Plate Tectonic Cycle

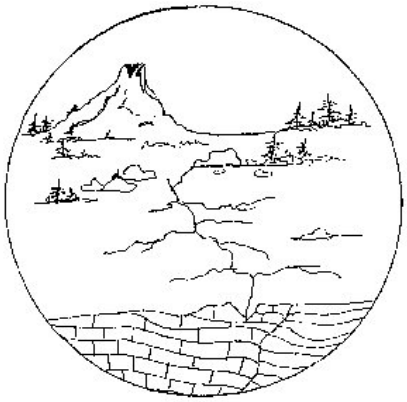
Earth's Moving Force

KINDERGARTEN

EARTHQUAKES

1 WEEK
LESSON PLANS AND
ACTIVITIES

PLATE TECTONIC CYCLE
OVERVIEW OF KINDERGARTEN



VOLCANOES

WEEK 1.
PRE: *Learning that all mountains are not volcanoes.*
LAB: *Investigating rocks that come from volcanoes.*
POST: *Discovering how volcanoes grow.*

EARTHQUAKES

WEEK 2.
PRE: *Learning that earthquakes cause the Earth to shake.*
LAB: *Discovering that earthquakes cause different types of shaking.*
POST: *Dramatizing different types of earthquake intensities.*

PLATE TECTONICS

WEEK 3.
PRE: *Learning that the crust of the Earth moves.*
LAB: *Analyzing a puzzle of the Earth.*
POST: *Comparing the continents with plate boundaries.*

HAZARDS

WEEK 4.
PRE: *Learning to critically think during an earthquake.*
LAB: *Analyzing the sounds created by earthquakes.*
POST: *Exploring dangers in the classroom.*

PLATE TECTONIC CYCLE - EARTHQUAKES (K)

PRE LAB

Students use penmanship to learn about earthquakes.

OBJECTIVES:

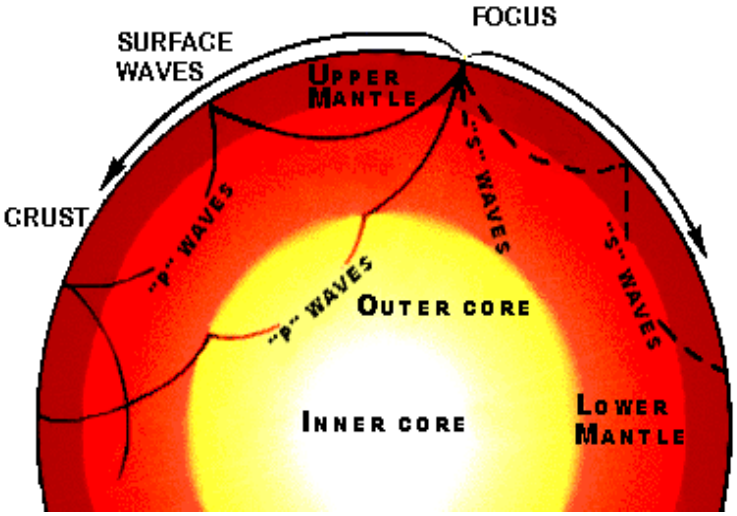
1. Learning that earthquakes cause the Earth to shake.
2. Understanding that an earthquake is less intense, the farther you are from the focus of an earthquake.

VOCABULARY:

earth
earthquake
shake
stress
volcano

MATERIALS:

worksheet
crayons



from U.S. Geological Survey

BACKGROUND:

The crust of the Earth moves when stress, or force, is applied to it. Earthquakes are caused by stresses from plate movement, and to a much lesser degree, from the movement of magma inside the Earth. Understanding earthquakes teaches students about the inside of the Earth and what causes visible movement on the outside surface of the Earth. Students should understand that stress within the crust of the earth can "relieve" itself by giving off energy (earthquakes). This energy is released in the form of seismic waves. These waves make the whole Earth ring like a bell and travel through the entire Earth. The movement of these waves within the Earth's crust can cause minor to major damage to structures on the surface of the Earth, especially close to the origin of the earthquake. The damage depends on the intensity of the original stress and how it travels through the crust.

Earthquakes are caused by the sudden movement and fracturing of rock masses along preexisting faults. A fault is a broken surface within the Earth's crust. The point on the fault at which the displacement begins is called the "focus" of the earthquake. The point on the surface of the earth directly above the focus is the "epicenter." Your students need to understand that an earthquake happens in rocks that have been stressed. This stress is stored until the strength of the rock is exceeded. The actual break (the earthquake) then releases the energy. Again, this energy travels in the form of waves.

The seismic waves generated by an earthquake can be recorded and measured on a seismograph. The interpretation of the waves provides seismologists with a way of "seeing" into the inside of the Earth. The waves produced by earthquakes travel through the Earth and bounce off different features of the Earth's interior. The patterns they form after bouncing off these features can be used to create images of the interior. The reflection of seismic waves indicates that the center of the Earth is composed of iron and nickel. This core has two parts, the outer core where the metal is liquid (not like milk, more like thick honey) and the inner core, which is solid. Since we cannot drill very far into the Earth's crust, the evidence from different waves becomes important in interpreting the earth's structures.

PROCEDURE:

1. State for students that volcanoes and earthquakes are related, but that this unit will concentrate on earthquakes. Explain that the stress within the crust of the Earth causes the Earth to "relieve" itself in the form of earthquakes and volcanoes. Tell the class that earthquakes can occur without volcanoes, but volcanoes are always accompanied by earthquakes.

2. On their worksheet, have the students trace the words. Emphasize to them that the entire Earth shakes during an earthquake, not just one little area. Point out that an earthquake is usually the strongest at the place where it starts, and that the farther you get from the break in the Earth (focus - within crust; epicenter - on the crust), the less you feel it. In the box, you may want students to draw a "shaking" person or building.

3. You might ask the students if any of them have ever felt an earthquake. Let them tell their own stories. Remember that if one of the students has had a bad experience, do not let that student continue too long for it may scare the other children. Ask the students if they thought of going to safety. Ask them if the earthquake was strong, moderate, or weak, and what it felt like.

PLATE TECTONIC CYCLE - EARTHQUAKES (K)
PRE LAB

earth

quake

shake

What happens during an earthquake?

PLATE TECTONIC CYCLE - EARTHQUAKES (K)

LAB

Students simulate an earthquake using a shaker table.

OBJECTIVES:

1. Discovering that earthquakes cause different types of shaking.
2. Comparing different intensities of earthquakes.

VOCABULARY:

earthquake
moderate
shake
stress
strong
weak


San Fernando, California 1971

MATERIALS:

toys for building model houses
primary shaker tables

BACKGROUND:

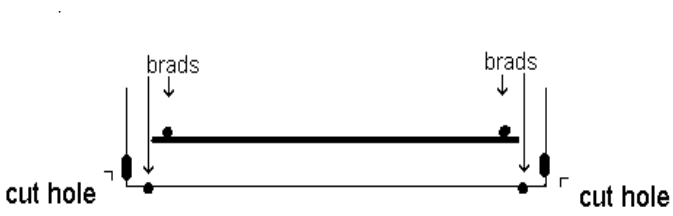
Earthquakes hardly ever occur one at a time. Foreshocks or smaller earthquakes which occur before the "mainshock." An "aftershock" is any earthquake that occurs after the main earthquake. The shaking people feel during an earthquake is caused by the energy released when movement is caused by a rupture in the Earth's crust or uppermost mantle. If you compare an earthquake to snapping your fingers, the rupture is the fingers snapping, but what you hear, or "feel" is the sound waves travelling through the atmosphere. The larger the energy released the larger the earthquake. Then energy moves in what we refer to as "seismic waves." Seismic waves are considered a physical wave and requires that it travels through a substance. It can be moved in many ways, but the major ways are primary (push-pull and P) waves and secondary (shear or S) waves

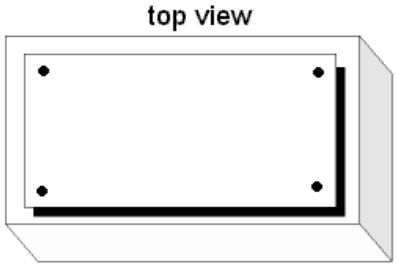
A wave travels through a material when a force pushes on that material and the material resists being pushed. For example, when you speak, your voice compresses a volume of air. One of the properties of air (and just about any other material) is that it resists being compressed into a smaller volume. When your voice compresses this volume of air, its resistance pushes back against neighboring volumes of air. These volumes then resist compression, and they push back against their neighbors, generating a wave of compression that travels through all the volumes of air between your mouth and the person hearing you.

Seismic waves can cause weak, moderate, or strong earthquakes.

PROCEDURE:

1. Prior to lab construct primary shaker tables. Make enough units so that the students can work in groups of 2 or 3. Here are directions:





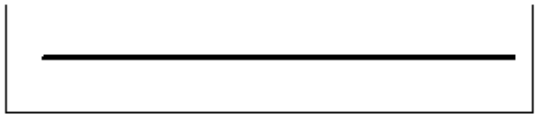
HOW TO CONSTRUCT A PRIMARY SHAKER TABLE

The primary shaker table is an inexpensive but very useful tool for demonstrating weak, moderate, and strong earthquake damage to children. It is called a primary shaker table because it can move in only one direction. It is thus not a fully correct analog to the many directions of motion in a real earthquake. However, the primary shaker table is an excellent visual tool to help small children can understand that earthquakes vary in both intensity and damage.

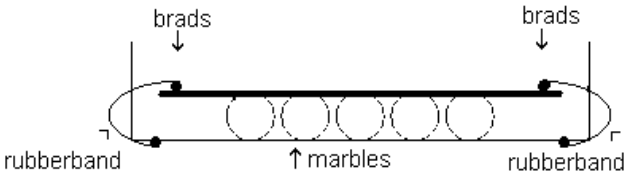
Materials: 8 long stemmed brads or nails
4 strong, thick rubber bands
marbles
cardboard box with lid
string
plastic container lid

Directions:

a. Cut a section from the cardboard box lid so that it will fit inside of the cardboard box as shown in the picture below.



b. Take 4 brads and insert them from the inside of the cardboard box so that the stems fall outside of the box. Insert the remaining four brads into the cut lid of the box. Make sure that the brads are not directly on the edge as this will cause the lid to tear when it is pulled.



c. Fasten the rubber bands to the brads inside of the cardboard box. Fasten the other ends of the rubber bands to the brads on the cut lid. Leave the lid inside of the box.

d. Place several marbles in a container top. Put the marbles in their container under the cardboard lid in the box, to allow it to move freely when up or down.

e. Make a small hole in one end of the box. Attach a piece of string to one end of the lid and. insert the opposite end of the string through the hole in the box. This move the lid. Don't forget to tie a knot at the end of the string where comes out of the box, this will prevent it from going back inside. Your "primary shaker table" is complete.

2. Discuss with the class that the Earth shakes during an earthquake. Explain that shaking is caused when stress builds up on the outer portion of the Earth and it "relieves" itself.

3. Discuss the words weak, moderate, and strong, by giving examples of familiar objects to the students. Weak refers to an earthquake that does not cause much shaking; Moderate might be when a house shakes and things might fall from shelves. Strong is when a house shakes a lot, causing many things to fall.

4. Divide the students into groups of 2 or 3. Give each group a primary shaker table. Familiarize the students with a creating strong, moderate, and weak earthquakes. A strong quake occurs when the students pull the string all the way out; a weak one occurs when they barely pull the string a little way out; and a moderate is between a strong and a weak. Make them repeat these a few times before going on to step 5.

5. Direct the students to build a house or town on the shaker table. Use toys that have been donated or that you have asked the children to bring from home. Do not let the students make their structures too big or the weight may prevent moving the shaker table.

Instruct students to observe what happens in a weak, moderate, or strong earthquake. Make sure you explain that the students are to build the same house or town three times and observe what each type of "shake" does to the same structure. After they experiment, have them describe what happened.

6. This exercise helps the students to understand that the Earth shakes during an earthquake, and that even houses which are "anchored" to the Earth still experience the Earth's shaking. Moreover, buildings may experience structural failure during a particular earthquake, but not during others. This is because each earthquake has its own "signature" or specific characteristics.

7. Make sure that you do not over emphasize the damage that can occur during an earthquake; you do not want the students to become fearful. This would be a good time to discuss your school's policy during an earthquake or other disasters. If your school does not have a plan, you may wish to contact local government agencies.

8. Discuss with students what they should do when an earthquake occurs.

They should try and remain calm. Panic does not help a situation.

Make a judgement of whether to stay where put or move. Many people are injured as they enter or leave buildings, but in other situations, safety is just a few steps away. The intensity of shaking and a sense of the magnitude of damage should be assessed before moving. Teach your students that each earthquake may be different, and knowledge of different responses is necessary.

If you hear glass breaking, turn your head away from the glass.

If outside, stay away from buildings and power lines.

If inside take cover under a heavy table or desk.

It is important to remember to use critical thinking skills during a disaster, whether an earthquake, volcano or weather hazard, there are certain steps one should take. In a big disaster, you have to make do with what you have available. Humans seem to get enormous strength during disasters; they tend to bond together. Disasters make people realize how insignificant lives are, when nature decides to unleash her powers. But after any crisis it is always good to say that we did all that we could before it happen. Preparedness is a skill used not only in disasters, but in every day little crisis.

PLATE TECTONIC CYCLE - EARTHQUAKES (K)

POST LAB

Students learn the shake, quake game.

OBJECTIVES:

1. Dramatizing the different types of earthquake intensities.
2. Simulating the shaking during an earthquake.

VOCABULARY:

earthquake
moderate
stress
strong
volcano
weak

Pt. Reyes, 1906

MATERIALS:

none

BACKGROUND:

According to plate tectonic theory, the Earth's crust is fractured into a number of large tectonic plates, composed of the crust and upper mantle. The plates have moved very slowly, sliding over the the Earth's asthenosphere (a partially molten layer in the mantle). This movement causes a great amount of stress as the plates either bump together, moves away from, or slide past each other.

The stress from plate motion builds up in rocks until they break. On the surface of the Earth, the break appears as a fault or fracture, such as the 1906 rupture in the picture above. When the break happens, the stress is released as seismic waves, which travel through the Earth. The larger the break, the greater the release of energy.

In this Post Lab, the students will play the "Quake, Shake Game," which is a large motor skill activity.

PROCEDURE:

1. Review that earthquakes occur when the outer portion of the Earth's crust, is under stress. Slow movement inside the Earth and from rotating on its axis, all add stress. Emphasize slow by saying, "much slower than a turtle walking or the last drop of ketchup from a bottle." The movement of the Earth's crust is many times slower; it is actually about

the speed at which fingernails grow. To relieve this surface stress, the Earth experiences volcanoes and/or earthquakes.

Explain that this slow movement will eventually cause breaks in the crust: earthquakes. When an earthquake occurs, it releases energy in the form of waves. It is this wave energy that we feel.

2. Explain the rules of the "Quake, Shake Game," to the class. In this game the students will pretend to be earthquakes and will dramatize the energy released by various earthquakes using their body movements.

A weak earthquake consists of slight body movement, a moderate earthquake consists of a little more violent motion than that of a weak earthquake, and a strong earthquake consists of shaking, rocking, and rolling.

3. Instruct one student be the shake master (similar to "Simon Says.")

The shake master announces one of the following:

"The surface of the Earth is under a little stress; I am a weak earthquake."
"The earth is under some stress; I am a moderate earthquake."
"The earth is under a lot of stress; I am a strong earthquake."

The rest of the class does the appropriate type of shaking. The teacher acts as the "judge" to observe if the students acted out the right kind of earthquake.

Change the "Shake Master" as needed.