

## Seismic Waves

### Key Concepts

- What are the types of seismic waves?
- How does a seismograph work?

An earthquake occurs when rock beneath Earth's surface moves. This rock moves because forces inside Earth create stress in the rock. When the stress in the rock builds up enough, the rock breaks or changes shape, releasing energy in the form of waves. The waves produced by earthquakes are known as **seismic waves**. **Seismic waves include P waves, S waves, and surface waves.**

Some seismic waves are longitudinal waves. The longitudinal waves produced by earthquakes are made up of compressions and rarefactions of rock inside Earth. Longitudinal seismic waves are known as **P waves** or primary waves. They are called primary waves because they move faster than other seismic waves and so arrive at distant points before other seismic waves.

Other seismic waves are transverse waves with crests and troughs. Transverse seismic waves are known as **S waves** or secondary waves. Secondary waves cannot travel through liquids. Because part of Earth's core is liquid, S waves do not travel directly through Earth and cannot be detected on the side of Earth opposite an earthquake.

When P waves and S waves reach Earth's surface they can create surface waves. A **surface wave** is a combination of a longitudinal wave and a transverse wave that travels along the surface of a medium. Surface waves travel more slowly than either P waves or S waves, but they produce the most severe ground movements. Earthquakes that occur underwater can produce huge surface waves on the ocean called **tsunamis**.

To detect and measure seismic waves, scientists use instruments called **seismographs**. A **seismograph records the ground movements caused by seismic waves as they move through Earth**. Because P waves travel faster through Earth than secondary waves, primary waves arrive at seismographs before S waves. By measuring the time between the arrival of the P waves and the arrival of the S waves, scientists can tell how far away the earthquake was. By comparing readings from at least three seismographs at different places on Earth, scientists can tell where the earthquake occurred.

Name \_\_\_\_\_ Date \_\_\_\_\_ Class \_\_\_\_\_ 4

## Characteristics of Waves ▪ Guided Reading and Study

### Seismic Waves (continued)

1. What does a seismograph record?  
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2. What is the frame of a seismograph attached to?  
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3. What happens to a seismograph's frame when seismic waves arrive?  
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4. How can scientists tell how far away an earthquake was from a seismograph?  
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5. How can scientists tell where an earthquake occurred?  
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6. Complete the flowchart about how geologists locate valuable substances under Earth's surface.

