Earthquakes / tsunamis

**Video:** [**https://www.youtube.com/watch?v=1PVMs2NSdmc**](https://www.youtube.com/watch?v=1PVMs2NSdmc) **(0-2min)**

**Introduction**

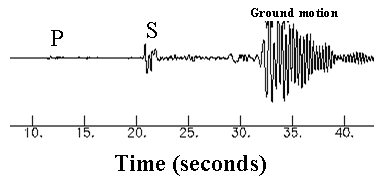
An **earthquake** (also known as a **quake**, **tremor** or **temblor**) is the shaking of the surface of the Earth, resulting from the sudden release of energy in the Earth's *lithosphere*, which is the rigid outermost shell of the planet. The energy released creates seismic waves. Depending on the wave magnitude, the earthquakes can range in size from those that are so weak that they cannot be felt to those violent enough to toss people around and destroy whole cities. At the Earth's surface, earthquakes manifest themselves by shaking and sometimes displacement of the ground. When the epicenter of a large earthquake is located offshore, the seabed may be displaced sufficiently to cause a tsunami. Earthquakes can also trigger landslides, and occasionally volcanic activity.

In its most general sense, the word *earthquake* is used to describe any seismic event — whether natural or caused by humans — that generates seismic waves. Earthquakes are caused mostly by rupture of geological faults, but also by other events such as volcanic activity, landslides, mine blasts, and nuclear tests.

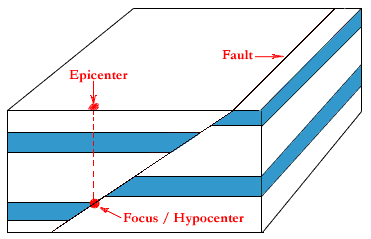
**Objectives**

1. Understand the concept of how lithosphere is broken in tectonic plates
2. Correlate the motion of tectonic plates to their type of boundaries and their location in the planet.
3. Understand how the movement of tectonic plates release energy (seismic waves)
4. Learn how we study/predict earthquakes

Scientific Terms for Students

* **Tectonic plate:** The lithosphere, which is the rigid outermost shell of a planet (the crust and upper mantle), is broken into tectonic plates. The Earth's lithosphere is composed of seven or eight major plates (depending on how they are defined) and many minor plates. Where the plates meet, their relative motion determines the type of boundary: convergent, divergent, or transform.
* **Continental drift:** Continental drift is the movement of the Earth's continents relative to each other, thus appearing to "drift" across the ocean bed, caused by the movements of the tectonic plates.
* **Seismic wave:**Seismic waves are waves of energy that travel through the Earth's layers, and are a result of earthquakes, volcanic eruptions, magma movement, large landslides and large man-made explosions that give out low-frequency acoustic energy.

[**USA earthquake**](https://earthquake.usgs.gov/earthquakes/map/#%7B%22autoUpdate%22%3A%5B%22autoUpdate%22%5D%2C%22basemap%22%3A%22grayscale%22%2C%22feed%22%3A%221day_m25%22%2C%22listFormat%22%3A%22default%22%2C%22mapposition%22%3A%5B%5B-86.12725429720946%2C-312.1875%5D%2C%5B86.12725429720948%2C113.203125%5D%5D%2C%22overlays%22%3A%5B%22plates%22%5D%2C%22restrictListToMap%22%3A%5B%22restrictListToMap%22%5D%2C%22search%22%3Anull%2C%22sort%22%3A%22newest%22%2C%22timezone%22%3A%22utc%22%2C%22viewModes%22%3A%5B%22list%22%2C%22map%22%5D%2C%22event%22%3Anull%7D)

* **Epicenter:** An earthquake's point of initial rupture is called its focus or hypocenter. The epicenter is the point at ground level directly above the hypocenter.
* **Seismograph**: an instrument used to capture and record the ground vibrations that accompany an earthquake
* **Seismic activity:**The seismicity or seismic activity of an area refers to the frequency, type and size of earthquakes experienced over a period of time.

Activity: Build your own seismograph

**Materials:**

* Cartbox, rubber bands, pencil or marker,

**Directions** [**https://www.youtube.com/watch?v=KnocP26HL5M**](https://www.youtube.com/watch?v=KnocP26HL5M)

1. Have an adult cut a window in the cartbox. Use the plastic container as a base
2. Tie the rubber bands in an x shape and tie a pencil/marker in the middle
3. Move the box in different directions and with different forces simulating the seismic waves.
4. Move the paper from right to left as is finishing recording the waves

**Discussion questions**

1. Does the location of earthquakes and volcanoes show a pattern? If so, what tectonic process may be responsible?(*compression, extension, shearing*)
2. How do earthquakes differ from tsunamis?
3. Which parts of the world are more likely to get earthquakes and tsunamis?
4. How are scientist working on study earthquakes?
5. What can you do to help people in case of an earthquake?

Tsunamis

Adapted from ShakeOut Curriculum <https://www.shakeout.org/california/downloads/ShakeOut_ES1_TsunamiBottle.pdf>

CONTENT BACKGROUND:

Underwater Earthquakes

Sometimes an earthquake can occur along the ocean floor, resulting in the up or down shifting of large blocks of the crust. Such motion can generate a special kind of ocean wave called a tsunami, or seismic sea wave. A series of these waves may travel at speeds up to 800 km/hr (~500 mi/hr) in the deep ocean, where they are too small to be seen. However, when they reach land, they mount to heights of tens of meters and break against the shore and its buildings. Low coastal areas can be flooded, and many lives can be lost.

It is difficult to recognize the geological events and structures that surround us on dry land. It is even more difficult to think about those events and structures when they occur underwater, where we cannot see them. Yet, water covers about 70 percent of our planet, and the same tectonic forces are at work on the floors of the oceans as on the continents.

Although the same processes are at work, we need a new vocabulary to understand them. Mountain ranges in the ocean are called mid-ocean ridges; plains are called abyssal plains. Submarine slides occur as well, but we call them turbidity currents.

**Activity Objective:**

For students to learn that tsunamis can be caused by earthquakes and to understand the effects of tsunamis on the shoreline

**Materials:**

* 2-liter plastic soda bottles
* Small gravel (fish tank gravel)
* Water source

**Pre-activity Questions:**

* Do earthquakes occur under the ocean? (Yes)
* Why? Are there faults in the ocean? (Yes)
* Does anyone know what earthquakes in the ocean can cause? (Some may guess tsunamis)

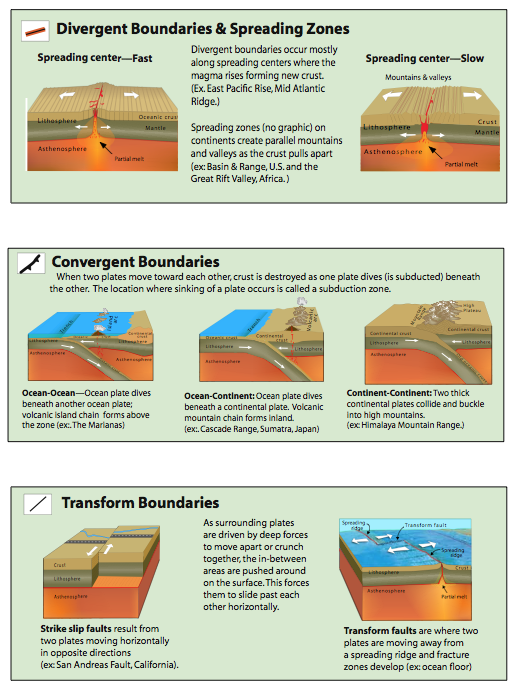
**Activity:**

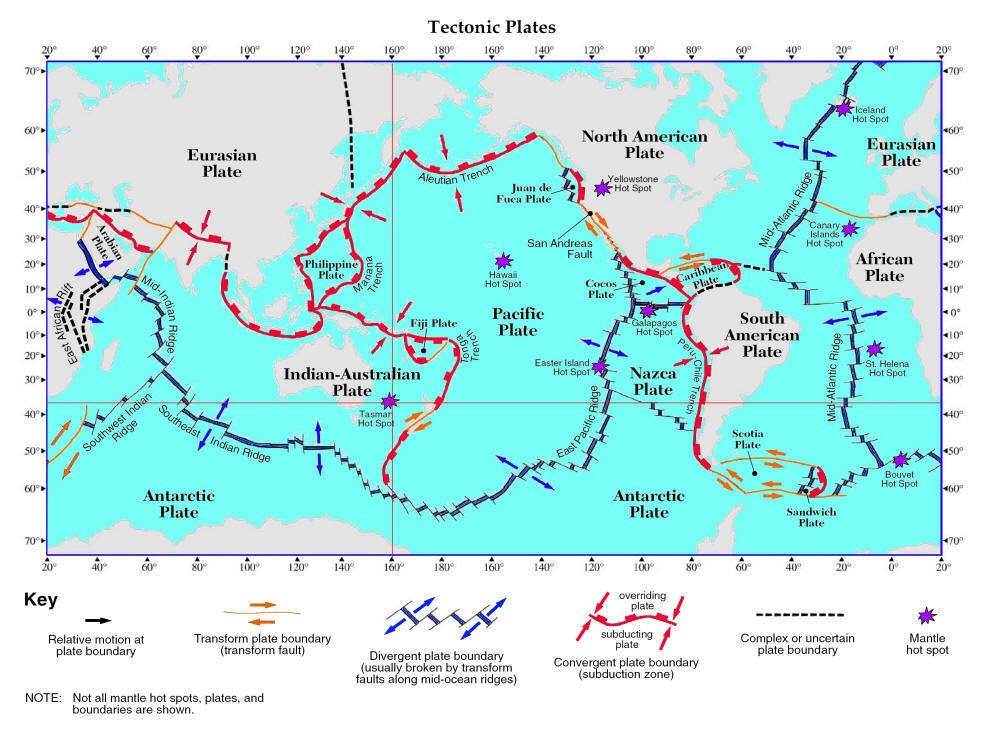
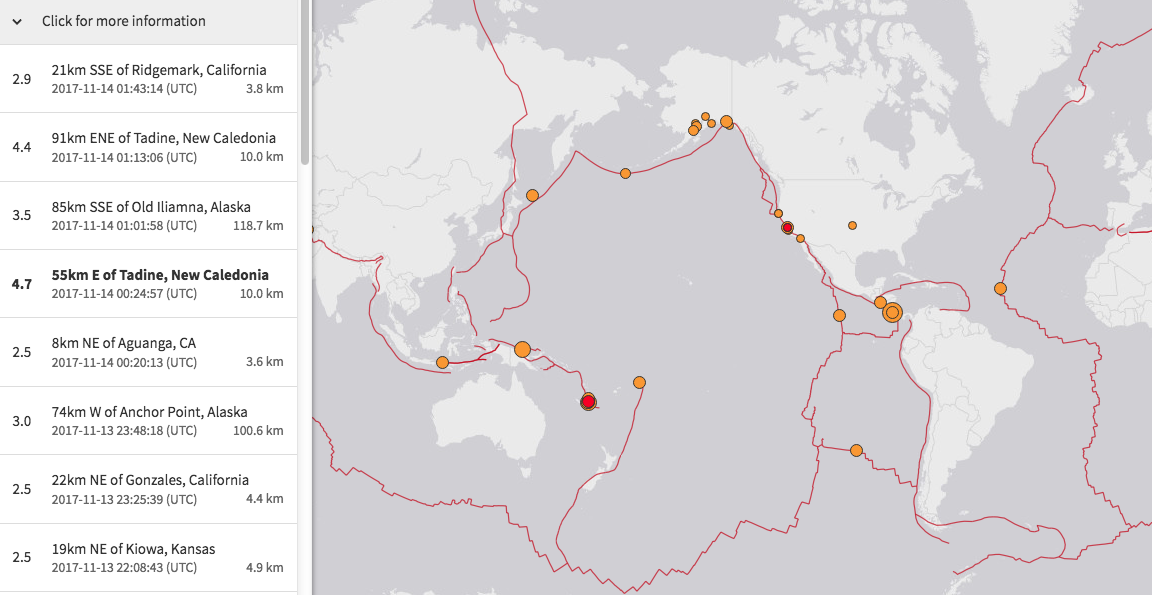
1. Ask students to add about 2 inches of gravel to the bottom of the soda bottle.
2. Then, students add water until the bottle is about one-eighth full.
3. With the bottle standing upright, students should carefully lie the bottle down on its side. The gravel should form a small hill.
4. Now ask students what they would do to to create a tsunami in the bottle (lift up on one end) Also ask what this lifting motion represents in relation to a real tsunami (the lifting of the sea floor during an earthquake)
5. Before creating a tsunami in the bottle, instruct students to watch through side of the bottle.
6. Have one student place his/her hand under the mouth of the bottle and lift about two inches to create a tsunami.
7. Now have students draw what they saw in the “Side” box on the “Tsunami! - What do I see?” worksheet.
8. Have students place the bottle upright until the gravel settles, then set the bottle back on its side to recreate the hill.
9. This time, instruct students to watch what happens through the top of the bottle.
10. Now have another student create a tsunami by lifting the bottle about two inches using the mouth of the bottle.
11. Have students draw what they saw in the “Top” box on the “Tsunami! - What do I see?” worksheet.
12. Repeat steps 8 - 11, except this students will watch through the front of the bottle, and draw what they see in the “Front” box on the worksheet.
13. Finally, have students draw what they would see if they were on the coastline during a tsunami.

Post-activity questions

1. Have students show what they drew on their worksheets. For each view, ask the students to explain why they drew the picture the way they did.
2. In case of a tsunami, where is the safest place to go, and when should you go there? (high ground, as soon as possible)

**Final video:** [**https://www.youtube.com/watch?v=1PVMs2NSdmc**](https://www.youtube.com/watch?v=1PVMs2NSdmc) **(5min -end)**

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