9 Modeling Earthquakes

MODELING

WHY DO EARTHQUAKES occur at plate boundaries? In this activity, you will use common materials to model what happens when Earth's plates move. As you use the model, you will investigate how forces between moving plates cause earthquakes. You will plan and carry out your own investigation to determine what factors influence the **magnitude** or size of an earthquake. Strong earthquakes can cause problems for the safe storage of nuclear waste, so it is important to understand how and why earthquakes happen when deciding where to store nuclear waste.

GUIDING QUESTION

How can models help us understand earthquakes?

Collapsed building in Concepción, Chile, after a very large earthquake happened in February, 2010

MATERIALS

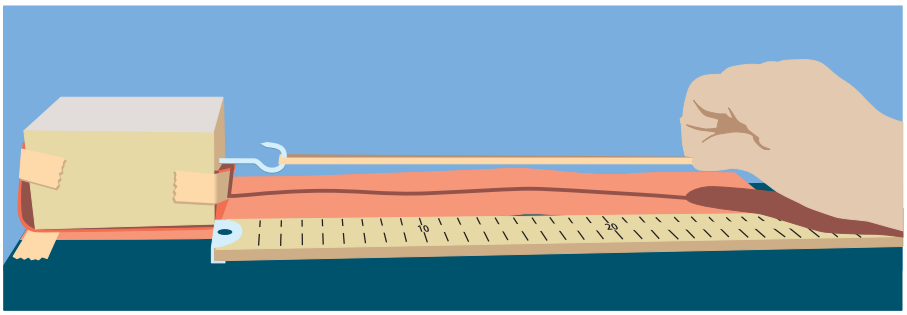
For each group of four students

- 1 long strip of sandpaper
- 1 block of wood, with coarse sandpaper and hook attached
- 1 block of wood, with fine sandpaper and hook attached
- 1 tape measure
- rubber bands, thick
- rubber bands, thin
- masking tape

PROCEDURE

Part A: Setting Up and Testing the Model

1. Tape the long strip of sandpaper to a flat surface so it is stretched out flat.
2. Place one of the wooden blocks on the end of the sandpaper strip so the hook is pointing along the sandpaper strip. Make sure the face of the block covered with sandpaper is in full contact with the sandpaper strip.
3. Fasten the tape measure alongside the strip of sandpaper so that the zero mark on the tape is in line with the front edge of the block with the hook.
4. Loop one of the rubber bands onto the hook, and pull slowly and steadily. Do not use a jerky or sudden motion.



5. Pull steadily until the block moves. Stop pulling as soon as the block moves, and use the markings on the tape measure to make note of the location of the hand of the person who was pulling. Record this position in your science notebook.

6. Measure the distance the block moved, and record it in your science notebook, as well as your observations of how the model moved.
7. Repeat Steps 2–6 two more times to see how consistent your results are. Record your results each time.

Part B: Planning and Carrying Out an Investigation

8. With your group, brainstorm at least three possible variables to test that may change the movement of the block.
9. As a group, choose a variable to test.
10. Design an experiment that will determine how changing your variable will affect the behavior of the model.

    When designing your experiment, think about these questions:

    - What is the purpose of your experiment?
    - What variable are you testing?
    - What variables will you keep the same?
    - What is your hypothesis?
    - What is your control?
    - How many trials will you conduct?
    - Will you collect qualitative or quantitative data, or both? How will the data help you form a conclusion?
    - How will you record the data?
11. Record your hypothesis and your planned procedure in your science notebook.
12. Obtain your teacher's approval of your experiment.
13. Make a data table that has space for all the data you need to record during the experiment.
14. Conduct your investigation, and record your results.
15. Be prepared to share the results of your experiment with the class.

ANALYSIS

1. In science, we use models to help us understand phenomena, but all models have strengths and weaknesses.
   a. What are the strengths of this model? Explain your reasoning.
   b. What are the weaknesses of this model? Explain your reasoning.
   c. Come up with at least one idea to improve the model used in this activity. Explain how your idea would improve the model.
2. In Part B, how did changing your variable affect the movement of the block in the earthquake model? Use data you collected as evidence to support your claim.
3. Revisit the hypothesis and experimental design you wrote for Part B.
   a. Did the data you collected support your hypothesis?
   b. Did you collect enough high-quality data to answer your question? What is one way in which you could improve your experimental design to collect higher-quality data?
4. After listening to your classmates share the results of their experiments for Part B, which variable affected the movement of the block in the earthquake model the most? Why do you think that is?
5. Use the model to explain how earthquakes happen.
6. What additional questions do you have about how or why earthquakes happen after working with the earthquake model?
7. Some geological processes that cause changes to Earth's surface happen suddenly, and others happen slowly. Describe one sudden change and one slow change using evidence from this activity.

EXTENSION

All earthquakes occur along faults. *Faults* are areas of weakness in Earth's crust often found on or near plate boundaries. The rock along either side of a fault moves at different rates or in different directions, causing earthquakes. One well-known fault system is the San Andreas fault, at the boundary between the Pacific and North American plates. Other examples include the Northridge and Hayward Fault Systems. Visit the *SEPUP Third Edition Geological Processes* page of the SEPUP website at *www.sepuplhs.org/middle/third-edition* for links to learn more about earthquakes and faults.