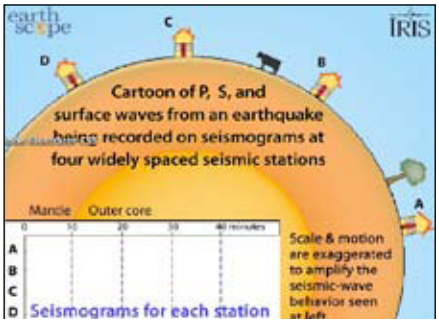
Same earthquake, different stations; why do the seismograms look different?

4-Station Seismograph Network

OBJECTIVES

This activity, paired with the 4 Station Seismograph Network animation, is designed for students to:

- explore properties of seismic waves
- identify large scale earth structure properties
- recognize that earthquakes can be recorded anywhere on the planet

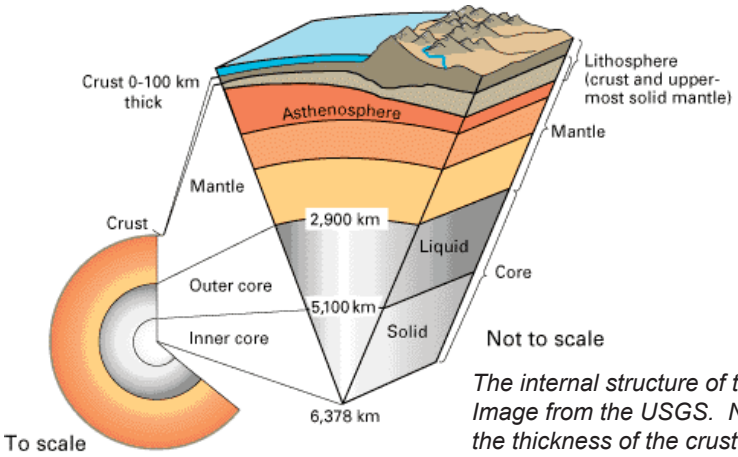


Screen grab from the animation found on IRIS Animations page: www.iris.edu/hq/inclass/animation/116

LESSON DEVELOPMENT

Review of Earth Structure

Understanding which seismic waves will be detected at a distant seismometer requires a general understanding of Earth structure. A key to understanding this animation is recognizing the Earth has a liquid outer core.



The internal structure of the Earth. Image from the USGS. Note that the thickness of the crust is greatly exaggerated.

Review of Seismic Waves

An earthquake is the sudden breaking of rock in the Earth. When a break occurs, some of the energy radiates out in the form of seismic waves. For every earthquake there are multiple types of seismic waves that fit in two broad categories:

Body waves (P and S waves; see descriptions at right) travel *through the interior of the earth*, and for the purposes of this animation, are described as a ray that leaves the earthquake and travels to the recording station.

Surface waves *travel over the surface of the earth.* These waves are slower, thus arrive after both the P and S body waves. Surface waves are responsible for most of the damage and destruction associated with earthquakes.

VOCABULARY

Seismometer: An instrument that detects motions of the Earth's surface caused by seismic waves produced during an earthquake.

Seismograph: Generally refers to the seismometer (detector) and its recording device (computer) as a single unit.

Primary Waves (P waves): Compressional waves that move rock particles apart and back together in the direction the wave is traveling. P waves can travel through solid or liquid, so they can travel through all layers of the Earth. P waves are the fastest seismic waves, therefore they will be the first wave to arrive following an earthquake at the recording station.

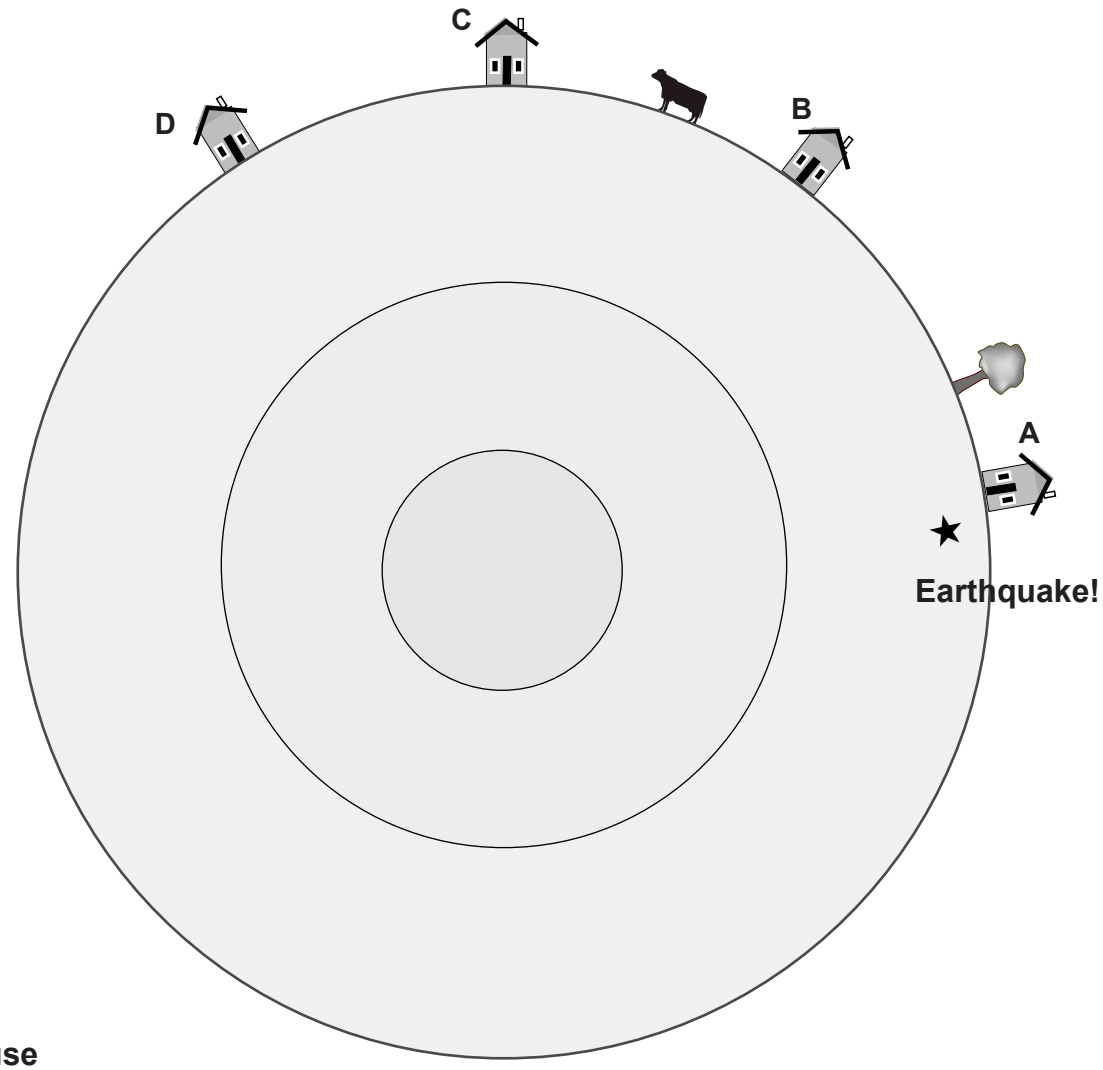
Secondary Waves (S waves):

Shear waves cause vibrations that are perpendicular to the direction the waves are traveling through the rock. Because liquids cannot be sheared in the way a solid can, S waves do not travel through liquids such as the outer core. S waves are slower than P waves, and arrive later. The delay time between the P arrival and the S arrival reveals how far away the earthquake is from the recording station.

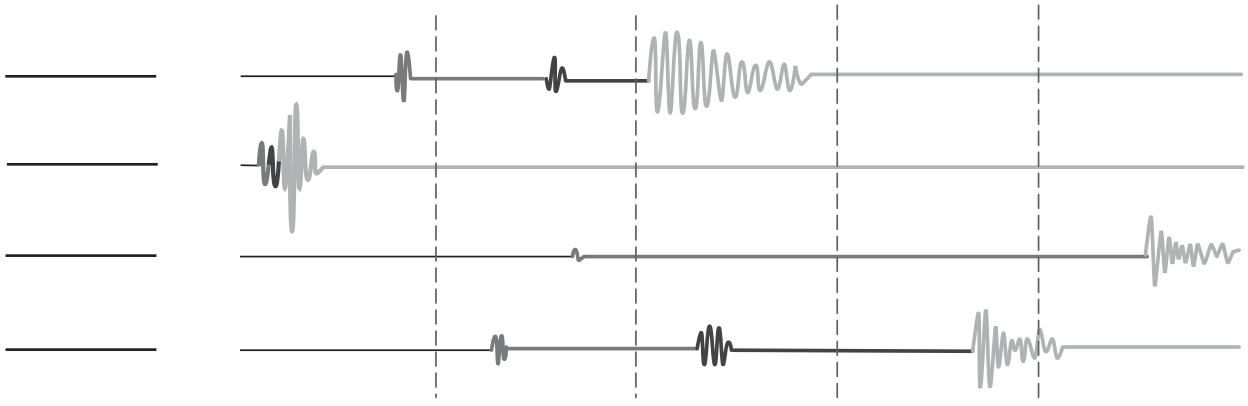
Name _____

Earthquake!

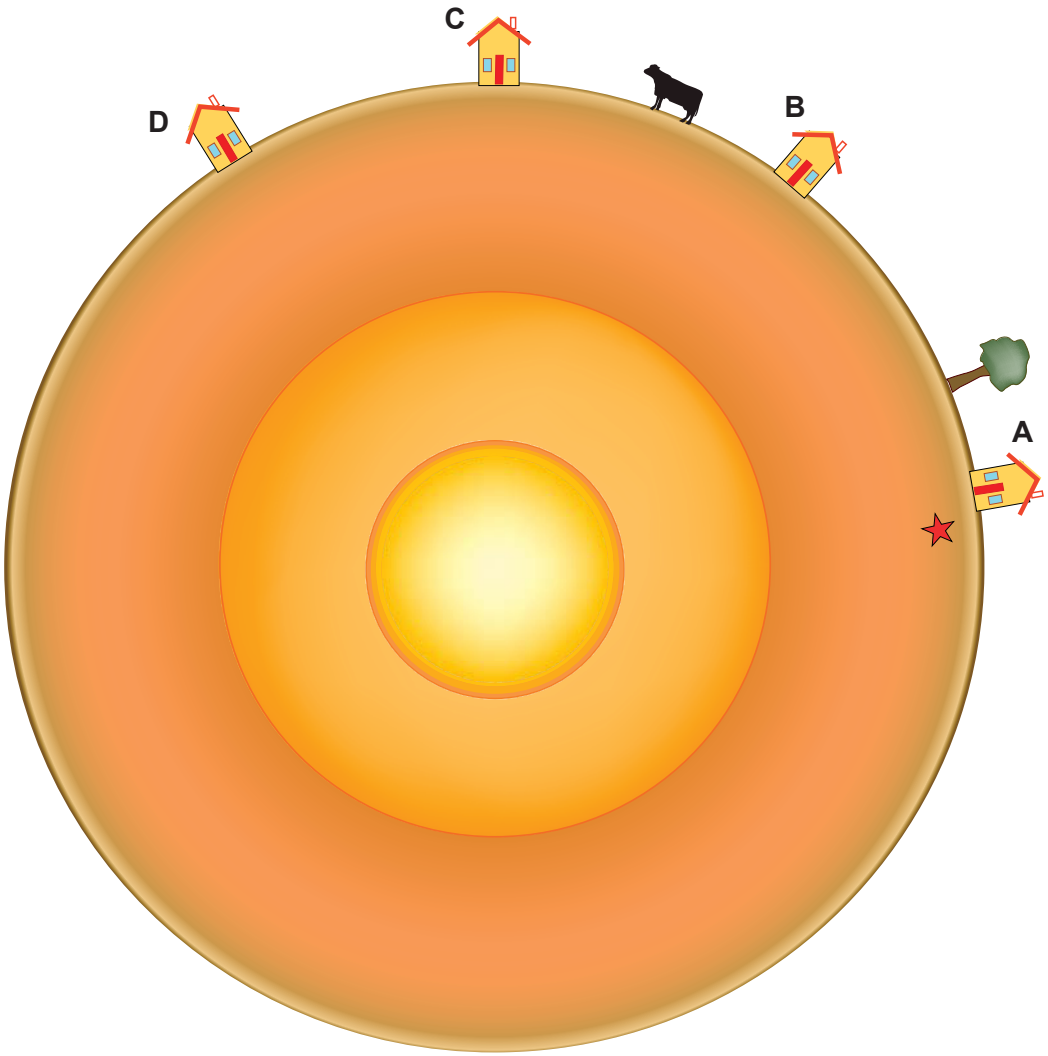
1. Label the four main layers of the Earth: Crust, mantle, outer core, and inner core.
2. Draw the path of the body waves from the earthquake to each of the four houses.
3. Label the segments of each path with the type of body wave found on that segment (P, S, P&S).
4. Identify which seismic record belongs to which house.
5. Label the type of wave arrival on each seismic record.

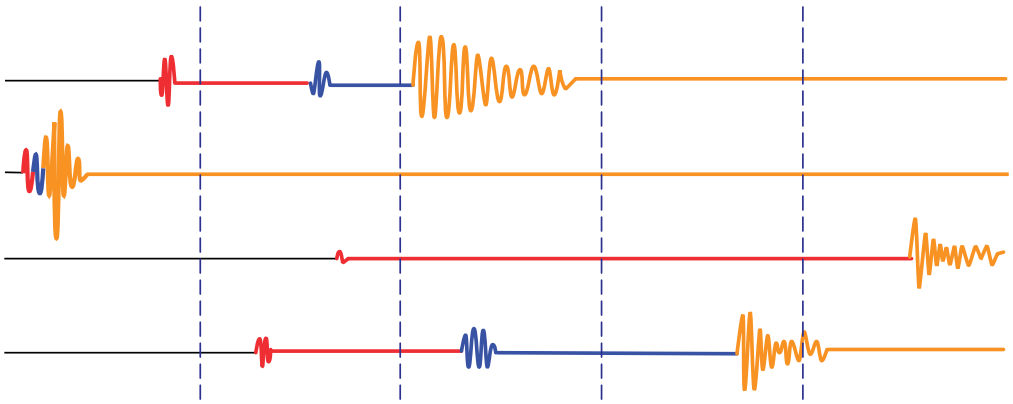


House



4-Station Seismograph Network: Overhead Image





4-Station Seismograph Network: Earthquake! Key

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