SHAKE, RATTLE AND ROLL *(MODIFIED FOR ADEED)*

INSTRUCTIONS

Science Concept:

Earthquakes move things.

Objectives:

The student will:

- describe what happens to the land during an earthquake;
- predict what will happen when the land is changed due to an earthquake; and
- draw a picture and write at least one sentence explaining how earthquakes move and change things.

Targeted Alaska Grade Level Expectations:

Science

[4] SD2.2 -- The student demonstrates an understanding of the forces that shape Earth by identifying causes (i.e., earthquakes, tsunamis, volcanoes, floods, landslides, avalanches) of rapid changes on the surface.

[3] SA1.1 The student demonstrates an understanding of the process of science by asking questions, predicting, observing, describing, measuring, classifying, making generalizations, inferring and communicating.

Writing

[1] W1.2.1 The student writes for a variety of purposes and audiences by writing thoughts or ideas to communicate with specific audiences (e.g., cards, letters, notes, lists).

Vocabulary:

earthquake –a sudden movement of Earth's crust caused by the release of stress accumulated along geologic faults due to tectonic or volcanic forces

fault – a fracture in Earth's crust along which two pieces of crust can move with respect to each other

movement – the act or an instance of moving; a change in place or position

surface waves – earthquake waves that travel on Earth's surface that make the ground shift from side to side and up and down

tectonic plates – the rocky, divided segments of Earth's crust that support continents, islands, and oceans

Materials:

Needed for two to four students:

- Cookie sheet with edges
- Water (one cup)
- Sand (three cups)
- Gravel (three cups)
- Soil (three cups)
- Plastic figures (ten various: animals, plants, houses, etc.)
- Rope
- Slinky® or wave spring
- Wooden board
- Blocks to pick wooden board off the ground (one for each end)
- Science journal (one per student)
- *Forces of Nature* DVD produced by National Geographic (2004). Author: Catherine O'Neill Grace
- ASSESSMENT WORKSHEET: "T1" (*for teacher*)

Activity Preparation:

1. Prepare a KWL chart on paper.

2. Prepare vocabulary list of student words.

Teacher Background:

The teacher will need to have some background knowledge of how Earth can move like a wave. P and S waves are described below along with a suggestion about how to demonstrate each type of wave to students.

At the first grade level students are not responsible for knowing what S and P waves are. This activity is done just to introduce them to how the earth can move like a wave: up and down and side to side. Use phrases like "up and down movement" and "side-to-side movement." The information written below is only for teachers to read and understand how to demonstrate the movement using both the Slinky® and rope.

Making P Waves

P waves consist of a compression (shortening) motion and a dilation (expanding) motion that both lie along a line. As you make your own P wave in this exercise, try to identify the compressions and dilations in the Slinky®. Here's how you do it:

1. Place the Slinky® on a flat surface. Have your partner hold the opposite end of the Slinky®. If you don't have a partner, you can tie the Slinky® onto a hook in the wall or onto a doorknob (close the door first) and try this activity in the air.
2. Holding the other end of the Slinky®, walk away from your partner, or from the wall or door.
3. Stop walking away when the Slinky® isn't sagging anymore (if in the air) or there is no more slack. Don't pull the Slinky® too tight; just take up the slack.
4. Push your end of the Slinky® towards your partner in one, quick motion (if the Slinky® is suspended in the air, quickly jerk your end of the Slinky® towards the wall and then back). Don't let go of the Slinky®.

Making S Waves

When making your S wave, notice how the Slinky® itself moves in a direction perpendicular to the direction that the wave is traveling in (perpendicular to the direction of wave propagation). S waves are more complex than P waves, but they should be easier to simulate in this activity:

1. Place the Slinky® on a flat surface, and have your partner hold the opposite end of the Slinky®. If working alone, tie one end of the Slinky® to a hook on the wall or a doorknob (close the door first).
2. Holding the other end of the Slinky®, walk away from your partner, or from the wall or door.
3. Stop walking when the Slinky® has only some slack left. If working alone and the Slinky® is suspended in the air, you want to stop walking only when the Slinky® no longer sags in the air. Don't pull the Slinky® tight; just take up most of the slack.
4. Quickly jerk your end of the Slinky® from side to side once. If the Slinky® is suspended in the air, a quick jerk up and down once is sufficient. Don't let go of the Slinky®.

Activity Procedure:

Please refer to the assessment task and scoring rubric located at the end of these instructions. Discuss the assessment descriptors with the class before teaching this lesson.

Gear Up
Process Skills: observing and communicating

Day 1:

1. Create a KWL with students, filling in the K/W sections only. Ask what they know about earthquakes and what they want to learn about earthquakes. Put student's initials next to their responses. Watch the

video "Forces of Nature" DVD created by National Geographic and discuss information learned from the DVD. Review vocabulary list and discuss definitions.

Explore
Process Skills: observing, communicating, predicting and describing

Day 2:

2. Revisit KWL checking to see if students have answered some of their questions. Have students review the different ways that the earth moves during an earthquake. Demonstrate the motion of P and S waves using a Slinky®. (NOTE: The metal ones work best). The S wave can also be simulated using a piece of rope in place of a Slinky®. The following activities work best with a partner and on a flat surface such as a table or floor.

3. In small groups have students create a land surface on a cookie sheet. In the center of the cookie sheet have students layer gravel, wet sand and soil packing each layer down into the next as they build up. Keep layering the gravel, wet sand and soil until it reaches approximately 4 inches. (Make sure students leave a one-inch border around the land surface on all sides.) Once they have created the "land," have them place plastic animals, cars, and buildings on top of the land. Students will then take turns shaking their cookie sheet back and forth representing S waves (side to side motion). Have them observe what is happening to the land and things that were placed on top of the land. Then have each group move their cookie sheet over to the plywood board that is slightly suspended above the ground by something solid holding up each end of the board. Make sure that there is enough flexibility in the board so that a student can bounce on it creating P waves (up and down motion) and be able to move it side to side to create a wave. As each child is taking their turn within their group have them observe what is happening to the land and the items on top of the land.

   Teacher's Note: This may best be done outside or somewhere that it is okay to have dirt falling on the ground.

Generalize
Process Skills: communicating

4. Discuss the following questions as a class:
   a. What did you observe during the exploration?
   b. How did the land move or change?
   c. Why do earthquakes cause so much damage?
   d. If you are in a building where should you go if there is an earthquake?
   e. What do you think would happen to your town if there were an earthquake?

5. Complete the KWL chart, making sure that all questions are answered or further investigated.

Apply
Process Skills: communicating and describing

6. From the information that you have acquired, describe to a partner what an earthquake may feel like if you were in a tall building, a house, outside at the park, or in a car driving down the street. Where would you go or what would you do in each of those situations? Write what you told your partner in your science journal.

Extension Idea:

At home, have students create an earthquake diorama of what their local area would look like after an earthquake. Have students share their diorama with the class.

Assessment Task:

Task 1:

Students will individually be asked to predict at least two things that happen to the land when there is an earthquake. Use teacher created worksheet "T1" to record student's responses.

Task 2:

In your science journal, write at least one sentence describing at least two things that move or change on land if there is a strong earthquake. Draw at least one picture to go along with your sentence(s).

Rubric:

Objectives	GLEs	Below Proficient	Proficient	Above Proficient
Describe what happens to items on the land after an earthquake.	[4] SD2.2	Student describes less than two things that would move/change on Earth's surface after an earthquake.	Student describes two things that would move/change on Earth's surface after an earthquake.	Student describes three or more things that would move/change on Earth's surface after an earthquake.
Predict what will happen when the land is changed due to an earthquake.	[3] SA.1	Student predicts and tells the teacher one or less things that will happen to the land due to an earthquake.	Student predicts and tells the teacher two things that will happen to the land due to an earthquake.	Student predicts and tells the teacher three or more things that will happen to the land due to an earthquake.
Draw a picture and write at least one sentence explaining how earthquakes move and change things.	[1] W1.2.1	Student draws one picture, but has no sentences or student writes one sentence with no pictures explaining how earthquakes move and change the land.	Student draws one picture and writes one sentence explaining how earthquakes move and change the land.	Student draws two or more pictures and writes two or more sentences explaining how earthquakes move and change the land.

Resources:

Making P and S Waves Website: http://www.geo.mtu.edu/UPSeis/making.html

Forces of Nature. 2004. National Geographic DVD or Earthquakes 101 (online National Geographic video)

National Geographic Website: http://video.nationalgeographic.com/video/

Trueit, Trudi Strain. (2003). *Earthquakes*. New York: Franklin Watts

USGS Website: http://earthquake.usgs.gov/learning/kids/

ASSESSMENT WORKSHEET
T1

Assessment Sheet - Changes That Earthquakes Make?

Name	Predicts one or less changes	Predicts two changes	Predicts two or more changes
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			
16.			
17.			
18.			
19.			
20.			