EARTH SCIENCE ACTIVITY #2
Measure My Magnitude

All Grades

This activity is one of several in a basic curriculum designed to increase student knowledge about earthquake science and preparedness. The activities can be done at any time in the weeks leading up to the ShakeOut drill. Each activity can be used in classrooms, museums, and other educational settings. They are not sequence-bound, but when used together they provide an overview of earthquake information for children and students of various ages. All activities can be found at www.shakeout.org/schools/resources/.

Please review the content background (page 3) to gain a full understanding of the material conducted in this activity.

OBJECTIVE:

For students to construct and use a seismograph to demonstrate the measurement of earthquakes

MATERIALS/RESOURCES NEEDED:

- Student desks (moveable)
- Plain white paper
- Non-permanent markers
- Transparency of the 'Seismographs' sheet
- Tape

ACTIVITY:

Set-Up (10 minutes)

Create a transparency of the 'Seismographs' sheet. Gather plain white paper for each student and enough markers for half the class (students will be paired and share).

Procedure (25 minutes)

The italicized phrases are spoken suggestions for the instructor and those in parenthesis are possible answers students might provide.

1. Introduce the topic of earthquake measurement.
   Today, we will learn one method used to measure earthquakes. An earthquake's magnitude is a measurement of the amount of energy released by an earthquake. A seismograph is an instrument used to record the motion of earthquake waves.
2. Show students the 'Seismographs' transparency.
   Here we have three different seismographs. They each record the motion of earthquake waves with the wavy lines you see here. These wavy lines are called seismograms. Who has seen seismograms on the news after an earthquake? (Answers vary)
3. Describe how to conduct the activity. You may wish to demonstrate with a volunteer partner.

a. *Before we begin, find a partner and stand beside a desk or table.* (Have two sheets of paper and a marker ready at each desk). *We are going to create our own seismograms by 'being' the earthquake using only a sheet of paper, this marker, and this desk.*
b. Place one of the sheets of paper on the desk.
I'm going to have (insert name) *help me demonstrate.*
c. Have the student hold onto the marker so that it just touches the surface of the white paper.
While he/she is tightly holding onto the marker, I will "be" the earthquake.
d. Lightly shake the desk and slowly pull it toward you. Make sure to stop before you run off the paper.
This will leave seismograms on the white paper, representing the earthquake.
e. After you finish recording your seismograms, switch roles so that the student can "be" the earthquake as well. But this time ask him/her to shake the desk a little harder than the first time.

4. Let the students begin.
5. Compare the results.
*Look at your seismograms. Which shaking produced bigger seismograms? (*The second/harder shaking)
So what does this mean? What can the size of the seismogram tell us about an earthquake? (The bigger the waves, the bigger an earthquake.)
Scientists use the information collected in seismograms to determine the magnitude of earthquakes, which are the numbers you hear of after an earthquake, such as 5.4.
6. Students arrange their seismograms.
Now we will arrange our seismograms by taping them on the board/wall from smallest to largest (wave amplitude).

CONTENT BACKGROUND:

The Magnitude Scale: A Measure of Size

Magnitude (M) measures the energy released at the source of the earthquake. This is not to be confused with intensity, which measures the strength of shaking produced by the earthquake at a certain location. Using scientific instruments called seismometers, scientists can measure the amount of energy released based on the recorded vibration of the ground. You see, in an earthquake, the slip of a block of rock over another releases energy that makes the ground vibrate. That vibration pushes the adjoining piece of ground, causing it to vibrate, and thus the energy travels out from the earthquake in a wave. As the wave passes by a seismic station, that piece of ground vibrates and this vibration is recorded (Taken directly from Putting Down Roots in Earthquake Country).

The Richter Scale is the best known scale for measuring the magnitude of earthquakes. Devised in the 1930s by Beno Gutenberg and Charles Richter, the Richter Scale was logarithmic, making a recording of 7, for example, signify a disturbance with ground motion 10 times as large as a recording of 6. However, the Richter Scale did not adequately differentiate between the largest earthquakes and is no longer used. Instead, a new “moment magnitude” scale is being used by seismologists to provide a better measure. Moment is a physical quantity more closely related to the total energy released in the earthquake than Richter magnitude. It can be estimated by geologists examining the geometry of a fault in the field or by seismologists analyzing a seismogram.

Technology in this field has granted scientists greater precision and accuracy in locating distant earthquakes and in determining their magnitudes. Today computers are being used to analyze seismographic data – something your students may want to research on their own.

The Seismograph

The instrument used to record earthquakes is called a seismograph. The first seismographs were designed by British scientists working in Japan between 1880 and 1890. The most famous of these early seismographs was a horizontal pendulum model built by John Milne. Pendulum seismographs rely on a simple principle of physics, the principle of inertia. A heavy weight that is allowed to move freely will tend to remain in its original position when the ground beneath it begins to move in response to earthquakes waves.

Mechanical or electrical devices can be used to sense the motion of the ground relative to the heavy pendulum of the seismograph. Up-and-down or sideways ground motion sends a mechanical or electrical signal to a pen attached to a paper-covered drum. As the drum turns, the pen wiggles, producing an amplified recording of the ground motion. This recording is called a seismogram. Scientists use the amplitudes of earthquake waves recorded as seismograms to determine the magnitude ratings of earthquakes.

Seismographs