First, some background on earthquakes. Seismic waves are caused by earthquakes. As you may recall, seismic waves are mechanical, meaning they need a ?????? to transfer energy. An earthquake occurs when layers of rock beneath earth's surface move as a result of built up stress. The disturbance during this motion travels in the form of waves that spread out in every direction from the point where the earthquake occurs, known as the focus or epicenter.

There are three general types of seismic waves: primary waves, secondary waves, and surface waves. Primary waves, or P waves, are longitudinal waves.P waves travel faster than secondary or surface waves and are therefore detected before the others. The medium for these waves is rock, which experiences compressions and rarefactions much like air does as a sound wave travels through it. Secondary, or S waves, are transverse waves.

S waves vibrate from side to side and push the ground back and forth or up and down. As a result they shake structures on Earth's surface. Unlike P waves, S waves cannot travel through liquids. Therefore, S waves cannot travel through Earth's liquid core to the opposite side of the planet.

Surface waves are sometimes formed when P waves and S waves reach Earth's surface. These waves are a combination of longitudinal and transverse waves. They move in an almost circular pattern along the surface (think of dropping a rock in a still pond). Although surface waves travel more slowly than either P or S waves, they are responsible for the most severe ground movements during an earthquake.

As a side note, other explosions, air or underground, only give off compression(which kind is this?) waves. Imagine if an evil country sets off an atomic bomb underground and claims if it was an earthquake. If we only pick up longitudinal waves, we immediately know that this was NOT an earthquake!

1. Joe Hannan is running a race against Sam Chalmette. Joe, runs at a constant speed of 10 m/sec, while poor Sam can only run at a speed of 5 m/sec. The timekeeper finds that Joe arrives at the finish line 30 seconds before Sam. Can we figure the distance of the race? What was it?

2. An earthquake's S wave travels at 9 km/sec and arrives at a seismograph 60 seconds before the P wave, which is moving at a speed of 6 m/sec. How far away from the seismograph was the epicenter?

3. A earthquake in San Francisco rocks the bay. Our seismograph is located 50 km outside of the city. Someone who lives int he city calls us and alerts to the impending earthquake. If we know that P waves travel at 5 km/sec and S waves travel at 8.5 km/sec, then what should we expect the time difference between the arrival times be?

4. A lightning flash occurs some distance away. A couple seconds later, we hear the thunder boom. We counted 10 seconds between seeing the flash and hearing the boom. How far away was the lightning strike? Assume the speed of sound to be 343 m/sec.

5. If lightning strikes 2 km where we are located, how long should we expect it to be between seeing the lightning and hearing the thunder? Assume the speed of sound to be 343 m/sec.

6. Lightning strikes a spot .5 km away from where we are standing. We see the lightning and 1.4 seconds later, we hear the thunder. What is the speed of sound at this temperature? What can we say about the temperature?