

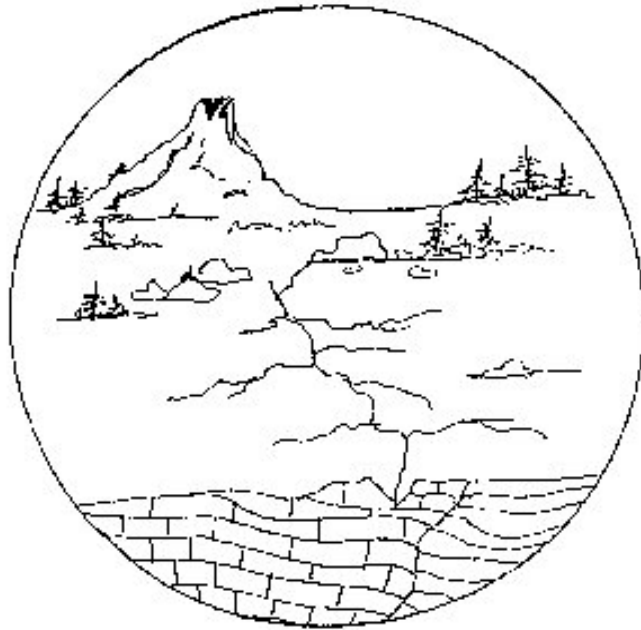


Plate Tectonic Cycle

Earth's Moving Force

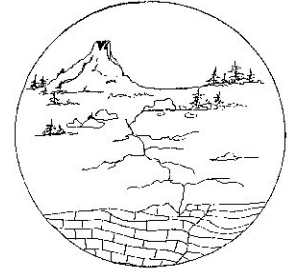


FIRST GRADE EARTHQUAKES



1 WEEK
LESSON PLANS AND
ACTIVITIES

PLATE TECTONIC CYCLE OVERVIEW OF FIRST GRADE



VOLCANOES

WEEK 1.

PRE: *Learning the shapes of volcanoes.*

LAB: *Experimenting with "lava."*

POST: *Comparing parts of an erupting volcano.*

EARTHQUAKES

WEEK 2.

PRE: *Demonstrating how energy can be released from an earthquake.*

LAB: *Simulating how an earthquake shakes an area.*

POST: *Learning about what happens when the earth shakes.*

PLATE TECTONICS

WEEK 3.

PRE: *Learning about stress within the Earth's crust.*

LAB: *Demonstrating features caused by stress.*

POST: *Comparing the shapes of South America and Africa.*

HAZARDS

WEEK 4.

PRE: *Investigating hazards caused by volcanoes.*

LAB: *Plotting different volcanoes in the west coast.*

POST: *Learning more about Mt. Shasta in California.*

PLATE TECTONIC CYCLE - EARTHQUAKES (1)

PRE LAB

Students observe energy in a cup.

OBJECTIVES:

1. Learning that earthquakes release energy.
2. Demonstrating how energy can be released from an earthquake.

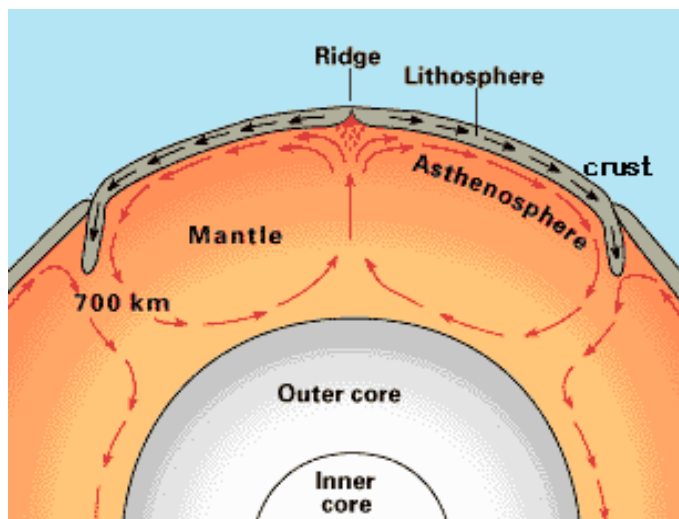
VOCABULARY:

earthquake
energy
shake
wave

MATERIALS:

cup
water
pebbles

BACKGROUND:



Stresses within the crust and upper mantle of the Earth causes earthquakes. The stress includes movement of molten rock and the slow movement of the upper mantle and crust.

The stress builds up in rocks. However, rocks eventually break, and the stored stress is released as energy in the form of earthquakes. Energy is the transfer of movement through a system. In the case of the Earth, the transfer of energy can be great, and can extend this over large distances. For instance, if you drop a pebble in a tub of water, you will notice that as the pebble hits the water, waves of "energy" migrate away from the initial drop. These "rings" of energy are transferring the force of the impact of the pebble a great distance from where it hit the water.

The energy released during an earthquake migrates away from the focus of the earthquake (location of the first break of the rocks) as waves. These waves are called seismic waves.

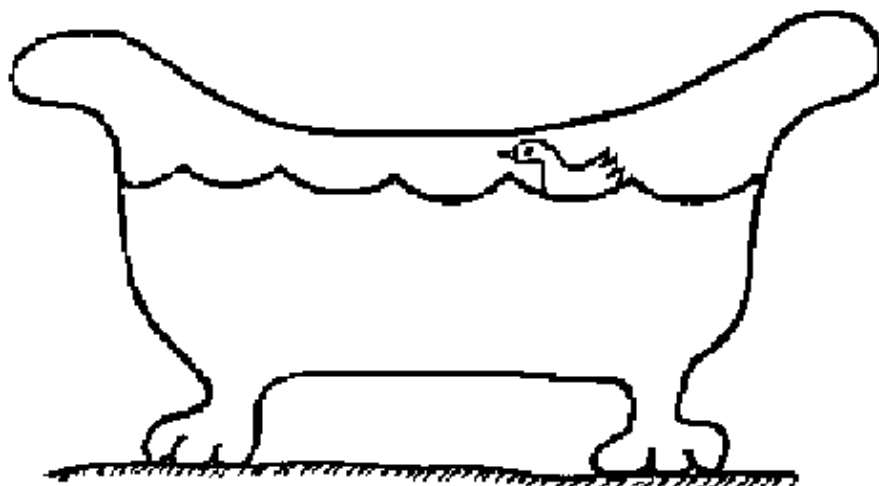
In this Pre Lab, the students will learn that there are many ways that energy is released in our everyday lives. Even in the bathtub! This exercise also gets students to think about the connection between waves and energy.

PROCEDURE:

1. Explain to the class that energy is released by earthquakes. It is this energy, in the form of seismic waves, that we feel when the Earth "shakes."

2. Draw the diagram below on the board. Notice that the bathtub is clear. Ask the students what will happen to the rubber ducky if someone jumps into the bath tub?

After getting their answers, ask the students to imagine being a body of energy. The energy that he or she emits when he/she jumps in the tub creates waves. Waves are the expression of energy as it goes through the water. The larger the person jumping in the tub, the larger the wave will be. If a person runs and jumps into the tub, there will be more energy, and hence, the waves will be larger. Emphasize that the rubber ducky will bob up and down because of the energy.



3. Explain that earthquakes emit energy that moves along in waves, similar to the water in the bathtub. You may want to perform a demonstration by using a large pan of water and pebbles, partly to show technique and partly to show energy "radiation" over larger water surfaces than in a cup.

4. If you have completed step 3, have the students repeat the demonstration using cups, water, and pebbles. Give them a pebble or other object and have them drop it from different heights into a cup half full of water. They should notice that the greater the height from which they drop the pebble, the bigger the "waves" created. Emphasize that when energy is released, this energy can be transmitted by waves. Remind the students that when an earthquake occurs, it releases energy through waves. This exercise can be repeated on a large scale outside. The energy wave might get a little high!

PLATE TECTONIC CYCLE - EARTHQUAKES (1)

LAB

Students stimulate an earthquake using a shaker table.

OBJECTIVES:

1. Discovering that earthquakes create energy.
2. Simulating how an earthquake shakes an area.

VOCABULARY:

earthquake
energy
moderate
strong
weak

MATERIALS:

primary shaker tables
village toys (i.e. small houses, people, cars)

BACKGROUND:

The crust of the Earth moves when force is applied to it. Earthquakes are caused by stresses from plate movement, and to a much lesser degree, from the movement of magma in the crust and upper mantle 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 as they travel throughout the 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 its dissipation as 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 in the form of seismic waves.

The more energy that is released the more severe the shaking will be. Seismologists (scientists that study earthquakes) use different ways of measuring the



Caracas, Venezuela

intensity of an earthquake. One method is the Richter Scale, which measures the size of the waves released by the earthquake. The larger the number, the more energy is released.

When an earthquake occurs, the shaking indicates that an earthquake has released energy. This activity will have the students experience different simulations of earthquake intensities and how it affects homes.

PROCEDURE:

1. Construct primary shaker tables before the activity. Make enough tables for the students to work in groups of 2 or 3. Here are directions:

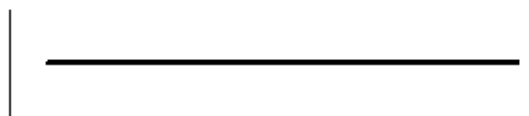
HOW TO CONSTRUCT A PRIMARY SHAKER TABLE

The primary shaker table is an inexpensive, but 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.

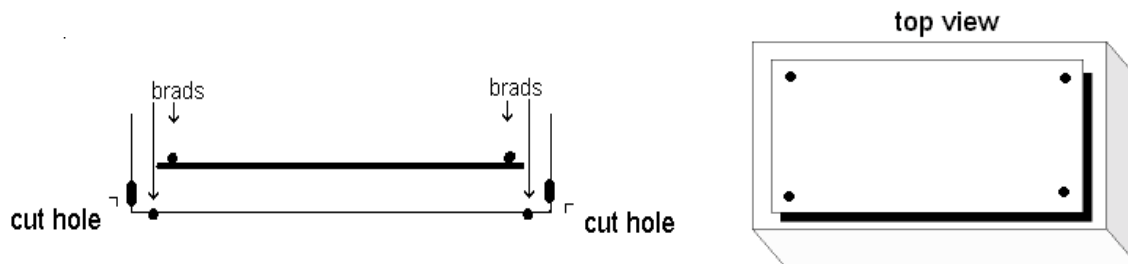
Materials: 8 long stemmed brads or nails
4 strong, thick rubber bands
marbles
cardboard box with lid
string
plastic container lid

Directions:

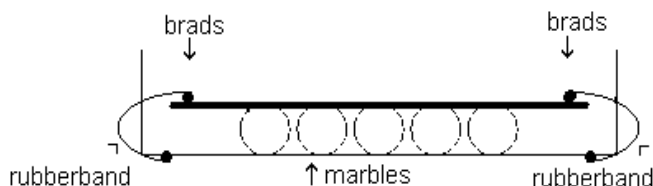
a. Cut a section from the cardboard box lid so that it will fit inside of the cardboard box as shown in the picture below.



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 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. Demonstrate how the shaker table works to the class. When it is "jolted" it simulates the movement of the Earth's surface (an earthquake). The earthquake creates energy that moves along the surface of the shaker table as waves. Control the "intensity" by how fast you shake the board. Demonstrate to students that a strong earthquake occurs when you shake fast; a weak earthquake occurs when you shake it less violently; a moderate earthquake occurs when you shake it somewhere in between.

3. Divide the students into groups. Instruct each group to make a little village on the shaker table. Illustrate to them how to shake the village at the different intensities. Discuss what happens after a strong, moderate, and weak earthquake. Emphasize the difference between the shaking events by comparing how and when the toys fell. During your discussion, relate your discussion back to the Pre Lab. Explain that the movement of the boards is like the person jumping into the tub, creating energy.

As the energy waves hit the village with enough force it will knock down the village. To make it more dramatic for the students, have the groups shake their tables together and say "strong, earthquake, a lot of energy," or "moderate earthquake, not too much energy," or "weak earthquake, little energy."

4. After each shaking, review what happens to the village. At the end of the lesson, go over each of the earthquakes and compare the effects of the different intensities. The conclusion should be that the higher the intensity, the more the damage to the homes. A small earthquake, which most earthquakes are, causes very little damage. You may want to tell children that earthquakes only cause damage where homes and buildings are not constructed to withstand shaking.

PLATE TECTONIC CYCLE - EARTHQUAKES (1)

POST LAB

Students use art to learn about shaking during an earthquakes.

OBJECTIVES:

1. Illustrating what happens on the Earth's surface during an earthquake.
2. Exploring what intensity of shaking means during an earthquake.

VOCABULARY:

earthquake
moderate
shaking
strong
weak

MATERIALS:

worksheet
Earthquake by F. Branley



Damage in Armenia

BACKGROUND:

The energy released during an earthquake causes the ground to shake. If you are close to the epicenter of a moderate quake, the shaking is more severe than if you were farther away. Scientists have developed many scales to measure the intensity of earthquakes. Two common ones are the Richter Scale and Modified Mercalli Scale. The Richter Scale measures the size of the waves produced by the earthquake, hence the energy it releases. The Richter Scale is absolute; seismologists will derive the same Richter magnitude wherever they measure the earthquake. The Modified Mercalli Scale describes what a person feels during an earthquake. This scale is relative; it changes depending on how far you are away from the epicenter.

PROCEDURE:

1. Read the book, *Earthquake* by F. Branley, to the class.
2. Have your students examine the worksheet of the shaking boy. Tell the students that the boy is experiencing an earthquake. Ask them if they think the earthquake is strong, moderate, or weak. Be sure to have them justify their answers. The earthquake probably is a strong one because the bird in the tree is startled by the shaking of the tree. In a very strong earthquake it will be difficult for people to stand up. However most

earthquakes are small, so hopefully children will never have to experience such a quake.

3. The boy is being shaken by an earthquake as he is walking through a forest. Ask the children if he is safe. When a person is in the open country with no telephone poles or overhead wiring, he/she is basically safe. The tree in this picture is too far away to harm the boy if it were to fall down. If the boy were at home, however, he should seek shelter under a strong structure like a heavy desk to protect himself from falling objects. If he were outside near his home, he should stay away from overhead wiring and not run inside. Some children have been taught to "duck and cover." However, during an earthquake they may attempt to do just that, move from outside to inside in order to "duck" and be "covered" by the table they practiced with. Emphasize with the students that they must think during an earthquake in order to make decisions that will keep them safe during the shaking.

4. Some children think that the Earth opens up and swallows people during an earthquake, as it is often depicted on television. An earthquake, however, is caused by stress within the outermost layers of the Earth. Some cracks may appear on the ground after an earthquake, but they are small, and rarely if ever threaten people. The seismic waves traveling through buildings may create enough energy to destroy a building.

PLATE TECTONIC CYCLE - EARTHQUAKES (1)
POST LAB

