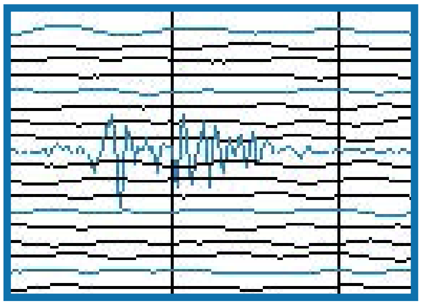
Half a Day

Grades 6–8, 9–12

Shake It Up with Seismographs

Record earthquake activity in your classroom by designing your own seismograph.



Instructions

Students create seismographs that visually record earthquake activity in the classroom.

1 Divide students into teams and describe their challenge. Talk about what seismographs are and some of the mechanisms people have invented over time, which will help students see that seismographs don't have to involve complex equipment. Explain that the simulated earthquakes will be created by placing the seismograph on a small table and dropping a ball onto the table from heights of 0.5, 1, and 1.5 meters. The seismograph that can visually record the weakest quake will be considered the best design.

Materials

PER CLASS:

- ☐ Ladder or stool (from which to drop a ball)
- ☐ Strings cut to lengths of 0.5 meter, 1 meter, and 1.5 meters
- ☐ Small rubber ball
- ☐ Balls of other sizes, such as tennis balls (optional)
- ☐ Pictures of simple seismographs

2 To give students a sense of how seismographs work, show them pictures of different, simple seismographs. Note that they usually consist of a mass attached to a fixed base. During an earthquake, the base moves, and the mass does not; how much the base moves is recorded on paper or some other medium. Show students the base and the mass in one or more of the pictures. To generate more ideas, explain how the pendulum-style seismograph works. A pencil hanging from a rod, which is attached to a wire, will make marks on the paper below it if the earth moves.

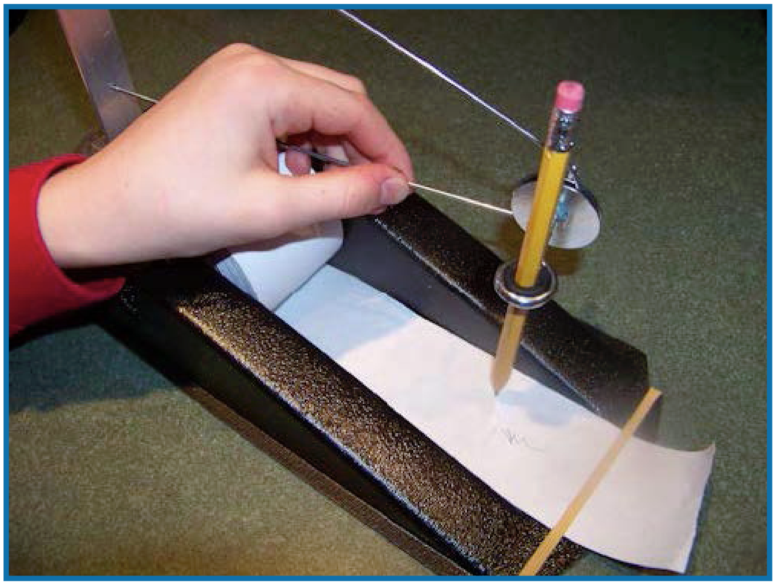
3 Tell teams to talk about the possibilities, sketch potential designs, and choose one to build.

4 Teams create their prototype seismograph.

5 Teams present their seismograph to the class and explain how it works.

6 Test each seismograph by setting it on a small table and dropping the ball from three heights. Students take notes on whether the seismograph gave a visual indication of each ball drop.

7 As time allows, hold a class discussion about the features of the most successful seismographs and how they could be made even more sensitive.



PER TEAM:

- ☐ String
- ☐ Wire
- ☐ Paper
- ☐ Pencil
- ☐ Marker
- ☐ Paper clips
- ☐ Glue
- ☐ Cardboard
- ☐ Poster board
- ☐ Foil
- ☐ Rubber bands
- ☐ Tape
- ☐ Pan or tray
- ☐ Clay

Engineering & Science Connections

- A seismograph, or seismometer, is an instrument used to detect and record earthquakes. Generally, it consists of a weight attached to a fixed base. During an earthquake, the base moves and the weight does not. The motion of the base with respect to the weight can then be recorded—on paper, for example.

- In order to better understand how structures respond to earthquakes, engineers need to gather data from as many measurement devices in as many different places as possible. The Advanced National Seismic System (ANSS) is creating a network of more than 7,000 earthquake sensor systems that will provide real-time earthquake information for emergency responders, engineers, and scientists.

- To measure the strength of earthquakes, scientists use mathematical scales that compare the strength of an earthquake to that of other earthquakes. The most well-known of these scales is the Richter scale, which assigns each earthquake a number ranging from 1.0 to 10.0. Each number represents an earthquake that is stronger than the previous one by a power of 10. So an earthquake of 2.0 is 10 times stronger than a 1.0 earthquake, and an earthquake of 3.0 is 10 times stronger than a 2.0 earthquake (and 100 times stronger than a 1.0 earthquake). Today, seismographers are able to measure earthquakes that are so small they have negative values on the Richter scale.

- The strongest earthquake ever recorded occurred in 1960 in Chile and was a 9.5 on the Richter scale. The earthquake killed over 1,600 people and caused $550 million in damage due largely to structural collapses. Engineers and scientists realized the Richter scale could not properly measure earthquakes of this magnitude. Better understanding of how earthquakes work and how buildings respond led to the creation of a new scale: the Moment Magnitude Scale.

Guiding Questions ?

How might each of the materials available move when a ball is dropped? Which ones might jiggle, for example?

Think about toys that move with the slightest motion. Do they inspire an idea for creating a motion detector?