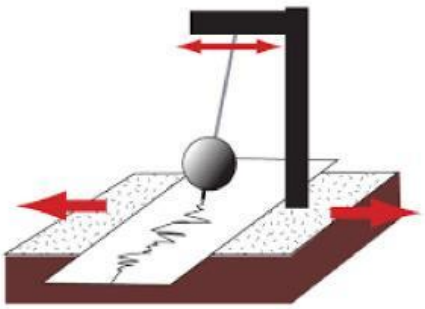
Earthquakes

A **seismograph** is a scientific instrument used to detect and record vibrations in the Earth caused by earthquakes. When the ground shakes, the seismograph measures those movements and produces a recording called a **seismogram**. Scientists use this data to determine where and how strong an earthquake was.

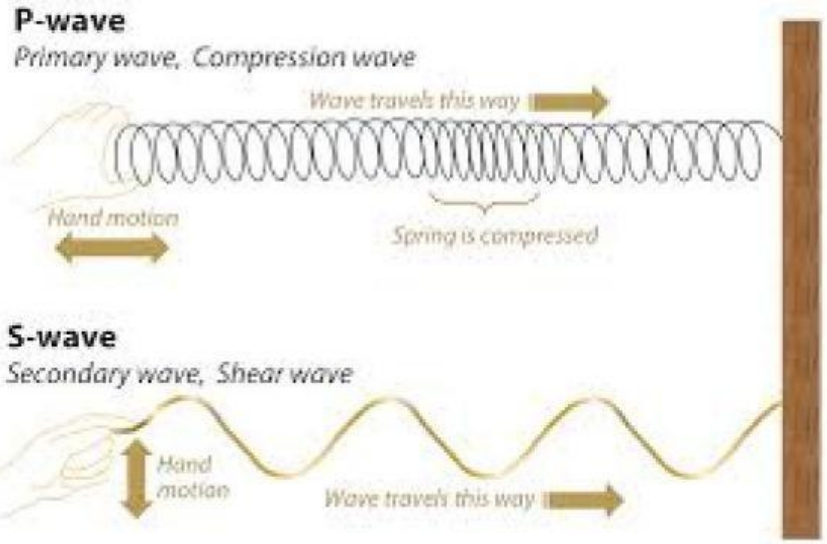


What is a Seismograph?

How a Seismograph Works

A seismograph typically has a heavy mass attached to a frame that is anchored to the ground. When an earthquake occurs, the ground moves, but the heavy mass stays relatively still due to inertia. This difference in movement is recorded as waves on the seismogram. These recorded waves show the arrival of different types of seismic waves:

- **P-waves (Primary waves)** – Travel the fastest and arrive first. Do these look familiar? Also known as longitudinal waves or compressional waves
- **S-waves (Secondary waves)** – Travel slower and arrive after P-waves. Do these look familiar? Also known as transverse waves.

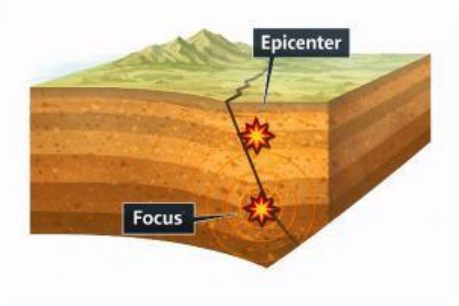


Compare P and S Waves:

The time difference between when the P-waves and S-waves arrive helps scientists determine how far away the earthquake occurred.

Focus vs. Epicenter

- The **focus** (also called the hypocenter) is the exact point underground where the earthquake begins. This is where energy is first released.
- The **epicenter** is the point on Earth's surface directly above the focus.



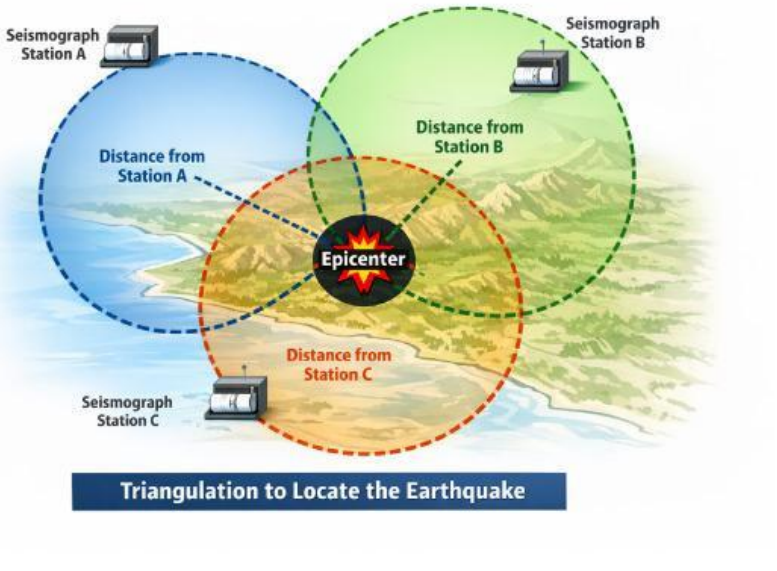
Compare the focus and epicenter.

How Scientists Pinpoint an Earthquake

When an earthquake occurs, seismographs at different locations record the waves. Scientists measure the time difference between the arrival of P-waves and S-waves at each station. The greater the time difference, the farther away the earthquake is from that station.

To locate the epicenter:

1. Scientists calculate the distance from at least **three different seismograph stations**.
2. They draw a circle around each station on a map using the calculated distance as the radius.
3. The point where the three circles intersect is the **epicenter**.
   This process is called **triangulation**.



Triangulation to Locate the Earthquake

Once the epicenter is known, scientists can estimate the depth of the focus by analyzing wave patterns and strength. Knowing both the focus and epicenter helps scientists understand how the earthquake happened and which areas may experience the most damage.

Why This Is Important

Identifying the focus and epicenter allows scientists to:

- Determine which fault caused the earthquake
- Estimate the strength and potential damage
- Issue tsunami warnings if needed
- Improve earthquake hazard maps

Seismographs are essential tools that help scientists quickly and accurately determine where an earthquake occurred, allowing communities to respond and prepare for future events.

Multiple Choice Questions

1. What is the main purpose of a seismograph?
   a) To predict when an earthquake will happen
   b) To measure ground temperature
   c) To detect and record vibrations in the Earth
   d) To stop earthquakes from occurring

2. The recording produced by a seismograph is called a —
   a) Seismometer
   b) Seismogram
   c) Magnitude scale
   d) Fault line

3. Which type of seismic wave arrives first at a seismograph station?
   a) Surface waves
   b) S-waves
   c) Tsunami waves
   d) P-waves

4. What does the time difference between P-waves and S-waves help scientists determine?
   a) The earthquake's magnitude
   b) The type of fault
   c) The distance to the earthquake
   d) The depth of the ocean

5. What is the **focus** of an earthquake?
   a) The point on Earth's surface where shaking is strongest
   b) The underground point where the earthquake begins
   c) The place where buildings collapse
   d) The edge of a tectonic plate

6. The **epicenter** is best described as —
   a) The deepest part of the Earth
   b) The place where two plates collide
   c) The point directly above the focus on the Earth's surface

d) The center of a continent

7. Why are at least three seismograph stations needed to locate an earthquake's epicenter?
   a) To measure earthquake magnitude
   b) To record aftershocks
   c) To triangulate the exact location
   d) To identify plate boundaries

8. What is **triangulation**?
   a) Measuring earthquake depth
   b) Comparing earthquake magnitudes
   c) Using three locations to pinpoint the epicenter
   d) Predicting future earthquakes

9. On a map, how do scientists use seismograph data to find the epicenter?
   a) By drawing fault lines
   b) By drawing circles that intersect
   c) By following mountain ranges
   d) By measuring ground temperature

10. Why is identifying the epicenter and focus important?
    a) It helps stop earthquakes
    b) It allows scientists to predict exact earthquake times
    c) It helps assess damage and improve hazard maps
    d) It prevents tsunamis from forming