LAB GUIDE

Engineering for Earthquakes

Grade Levels: 4-8
Duration: 90 min

Design a robust learning experience by selecting resources from this guide that fit the needs of your students. Reinforce learning before, after, and even during your visit by diving deeper into some of the science and engineering concepts.

Table of Contents	Page

When to implement

The following icons indicate when resources should be implemented for the greatest benefit to your students' experience in the lab.

Grade Levels: 4-8

Duration: 90 min

Concepts/Skills

Earthquake causes and effects, theory of plate tectonics, structural engineering and design.

Objectives

Students will:

- Explain the theory of plate tectonics and why earthquakes occur.
- Design and build a model structure that can withstand the effects of a large-scale earthquake.

Vocabulary

These are words and concepts that we will discuss in the lab. Your students' experience will be enhanced if they are familiar with these terms prior to your visit. If you need inspiration for vocabulary activities, please see our Vocabulary Choice Board activity.

Term	Definition
Boundary	Where two tectonic plates meet. There are three types: convergent, divergent, and transform.
Convection current	Convection currents transfer heat from one place to another by mass motion of a fluid such as water, air, or molten rock.
Core	The central portion of the earth, having a radius of about 2100 miles (3379 km) and believed to be composed mainly of iron and nickel in a molten state.
Crust	The outer layer of the earth, extending about 22 miles (35 km) deep under the continents and 6 miles (10 km) deep under the oceans. The crust sits on the uppermost part of the mantle (together, these solid zones comprise the lithosphere).
Earthquake	A shaking of the ground caused by the sudden movement of the earth's crust or by volcanic activity.
Fault	The fracture or zone of fractures in a rock formation, such as tectonic plates.
Mantle	The portion of the earth, about 1800 miles (2900 km) thick, between the crust and the core.
Plate tectonics	A geological model in which the Earth's crust and upper mantle (lithosphere) are divided into a number of segments (plates) that move in response to convection currents from the lower mantle (asthenosphere).
Advanced Vocabulary	These terms may come up in your lab depending on time constraints and age range:
Convergent plate boundary	An area where plates move towards each other.
Divergent plate boundary	An area where plates move away from each other.
Liquefaction	A process that occurs when saturated or semi-saturated soil loses substantial strength and stiffness as a result of an applied pressure, such as an earthquake.
Transform boundary	An area where plates rub against one another in different directions.

Related Texts BEFORE DURING AFTER

The following titles may provide students with a greater contextual understanding of the field of earth science and engineering and give additional opportunities to incorporate science and engineering into Language Arts lessons. We are not endorsing the following authors but feel that the information presented in these texts may benefit your students and enhance their learning experience.

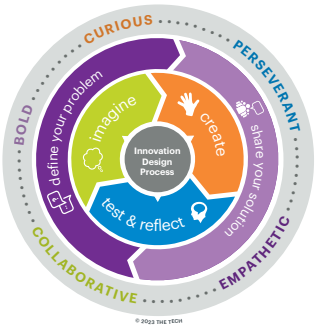
Age Range	Title and author	Text Type	Description
Grades 3-7	"The Earth Dragon Awakes" by Laurence Yep	Narrative	Historical fiction about the San Francisco Earthquake of 1906 and the resulting firestorm as told from the perspectives of China Town residents Henry and Ching.
Grades 5-7	"Earthquake at Dawn" by Kristiana Gregory	Narrative	Historical fiction based on Edith Irvine's actual photographs, this tale documents San Francisco's physical destruction and the compassionate acts prompted by the tragedy.
Grades 5-7	"Building Big" by David Macaulay	Reference	A book that has the answers to questions regarding shape, material and location considerations of large structures including bridges and buildings.
Grades 9-12	"Earthquakes: Science and Society" (2nd Edition) by David S. Brubaugh	Reference	A reader-friendly illustrated text that introduces the scientific, historical and personal safety aspects of earthquakes.
Grades 9-12	"Structures: Or Why Things Don't Fall Down" by J.E. Gordon	Reference	For anyone who has ever wondered why megastructures don't collapse, J.E. Gordon answers all your questions without confusing technical and engineering terms.

Exhibit Connections BEFORE DURING AFTER

Make connections between learning from the lab and the exhibits and programs found in The Tech Interactive's galleries.

Just Wing It

Students will use the same Innovation Design Process used in the lab to brainstorm, design, build, test, and iterate on a gliding device inspired by real-life flyers.



Lab-Related Activities

The following activities can be implemented either before or after the lab and are meant to bridge the learning from the lab to the classroom.

Activity	Description	Time
Convection Currents	Students work in teams to explore how differences in density can create motion in liquids. Then they reflect on a demonstration of convection currents in action.	Two 40-minute sessions

Looking for other hands-on activities and resources to use in your classroom? Check out our **education resources** page!

Writing Prompts

The following writing prompts and questions are just a few examples of journal topics you can use to incorporate writing into your students' lab experience. These prompts can be used in conjunction with any classroom writing journal.

Pre-visit prompts

- We will be attending the Engineering for Earthquakes lab at The Tech Interactive; what are you most looking forward to in this lab? Why?
- Before scientists discovered the real causes of earthquakes, there were many stories and legends about why earthquakes happened and what caused them. Write your own legend about why earthquakes happen and what causes them.
- Earthquakes are a natural occurrence we have to think about a lot in California. Have you ever experienced a real earthquake?
  - (If yes) Explain to someone who has never experienced an earthquake what it was like for you during the earthquake. What did it feel like? How did you feel? Were you prepared?
  - (If no) Explain what you think an earthquake would feel like. What would you need to do during the earthquake?

Post-visit prompts

- The principal is very excited to hear about your lab experience! Explain what you did and learned about in the lab since they were unable to attend the lab.
- Many families have earthquake preparedness plans. Create and share a plan to help your family prepare for an earthquake.
- The "visitor" in your structure had a very rough day. Write a story describing the earthquake and what it was like in your structure from the point of view of the "visitor."

Next Generation Science Standards

Engineering for Earthquakes supports the following NGSS:

Grades	Engineering Design	Earth and Space Sciences	Disciplinary Core Ideas	Crosscutting Concepts	Science and Engineering Practices
Grade 4	3-5-ETS1-1 3-5-ETS1-2 3-5-ETS1-3	3-ESS3-1	ESS1.C ETS1.A ESS2.B ETS1.B PS2.B ETS1.C	Influence of Engineering, Technology, and Science on Society and the Natural World	1, 2, 3, 6
Grade 5	3-5-ETS1-1 3-5-ETS1-2 3-5-ETS1-3		ETS1.A ETS1.B ETS1.C	Influence of Engineering, Technology, and Science on Society and the Natural World	1, 2, 3, 6
Grades 6-8	MS-ETS1-1 MS-ETS1-2 MS-ETS1-3 MS-ETS1-4	MS-ESS2-2 MS-ESS2-3 MS-ESS3-2	ESS1.C ETS1.A ESS2.A ETS1.B ETS1.C	Structure and Function Science is a Human Endeavor	1, 2, 3, 6

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