STEM IN THE LAB

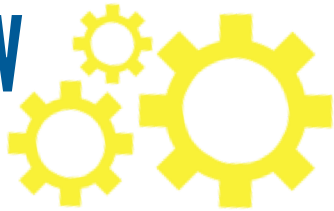
innovate. explore. discover.

Idaho National Laboratory

OUR MISSION

INL's K-12 STEM Program works to inspire Idaho's future STEM workforce, impact students, teachers and families by integrating best practices in STEM education, and empower employees to become STEM mentors to transform K-12 STEM into a driver for innovation.

CAN YOU SHAKE IT OVERVIEW



Earthquake engineering is a branch of engineering that designs and analyzes structures to ensure that they are resistant to earthquakes. The Seismic Research Group at INL performs earthquake engineering research. One area of study involves improving mathematical models that predict earthquake forces. They are also modernizing methods that are used to calculate earthquake risk. Engineers at INL also perform various earthquake related experiments. This activity is broken into two parts, in the first part students will build a structure (shake table) that will test to see if the structure will withstand an earthquake. In the second part, students will design a building that is stable enough to survive an earthquake.

SCIENCE BEHIND IT

The surface of the earth, called the "crust," is not one solid piece. It's more like a puzzle. Each puzzle piece is called a "plate." The plates constantly move. Fortunately for us, they don't move fast, and we don't even feel the movement. Earthquakes usually occur on the edges of large sections of the Earth's crust called tectonic plates. These plates slowly move over a long period of time. The edges of the plates are called fault lines. Sometimes the fault lines, can get stuck, but the plates keep moving. Pressure slowly starts to build up where the edges are stuck and, once the pressure gets strong enough, the plates will suddenly move causing an earthquake.

MATERIALS

SHAKE TABLE

- *2 pieces of sturdy cardboard (about 8½ x 11 in or A4)*
- *2 thick rubber bands*
- *2 tennis balls*
- *2 large binder clips*
- *paint stirrer (or thick piece of cardboard) to make a handle*
- *masking tape*
- *ruler*

STRUCTURE

- *wooden or plastic coffee stirrers*
- *Toothpicks*
- *craft sticks*
- *hot glue*
- *Marshmallows*
- *modeling clay or playdoh*
- *manila file folder or thin piece of cardboard (base of your building)*
- *ruler (to measure height)*

RESEARCH AND DESIGN PROCESS

RESEARCH QUESTIONS

- *How can you use supplies given to build a sturdy building that won't collapse when shaken?*
- *What did testing help you understand about your building?*
- *How safe would you feel if you were inside it during an earthquake?*
- *What could you do to make your building even better at withstanding an earthquake?*

BUILD THE SHAKE TABLE

1. *Wrap the rubber bands around the width of both pieces of cardboard. Space them about 4 inches apart.*
2. *Slide two tennis balls in between the pieces of cardboard, and position them underneath each rubber band.*
3. *Tape the paint stirrer under the top piece of cardboard.*

BUILD THE STRUCTURE

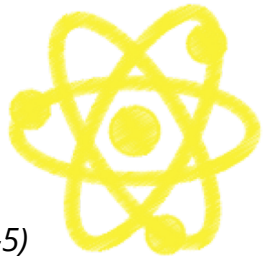
1. *Draw out a design of a structure that will be able to withstand the shake table*
2. *Using the supplies available, build a structure that is at least 8 inches tall.*
3. *Build your structure on top of the folder or piece of cardboard.*
4. *Once structure is finished, attach the folder with your building on top to the shake table using the binder clips.*
5. *Use one hand to hold the bottom of the shake table against the table, pull the handle with your other hand and then let go. Earthquake!*
6. *Make modifications and repairs and test your structure again.*

EXTENSIONS

- *Take it to the next level and build an even taller building! How tall can you go?*
- *Try different supplies to build the structure, which items work the best.*
- *Build different "levels", use cardboard bases to separate the levels. Does this help make the building more stable?*

RESOURCES

- *https://public.inl.gov/STEMHelpWanted/Brochure/index.aspx?page=22*
- *https://www.ducksters.com/science/earthquakes.php*



** This lesson plan meets NGSS standards ETS1-1 (3-5), ETS1-2 (3-5), and ETS1-3 (3-5)*