Name: _____ Date: _____

Guided Learning: Seismic Waves (Part 1)

Learning goals
After completing this activity, you will be able to …

- Compare and contrast the four different kinds of seismic waves
- Describe how seismic waves exhibit characteristic wave properties like diffraction, refraction, reflection, and superposition.
- Give examples of specific ramifications caused by the above wave behaviors.

Vocabulary: diffraction, dispersion, Love waves, mode conversion, P-wave shadow, P-waves, Rayleigh waves, seismic waves, S-waves, superpose

Warm-up questions

1. Where do earthquakes typically occur? _____

2. What happens to the ground near a pair of railroad tracks when a train runs past?

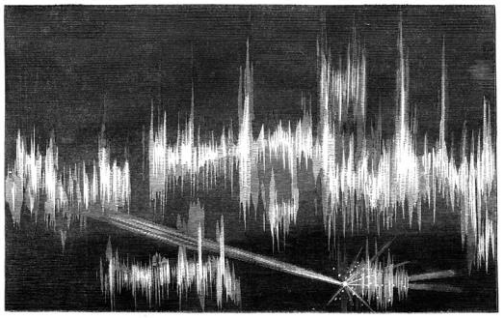
   _____

3. If a firecracker went off inside a sealed plastic bag, would you hear it or not? Explain.

   _____

   _____

Seismic waves
The Earth's crust is composed of several tectonic plates. Sometimes one plate will violently slide past another, releasing a great deal of energy. Earthquakes often arise as a consequence of this motion. Tectonic plates are immense. The motion of one against another disturbs the crust, sending out **seismic waves** as rock in one region pushes or pulls against rock in another.



An earthquake generates millions and millions of seismic waves because strain occurs at several separate points. These waves have a variety of wavelengths. Some might have wavelengths of a meter, others can have wavelengths of many kilometers. These millions of individual waves **superpose** upon one another, adding up to the wave felt by humans, buildings, and seismographs. Because the individual waves have many different, random frequencies, they are not in harmony with one another. This causes the combined wave registered by a seismograph to be jagged and appear irregular.

Some seismic waves travel just along the surface of the Earth. Other seismic waves (called body waves) travel down into the Earth's interior. The speed of a surface wave depends on its wavelength. In general, surface waves with longer wavelengths travel faster, so they will reach locations before those with shorter wavelengths. This means that the energy of the of waves spreads out as the gap between the faster waves and slower waves increases. This phenomenon is called **dispersion**. Surface seismic waves are not the only waves that suffer dispersion. Waves on water and light shining through glass are also dispersed. This is what allows a prism to separate the various colors of white light. Red light travels more quickly through glass than blue light, so it is refracted less.

1. Why do the waves on seismograms not appear smooth? _____

2. How is an earthquake like a large orchestra in which each member player a different note?

3. Why is the effect of dispersion greater for locations far from the focus of an earthquake?

4. It only takes about 50 liters of paint (13 gallons) to paint an entire basketball court.

   A. Why can such a small volume of paint cover such a large area? _____

   B. Do you think surface waves or body waves can transfer their energy a greater distance? Explain your answer.