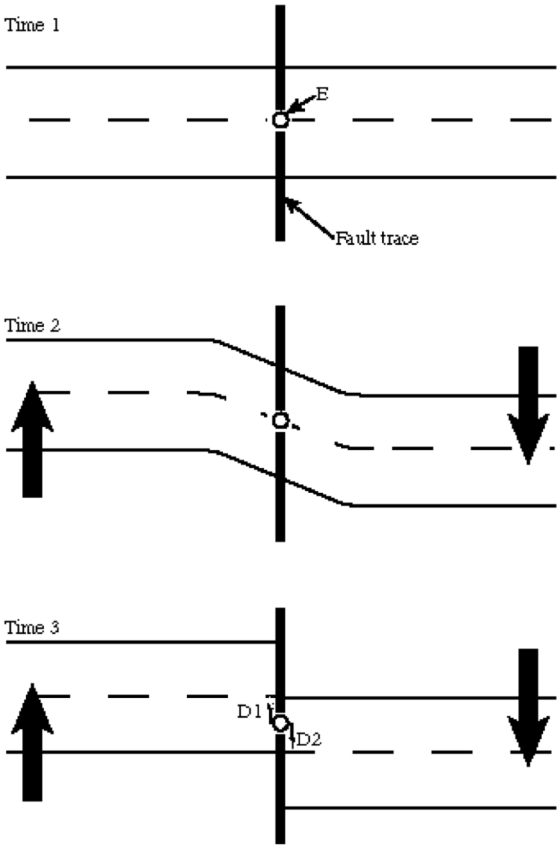
Slip Slide Activity

In this activity, you will use and analyze a couple of models to illustrate the mechanism for how earthquakes occur. The mechanism for explaining the energy of an earthquake is known as *elastic rebound*. As rocks on opposite sides of a fault are subjected to force, the rocks may slowly change shape, deform and store elastic energy (Time 2 in the figure).

Eventually the rocks may deform until the point where the deformation exceeds the internal strength of the rocks. An earthquake occurs when the rock ruptures and there is sudden movement along the fault (Time 3). After the earthquake, the rocks relax and return to their original shape. The stored elastic energy (from the deformation of the rocks) is the stored energy for the earthquake. *Stress* is the force that causes the rocks to deform. *Strain* is the relative change in shape of the rocks as a result of stress.



Wikimedia Bumfluff

Think-Pair-Share

We are going to examine a couple of models describing the mechanism for earthquakes known as *elastic rebound*. What types of things should we be sure to include in our model?

1.

2.

3.

Part 1: Popsicle Stick Model

Materials:

Popsicle sticks (1/person)
Safety Googles (1/person)

In this part of the activity, we will use a popsicle stick to investigate how objects can bend or deform until the point where they break. We will use the popsicle stick as a model to illustrate how earthquakes might occur.

Warm-up Quick Write

Don't bend the popsicle stick yet, but make a prediction about how far you could bend a popsicle stick before it breaks?

How might you measure how far the stick bends before it breaks?

Do you think that you will be able to bend the popsicle more if you apply slow steady pressure or try to bend it quickly until it breaks? Why?

Model Experiment

Test your prediction by slowly bending a popsicle stick as far as you can until it breaks. Be sure to observe how the popsicle stick changes shape as you bend it and after it breaks.
Write a sentence or two with your observations about the bending and breaking of the popsicle stick. Things that you might include is how much it bent, did the shape change after it broke, or did it break quickly or slowly.

Why do you think the Popsicle stick finally breaks?

Are the two broken parts of the popsicle stick mostly straight or mostly bent?

Class discussion questions

- What do you think the popsicle stick represents?
- What do you think the bending of the popsicle stick represents?
- What do you think the breaking of the popsicle stick represents?

Part 2: Slip Board

Materials:

Sanding belt (1/group)
Painter's tape (1/group)
Slip block with weights with sandpaper attached to the bottom (1/group)
Heavy duty rubber band (1/group)
Smart phone with seismometer app (optional; 1/group)

Instructions:

1. Cut the sand belt in so that it forms a long strip and tape on a table top at each end. In order for it to remain in place, you should put a couple of loops of tape under the strip of sandpaper strip.
2. Attach a heavy duty rubber band to the block so that you can use it to pull the block down the sandpaper belt. Place the block (and weights) at the end of the sandpaper belt.
3. Place the smart phone or tablet on the top of the block (tape in place if necessary to keep it from falling off the block).
4. Slowly and steadily pull the rubber band parallel to the tabletop and sandpaper belt.

Draw the set-up of the slip slide experiment below. Label the sandpaper, block, and rubber band in your drawing.

For practice, slowly drag the block on the sandpaper belt using the rubber band by pulling it parallel to the sandpaper belt. You should practice pulling the rubber band slowly and steadily. Take turns pulling the block and observing someone else pulling the block. Describe the motion of the block: does it move continuously or is the motion of the block in start and stop?

Write down several scientific questions about the mechanism for earthquakes that could be investigated using this model.

During the "blockquake," observe the seismograph signal recorded on the smart phone. What does it represent?

Carefully examine how far you can stretch the rubber band and how far the block moves. If you slowly pull the rubber band until it stretches a large distance, does the block move a larger distance or a small distance? Why?

Can you accurately predict when the block will move?

Does the probability that the block will slip depend on what happened in previous slip events?

What prevents the block from moving continuously as you pull the rubber band?

Looking at Parts of the Model

Model Feature	**Actual Earth Feature**
Pulling the rubber band	
Stretching of the rubber band	
The two pieces of sandpaper	
Movement of the block	
The distance that the block slides	

Analysis of the model

Based on your experiment, what do you think influences when a blockquake occurs?

What controls whether the block will move? Does the probability that the block will slide depend on what happened in previous slip events?

Does this model accurately represent the *geometry* of a fault? Why?

How is the block model not like actual earthquakes? How can you improve the model?