

Section 10.5: Seismic Waves

Research This: Tsunami-Warning Systems, page 467

A. Tsunamis can destroy coastal regions, damaging property and the environment, and killing people who cannot escape.

B. Tsunami-warning systems are based on the fact that P-waves arrive first, letting seismologists know that they should expect S-waves in the form of tsunamis soon.

C. Tsunami-warning systems are effective at warning people to get to higher ground if the epicentre is far enough away. There is seldom enough time to prevent property damage.

D. Tsunami-warning systems are needed most in high-risk areas such as in the Pacific Ocean and the Indian Ocean. The systems should be a low priority in places that rarely experience tsunamis, though it is worthwhile to install them just in case.

Section 10.5 Questions, page 468

1. Answers may vary. Sample answer:

(a) A surface wave travels on the surface of Earth while a body wave travels into Earth.

(b) P-waves are longitudinal waves that travel twice as fast as S-waves. S-waves are transverse waves that are more destructive than P-waves. P-waves can travel through solids and liquids whereas S-waves can only travel through solids.

2. Answers may vary. Sample answer:

S-waves can only travel through solids. The outer core of Earth was found to be surrounded by liquid material because S-waves could only travel until a certain point while P-waves continued further.

3. Using the fact that distance equals speed times time, you can find the point of origin because the speed of the wave is known and the time it takes for the P-wave or S-wave to arrive at a location can be measured. Measuring this data at different positions close to the epicentre is important to locate direction.

4. Answers may vary. Sample answer:

It is expensive to start digging without knowing what exists underground, so geophysical exploration saves money on drilling. Geophysical exploration can determine what materials are available below the surface. It can also determine how much material exists and at what depth.

5. Answers may vary. Sample answer:

(a) By sending out and receiving seismic waves, researchers can determine the types of materials and their thicknesses based on the speed waves take to reflect off the underground layers.

(b) The rarefactions and reflections of the seismic waves are used to gather the required information.

6. Diagrams may vary. Students should show waves starting at the source and then bending sharply as they pass through each layer. There should also be reflections back up to the surface at the same angle as the refraction.

7. **(a)** Helioseismology is the study of the Sun through the waves we can observe from Earth.

(b) A bell rings by vibrating its entire structure. Likewise the entire Sun vibrates because of all the sound waves travelling through it.

(c) We cannot hear the Sun's vibrations because sound does not travel through space.