



Classroom Teacher Preparation

Earth Science 15: Seismic Waves

Please use the following to prepare for the next SfS lesson.

Description:

This lesson is an introduction to the concept that S- and P-waves travel at different speeds away from the epicenter of an earthquake, and explains how we can take advantage of this fact in order to locate the epicenter. After a brief review of basic earthquake plate tectonics, S- and P-waves will be defined and explained with a demonstration using multiple Slinky toys. Students will then be challenged to locate the epicenter of an earthquake by using data from the timing of S- and P-waves to triangulate on a map. This lesson is geared towards older (6th-8th grade) students.

Lesson Objectives – SWBAT (“Students Will Be Able To...”):

6th-8th

- Explain that earthquakes are a result of wave energy
- Understand the major differences between P-waves and S-waves
- Understand that seismic waves travel through the earth’s interior
- Triangulate the location of an epicenter based on the arrival times of P- and S-waves

Disciplinary Core Idea (DCI):

PS4 Waves and their Applications in Technologies for Information Transfer – PS4.A Wave Properties

- (6th-8th) A simple wave model has a repeating pattern with a specific wavelength, frequency, and amplitude, and mechanical waves need a medium through which they are transmitted. This model can explain many phenomena including sound and light. *Waves can transmit energy.*

Science & Engineering Practice (SEP):

Analyzing and Interpreting Data

Preparation:

Students should already be familiar with the concept that the earth is made of layers and that the solid lithosphere floats upon the semi-solid asthenosphere.

Room Set Up for Activities:

There are two demonstrations during which the instructor and various student volunteers will stretch and shake Slinkys. There is also an optional “Human Wave” demonstration that can replace one of the Slinky demonstrations. In the Human Wave demo, the students stand next to each other and act as a wave, so this demonstration requires enough room for the students to be bumped around.

Safety:

Check if your instructor will execute the Human Wave demonstration. There must be adequate room to perform this demo, as there is potential for the students to be knocked over. There is a link to a video of this demo in the Additional Resources section. Please advise the instructor if you think your students cannot handle this demo.



Related Modules:

This lesson may be taught as part of a sequence or group of related modules on **Earth Science**, particularly Earthquakes. Other modules in this sequence include:

Earth Science 18: Understanding the Asthenosphere – Students experiment with Silly Putty and oobleck as they develop an understanding of the viscoelastic mantle.

Engineering 7: Earthquake Resistant Buildings - Students will be introduced to the problem—damage due to seismic waves—and will build and test different block configurations to determine which model provides the best solution.

For other module sequences and groups, look here: www.sciencefromscientists.org/sequences

Standards Covered:

Please click the following link to our website to review the standards covered by this lesson, listed by state: <http://www.sciencefromscientists.org/standards/>

Lessons are matched to both national NGSS and local state standards.

After Our Visit:

Extend this lesson by using a homemade seismograph and a Richter scale to measure the magnitude of bumps experienced during a car ride.

Access this Extension activity by visiting the Classroom Post found on our website at sciencefromscientists.org/cohorts. Use the name of your school/cohort and password to log in.

To help Evaluate, check out our Open Response questions online at sciencefromscientists.org/open-response-questions. They are freely available for all of our lessons for current teachers. Use the password supplied by your instructor to log in.

Additional Resources:

WGBH Videos and Activities: The PBS educational site is a great, **free** resource for educators but you must create an account to use the materials. The first time you log in to the [PBS Learning Media](http://www.pbslearningmedia.org) website you will be asked to create an account and provide an email and password. Once you have logged in, select “keep me logged in” to avoid having to repeat the process.

- Human wave propagation: http://www.iris.edu/hq/inclass/demo/human_wave
- Musical plates: A study of earthquakes and plate tectonics: <http://www.k12science.org/curriculum/musicalplates3/en/index.shtml>
- NOVA: Earthquakes: The Seismograph <http://mass.pbslearningmedia.org/resource/ess05.sci.ess.earthsys.seismograph/earthquakes-the-seismograph/>