



Grade 6<sup>th</sup> to Grade 10<sup>th</sup>

**Title: Seismology  
"Recorder"**

**Stating the Problem - The Big Question**

How does a seismograph record the magnitude of an earthquake?

**Materials**

- \* Scissors
- \* Ruler
- \* String
- \* Masking Tape
- \* 5-oz (150-ml) Paper Cup
- \* Adding-machine Paper
- \* Black Marking Pen
- \* 5 ounces (150 ml) small rocks
- \* Modeling Clay
- \* Sharpened Pencil
- \* Cardboard Box, measuring about 12 inches (30 cm) on each side
- \* Adult Helper

**Planning the Procedure**

1. Ask an adult to prepare the box as follows:
  - \*cut the lid off the box, then turn the box on its side so that the opening faces outward.
  - \*Cut a 2-inch (5-cm)-diameter hole in the center of the top of the box.
  - \*Cut two  $\frac{1}{2}$ -by-4-inch (1.25-by-10-cm) slits in the box. Make the first slit in the center of the bottom, near the opening. Make the second slit, in line with the first slit, in the back of the box.
2. Cut a 24-inch (60-cm) section of adding-machine paper.
3. Thread the strip of paper through the slits in the box so that about 2 inches (5 cm) of paper extends past the front edge of the box.
4. Cut two 18-inch (45-cm) pieces of string.
5. Ask an adult to use the point of the pencil to punch two opposite holes below the rim of the cup.
6. Attach the two pieces of string to the cup. Do this by inserting one end of a string through one of the holes, then looping the string over the rim and tying it to itself. Tie the other string to the other hole in the same way.
7. Set the cup in the box and insert the free end of each string through the hole in the top of the box.

This project is from Janice VanCleave's book, *Guide to the Best Science Fair Projects*, New York, Jossey-Bass Publisher, A Wiley Imprint, 1997. The Guide is available on line at: [SchooDoodle.com](http://SchooDoodle.com)



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8. Lay the pencil across the hole and tape the ends of the strings together to the center of the pencil. The bottom of the cup should be about 1 inch (2.5 cm) above the floor of the box.
9. Push the tip of the marking pen through the inside bottom of the cup.
10. Fill the cup with small rocks to surround the pen.
11. Wind the string around the pencil until the tip of the pen barely touches the adding-machine paper.
12. To prevent the string from unwinding, secure the pencil to the box with a small piece of modeling clay near each end of the pencil.
13. Pull the adding-machine paper toward you with one hand as you gently shake the box with your other hand.
14. Observe the markings made by the pen on the paper.

**Results**

The pen draws a zigzag line on the paper as the paper moves underneath the pen.

**Why?**

The **inertia** (resistance to a change in motion) of the heavy cup keeps it steady while the box **vibrates** (shakes back and forth repeatedly). As the box vibrates, it moves the paper from side to side underneath the pen; thus, a zigzag line is drawn as the paper is pulled. The shaking energy for an **earthquake** (a violent shaking of the earth's crust caused by a sudden movement of rock beneath its surface) is measured and recorded by an instrument called a **seismograph**. Like your model, a seismograph uses a very heavy suspended object that remains steady, while the frame to which it is attached moves when the earth vibrates. A recording pen attached to the suspended object records the vibrations on the moving paper. The width of the zigzag produced increases with the **magnitude** (measurement of the amount of shaking energy released) of the earthquake being recorded. The written record is called a **seismogram**.

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**LET'S EXPLORE**

1. Does the weight of the cup affect the seismogram produced? Repeat the experiment, using an empty cup.
2. Does the direction of the earthquake affect the pattern on the seismogram? Use a compass to position the box so that the tap points in a north-to-south direction. Repeat the experiment, shaking the box from the four different directions: North (back), south (front), east (right side), and west (left side).

**Science Fair Hint:** Use the model as part of a project display. Label each seismogram with the direction of the vibrations.

**SHOW TIME!**

Construct a sensitive seismograph using a beam of light. Place a bowl full of water on a table. Ask a helper to hold a flashlight so that its beam of light falls on the surface of the water and is reflected to a nearby wall. Watch the spot of light on the wall while you gently tap the surface of the water with your finger. Produce other small quakes by tapping the bowl or the table.

**CHECK IT OUT!**

Andrija Mohorovicic (1857-1936), a Yugoslavian seismologist, analyzed the seismograms of a Balkan earthquake in 1909. Read about this scientist, and think about these questions:

- What did Mohorovicic discover from the seismograms about the speed of seismic waves at depths around 25 miles (40 km)?
- What is Moho short for?

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