question: Is Silly Putty® a solid or a liquid? Instruct them to record their answer, and the reasons for their thinking.
2. As a whole group, return to the drawing of the cross section of the Earth you drew on the board. Ask the students to share what they have learned about the Earth's interior layers from part one of the activity. Record their ideas. Together, identify some key concepts about the Earth's interior and create a class concept map. Have each student create their own copy of the concept map.
3. Tell the students to rejoin their partners. Have them retrieve the card with the ball of putty on it and trace a circle around the edge of the putty before removing it from the card. Have the students remove the Silly Putty® from their index card and note what they observe. Collect each index card and assemble them for the whole class to see. As a whole group, review the answers to the question, “Is Silly Putty® a solid or a liquid?” Discuss the students' ideas. Ask the group what part of Earth's interior they think is modeled by the putty. After discussing their ideas, explain that the mantle is composed of a solid that flows. Talk about how the mantle differs from the other layers of the Earth.

4. Have the students return to their groups of four, and ask them to talk about how to incorporate this new information on the nature of each of the Earth's layers into the class concept map. Instruct them to make the additions into their copies of the concept map.