

Earthquake Shakes

Investigation Set Teaching Guide

This Investigation Set is designed for students to explore the characteristics of earthquakes and how to prepare for them. In this set, students will learn how scientists determine an earthquake’s location and how they use this information to predict the strength of an earthquake. As students progress through this set, they will design and build model structures and test their abilities to withstand an earthquake, before finally learning best practices to individually prepare for natural disasters.

Target Grades & Subject(s): Grades 6-12; Science

Learning Objectives

- Next Generation Science Standards (NGSS)
 - Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of past plate motions. (MS-ESS2-3)
- Science and Engineering Practices (SEP)
 - Use and construct models for representing ideas and explanations. (NGSS, SEP 2)

Before teaching Part 1: 4-06: Earthquake Characteristics [Download texts [here](#)]

- Students should be familiar with tectonic plates and how their motion creates unique geographic features (e.g. mountains) as well as earthquakes.
- To introduce this set, state that you are going to show a video of an earthquake that occurred in Northern California in 1989. Show [this](#) video and ask students to record their observations. Use their responses to frame a discussion on how quickly natural disasters like earthquakes can occur and why it’s important to understand how to best prepare for them.

Text 1: 4-06: Earthquake Characteristics (1 page)	
<p>The first text in this set outlines how scientists determine the location of an earthquake and how we can use this information to predict its intensity. As students read, they should consider how this knowledge can be used to build safer buildings and cities and how individuals can best prepare themselves for an earthquake.</p>	<p><u>Extension Activities:</u></p> <ul style="list-style-type: none"> - Have students draw models that show how changing the focus and epicenter of an earthquake influences its intensity.

Before teaching Part 2: Investigation: Earthquake-safe Structures [Download texts [here](#)]

- Plan for this activity to take 45-60 minutes.
- Print a class set of the data table for the investigation (on 3rd page below).
- Ensure you have the following materials (some can be reused each class):
 - *Make sure to prepare the pan of Jell-O @ before class starts.*

Lab Specific Materials*	Common Lab Materials
<ul style="list-style-type: none"> ● Mini-marshmallows (~30/group) ● Toothpicks (~30/group) ● ~8" square baking pan of Jell-O ® (pre-made, at least 1/class) 	<ul style="list-style-type: none"> ● N/A

- You can also simply have students place their structures on a table and shake it, without Jell-O®, to simulate an earthquake.

Text 2: Investigation: Earthquake-safe Structures **Note: This is an assignment in Actively Learn* (2 pages)*

What This Could Look Like:

In this activity, students will design, construct and test structures to determine their ability to withstand an earthquake.

First, have students answer the pre-reading question and read the background information in the assignment in Actively Learn. Use their responses to generate a discussion on strategies to make buildings earthquake safe.

Model how students should conduct their tests when simulating an earthquake. Emphasize the importance of consistency between trials in order to minimize error. If you don't have Jell-O®, simply have students shake their table for a test.

Encourage students to research basic engineering principles (e.g. triangles, weight distribution) as they design and build their models.

Teaching Tips (Best Practices):

- Depending on the amount of materials, have students work individually, in pairs, or in small groups of 3 or 4.
- If students are working in groups, consider assigning roles to each student (e.g. Materials Manager, Facilitator). Students could also generate their own roles in each group.
- Tight on space? After students read Text 1, have half of your class begin by reading Text 2 and half completing the Investigation. At a certain time point, have students switch to complete the other half.
- Consider setting a time limit (e.g. 20 minutes) for students to design and build their structures to encourage efficiency and focus.
- After testing, have students share their designs and models with the whole class to generate a list of best practices in engineering for structures to withstand earthquakes.

Text 3: Preparing For A Disaster (2 pages)

The final text in this text extends students' thinking around preparation for natural disasters beyond their model structures and focuses on what they can do as individuals to be safe during an earthquake or tornado. As students read, they should consider how our understanding of why and how earthquakes and tornadoes occur influence the steps we should take to increase our safety.

Discussion Questions:

- What are some challenges in predicting when earthquakes or tornadoes will occur and how can we address them?
- As the mayor of a city prone to earthquakes and tornadoes, what steps would you take to ensure your city and citizens are best prepared for both?

Data Table

Directions: Use this document as you progress through the assignment on Actively Learn. Some questions in the assignment will ask you to record responses on this sheet.

Part 1: Design

1. In the space below, draw the design of your structure. Be sure to label dimensions, explain the features you've included and why they will make your structure more stable.

Part 2: Construct and Test

1. After you test your structure, record your observations below. What parts of your structure were stable and what areas were weak?

Part 3: Refine

1. Based on the results of your first test, what modifications will you make to your design to improve its stability? Explain and draw them in the space below.

2. After you test your structure after refinements, record your observations below.