

MOTORIZED SHAKE TABLE

Model an earthquake on a small scale!

Curriculum topics

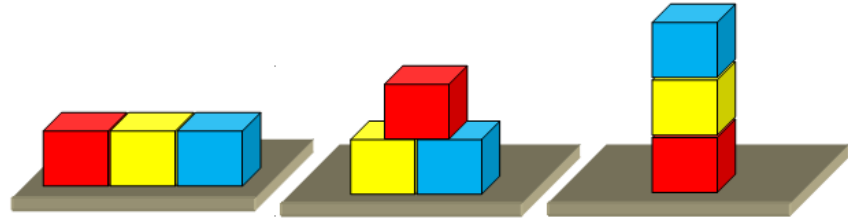
- Earthquakes
- Electrical Circuits
- Energy Conversion
- Plate Tectonics
- Vibrations

Subjects

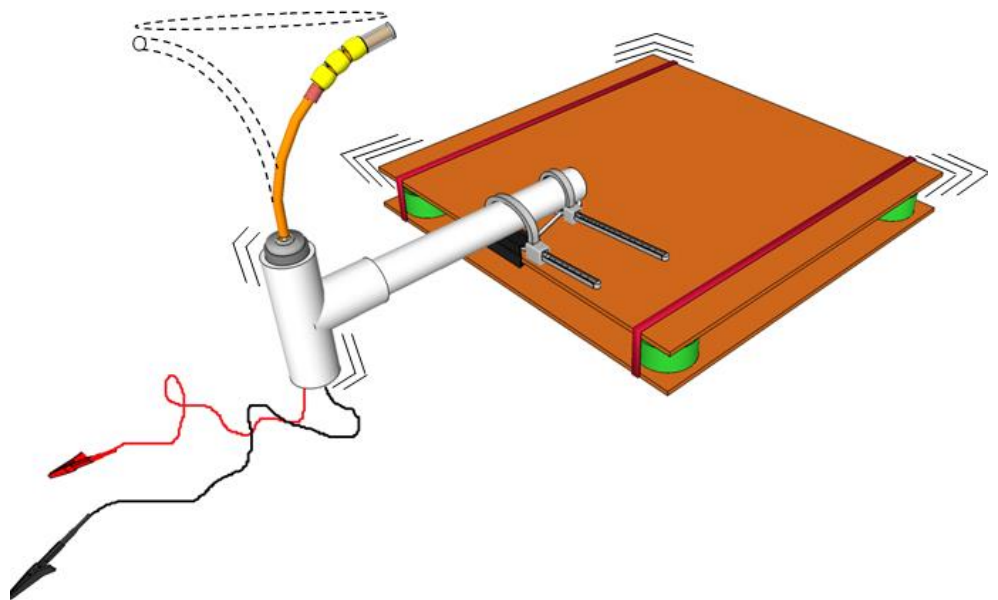
- Earth & Space Science
- Engineering
- Physical Science

Grade range: 2 – 12

Who we are: Resource Area for Teaching (RAFT) helps transform the learning experience by inspiring joy through hands-on learning.



Build a simple structure on the shake table, start the motor, and watch the action! Will your building design survive the “earthquake”?



Share Your feedback!

<http://bit.ly/RAFTkitsurvey>

Materials

Materials in the kit may vary but generally, this kit contains the following:

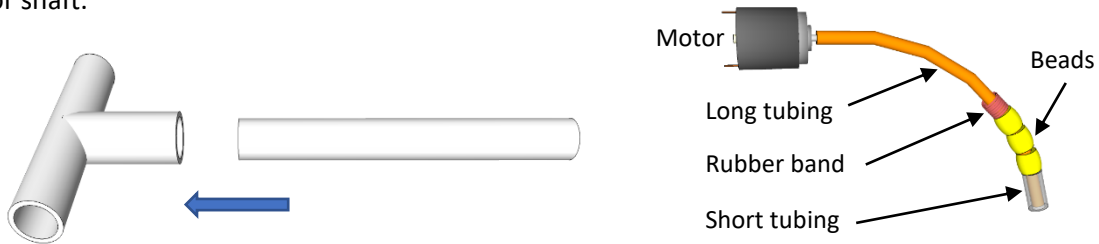
- PVC pipe, ½", 5" long (1)
- PVC tee fitting, ¾" (1)
- Motor, 1.5-3 volts, ¾" diameter (1)
- Tubing, ¼" x 1/8" (1)
- Tubing, 1/8" x 1/16" (1)
- Pony beads, regular (5)
- Alligator test leads, 12" long (2)
- Cardboard, double wall, 12" x 12" (2)
- Binder clip, medium (1)
- Zip ties, releasable, 5" (2)
- Rubber balls, 1" (4)
- Rubber bands, 5 ½" (2)
- Rubber band, small (1)
- Plastic caps (4)
- Battery holder, AA (1)
- Corrugated plastic, 2" x ½" (1)
- **Not included:** Materials for stacking structures, batteries
- **Recommended:** Eye protection

WARNING: CHOKING HAZARD – Activity uses small ball. Not for children under 3 yrs.

To Do and Notice

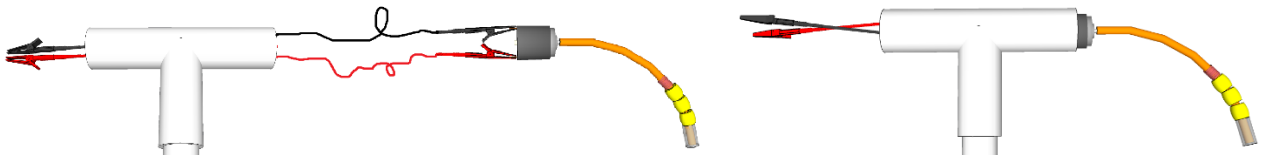
1

Shaker Unit Assembly: Push the PVC pipe into the center of the tee fitting (below, left). Push the long tubing onto the motor shaft, leaving a small gap. Loop the small rubber band tightly around the tube, add some beads, and cap with the short tubing (below, right). Make sure the tubing is firmly connected to the motor shaft.



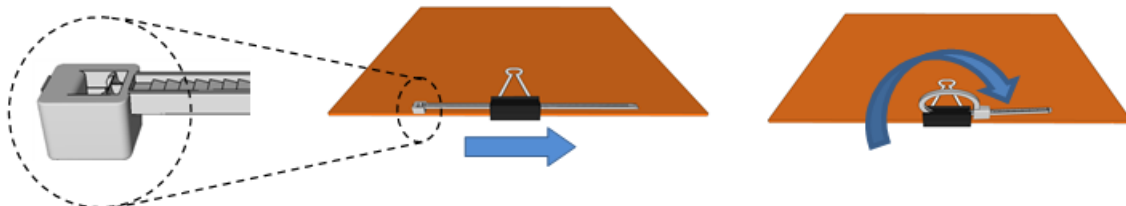
2

Attach the alligator test leads to the motor and then run them through the tee (below, left). Push the motor into an end of the tee (below, right). The motor, wrapped with foam, should fit snug in the tee.



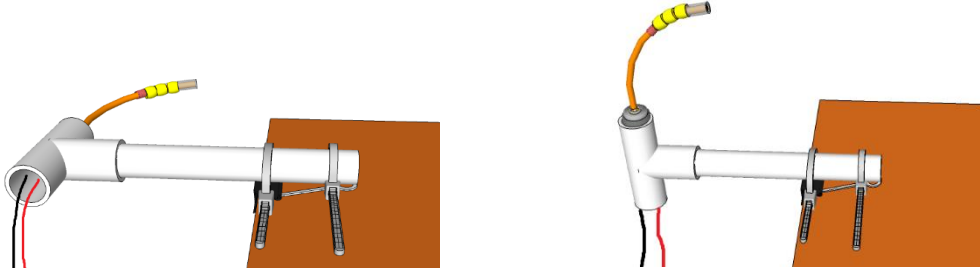
3

Shake Table Assembly: Attach the binder clip to one sheet of cardboard, centered (below, left). Slide a zip tie through the clip with the small ridges on the tie facing up. Put the ends together to form a large loop but do not tighten (below right).



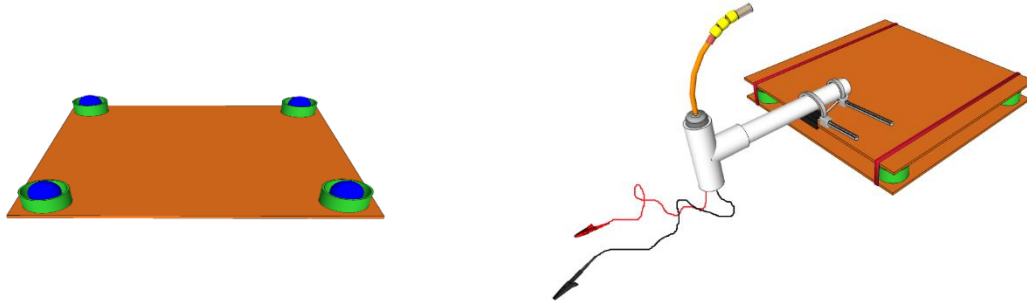
4

Slide the PVC through the loop and tighten the zip tie (see below). Attach a second zip tie around the PVC and the narrow part of the binder clip handle (below). Tighten the zip tie and rotate the tee so the motor points upward (below, right).



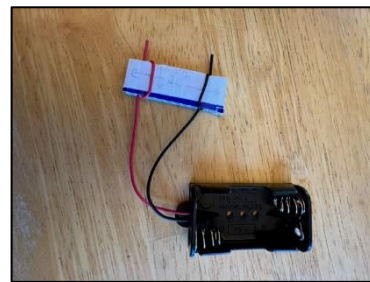
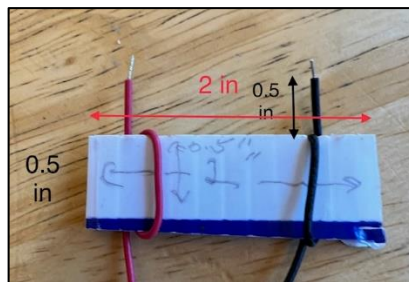
5

Put a ball in each of 4 caps and put them at the corners of the second cardboard sheet (below, left). Put the cardboard with the shaker unit on top of the balls and align the boards. Stretch 2 large rubber bands around the whole shake table to hold it together, centered over the balls and caps (below, right).



6

Battery Holder Assembly: Insert one battery holder wire lead through a channel on one side of the corrugated plastic rectangle and the other lead into a channel on the opposite side (see below). Loop each of the wires around the rectangle so that the wires are secured with only 1/2 inch of the insulation on the stripped end extending beyond the block. This prevents the stripped wires from touching and causing a short circuit. **WARNING:** A short circuit can result in heat, melting, and possible injury.



7

Attach the alligator leads to the battery holder wires. The motor shaft will spin, causing the platform to shake. If the shaft does not spin, check the batteries and connections. Disconnect one wire to turn it off. **Safety Tip:** We recommend wearing eye protection during use. Avoid contact with spinning parts.

8

Build a simple structure with blocks or other materials. Put the structure on the shake table and notice what happens when it shakes. Repeat for other structures. Which material/design is most stable on the platform? What does this tell you about structural design and earthquakes?

9

Learn more with these suggestions: 1) Create a bed of fine grain material and put underneath a structure on the shake table and observe the effect of soil conditions on building stability, 2) Mix cornstarch and water to model "liquefaction."

10

Share your learning with RAFT! Submit photos/video via email at education@raft.net or on social media ([Facebook](#), [Twitter](#), [Instagram](#)).

Core Content Skills:

Science & Engineering (NGSS)

Developing and Using Models, Planning and Conducting Investigations, Forces and Motion, Cause and Effect; Transfer of Energy, Constructing Explanations and Designing Solutions, Waves, Earth's Materials and Systems, Natural Hazards, Human Impact on the Environment

Social Emotional Learning

- Self-awareness
- Self-management
- Responsible decision-making

The Content Behind the Activity

The force of an earthquake travels through the Earth in waves. **Surface Waves** occur close the surface. **Body Waves** happen deep inside the Earth. **Primary Waves** (P-waves) are fast-moving body waves that compress the earth in front of them as they travel. **Secondary Waves** (S-waves) are body waves that radiate force in all directions. **Love Waves** are S-waves that cause the side-to-side motion that damages many buildings. **Raleigh Waves** are S-waves that cause both up-and-down and side-to-side motion. They are like the waves in the ocean.

In the Motorized Shake Table, the vibration created by the spinning tube and beads mimics the side-to-side movement created by Love waves. By slightly rotating the shaker unit at an angle it is possible to create vibrations and motion on the shake table to simulate other types of earthquake waves and investigate potential damage to various structures in different locations/environments that experience seismic activity.

Reuse

This kit uses 100% reusable materials designed for other uses. To continue making a positive impact in reducing waste, reuse these materials in other projects. Additionally, any unused materials can be collected and delivered back to RAFT.

Feedback

Please comment on this kit by taking this short survey: <http://bit.ly/RAFTkitsurvey>. Let us know of any material concerns (missing, broken, or poorly fitting parts) as well as any suggestions for improvement.

Visit <https://raft.net> to view related activities!

Brace Yourself
Foam Faults
Simple Motor
Your Room in an Earthquake

Resources

- Types of earthquake waves - <https://bit.ly/3rBzLUg>
- Earthquake waves, movement, and damage - <https://bit.ly/3xAYUCa>