

Name: _____

WS Earthquakes

- ___ 1) The study of how seismic waves change as they travel through Earth has revealed that
- P*-waves travel more slowly than *S*-waves through Earth's crust
 - seismic waves travel more slowly through the mantle because it is very dense
 - Earth's outer core is liquid because *S*-waves are not transmitted through this layer
 - Earth's outer core is solid because *P*-waves are not transmitted through this layer

- ___ 2) What is the average velocity of an earthquake's *S*-wave in its *first* 4 minutes of travel?
- 1 km/min
 - 250 km/min
 - 4 km/min
 - 500 km/min

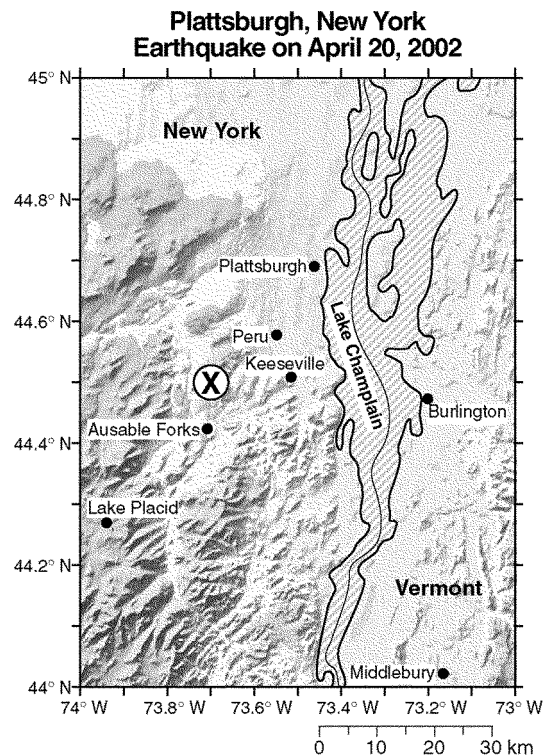
- ___ 3) A seismic station in a small town recorded the arrival of the first *P*-wave at 1:30:00 (1 hour, 30 minutes, 00 seconds) and the first *S*-wave from the same earthquake at 1:34:30.
- Determine the distance, in kilometers, from the town to the epicenter of this earthquake.
 - State what additional information is needed to determine the location of the epicenter of this earthquake.

- ___ 4) A huge undersea earthquake off the Alaskan coastline could produce a
- tsunami
 - hurricane
 - cyclone
 - thunderstorm

- ___ 5) How long would it take for the first *S*-wave to arrive at a seismic station 4,000 kilometers away from the epicenter of an earthquake?
- 12 min 40 sec
 - 13 min 20 sec
 - 5 min 40 sec
 - 7 min 0 sec

Questions 6 through 9 refer to the following:

The map below shows the location of the epicenter, **(X)**, of an earthquake that occurred on April 20, 2002, about 29 kilometers southwest of Plattsburgh, New York.



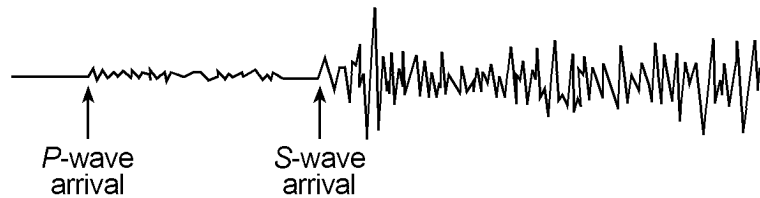
- ___ 6) State the latitude and longitude of the earthquake epicenter shown in the map. [Express your answers to the nearest tenth of a degree and include the compass directions.]

___ 7) A seismic station located 1,800 kilometers from the epicenter recorded the *P*-wave and *S*-wave arrival times for the earthquake shown. What was the difference in the arrival time of the first *P*-wave and the first *S*-wave?

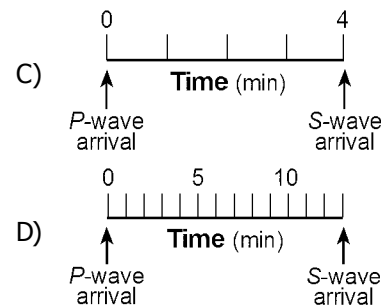
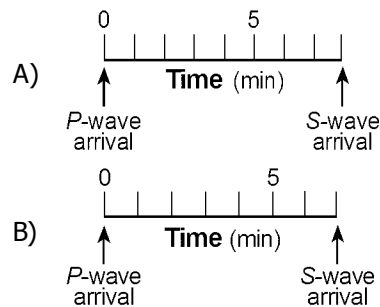
___ 8) What is the minimum number of seismographic stations needed to locate the epicenter of an earthquake?

___ 9) Explain why the earthquake described was most likely felt with greater intensity by people in Peru, New York, than by people in Lake Placid, New York.

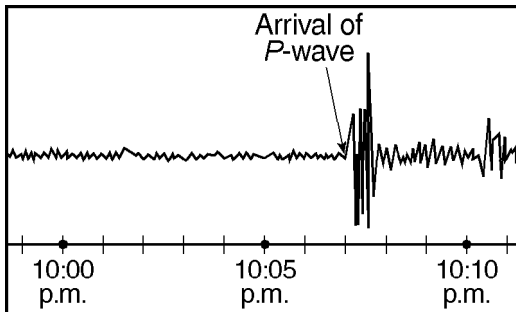
___ 10) The diagram below is a seismogram of the famous San Francisco earthquake of 1906, recorded at a seismic station located 6,400 kilometers from San Francisco.



Which time scale *best* represents the arrival-time difference between *P*-waves and *S*-waves at this station?



- ___ 11) The seismogram below shows the time that an earthquake *P*-wave arrived at a seismic station in Albany, New York.



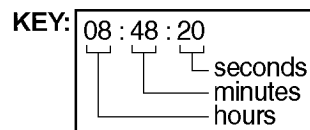
If the earthquake occurred at exactly 10:00 p.m., approximately how far from the earthquake epicenter was Albany, New York?

- A) 5,200 km
 B) 3,200 km
 C) 4,000 km
 D) 1,900 km

Questions 12 through 14 refer to the following:

The data table below gives information collected at seismic stations *A*, *B*, *C*, and *D* for the same earthquake. [Some of the data has been deliberately omitted.]

Seismic Station	<i>P</i> -Wave Arrival Time	<i>S</i> -Wave Arrival Time	Difference in Arrival Times	Distance to Epicenter
<i>A</i>	08:48:20	No <i>S</i> -waves arrived		
<i>B</i>	08:42:00		00:04:40	
<i>C</i>	08:39:20		00:02:40	
<i>D</i>	08:45:40			6,200 km



- ___ 12) What is the approximate distance from station *C* to the earthquake epicenter?
- A) 1,600 km
 B) 3,200 km
 C) 1,000 km
 D) 2,400 km
- ___ 13) What is the *most* probable reason for the absence of *S*-waves at station *A*?
- A) Station *A* was located on solid bedrock.
 B) *S*-waves cannot travel through liquids.
 C) Station *A* was located too close to the epicenter.
 D) *S*-waves were not generated at the epicenter.

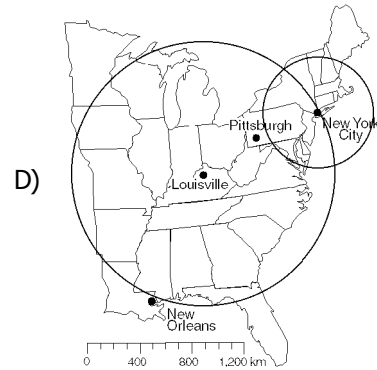
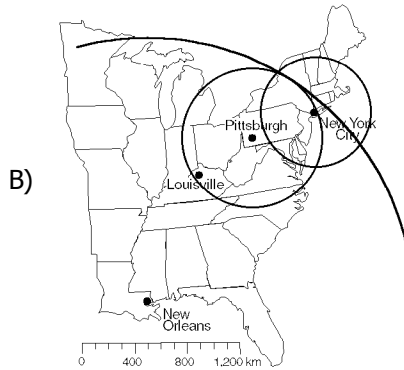
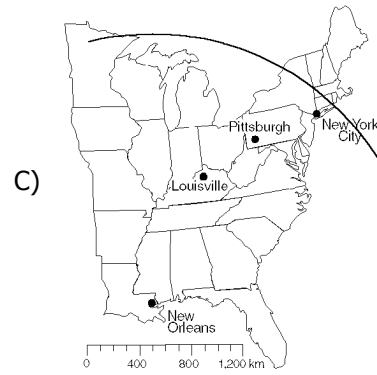
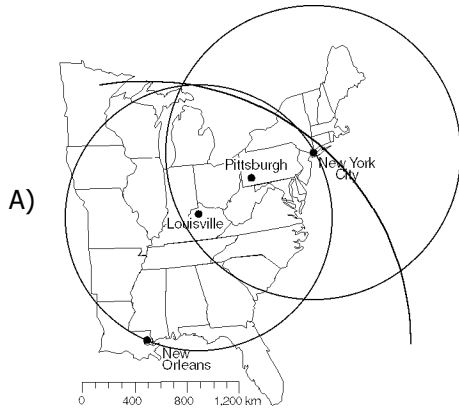
- ___ 14) How long did it take the P -wave to travel from the epicenter of the earthquake to seismic station D ?
- A) 00:09:40
 - B) 00:17:20
 - C) 00:39:20
 - D) 00:46:20

Questions 15 and 16 refer to the following:

Seismic stations are located at the four cities shown on the map below. Letter X represents the epicenter of an earthquake determined from seismic waves recorded at all four cities.



___ 15) Which map correctly shows how the location of the epicenter was determined?

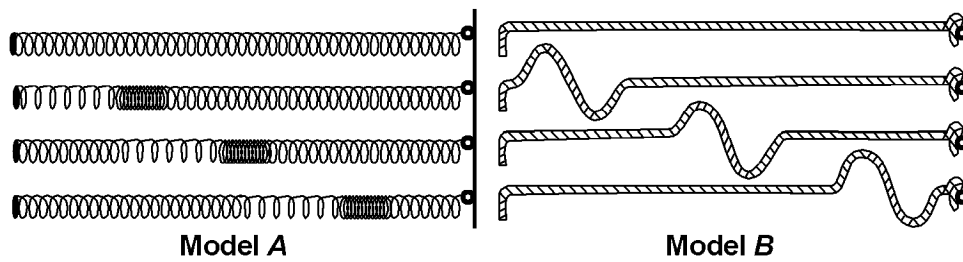


___ 16) At which city is there a difference of approximately 3 minutes and 20 seconds between the arrival times of the *P*-waves and the *S*-waves?

- A) Louisville
- B) New Orleans
- C) New York City
- D) Pittsburgh

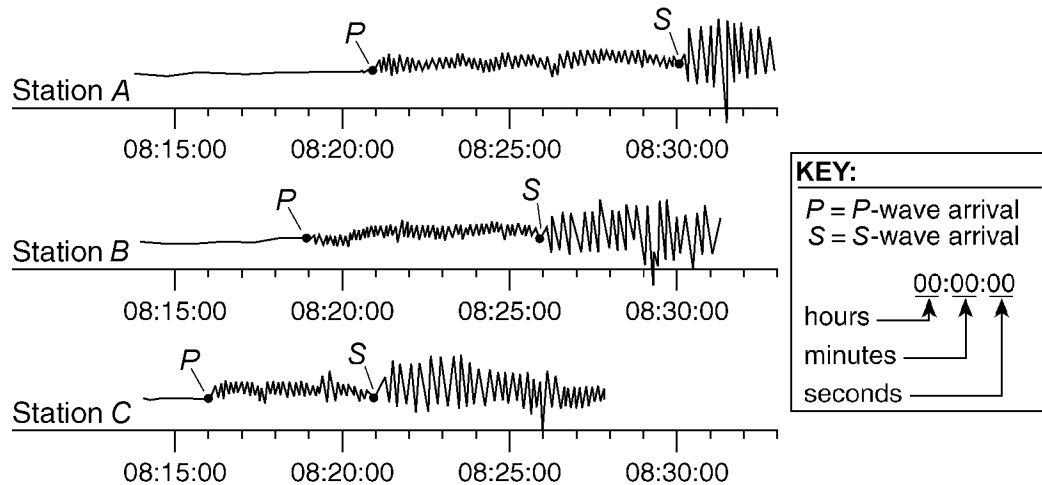
Questions 17 and 18 refer to the following:

The diagram below shows models of two types of earthquake waves.



- ___ 17) In the given diagram, model *A* best represents the motion of earthquake waves called
- A) *P*-waves (compressional waves) that travel faster than *S*-waves (shear waves) shown in model *B*
 - B) *S*-waves (shear waves) that travel slower than *P*-waves (compressional waves) shown in model *B*
 - C) *P*-waves (compressional waves) that travel slower than *S*-waves (shear waves) shown in model *B*
 - D) *S*-waves (shear waves) that travel faster than *P*-waves (compressional waves) shown in model *B*
- ___ 18) The difference in seismic station arrival times of the two waves represented by the models in the given diagram helps scientists determine the
- A) intensity of an earthquake
 - B) distance to the epicenter of an earthquake
 - C) time of occurrence of the next earthquake
 - D) amount of damage caused by an earthquake

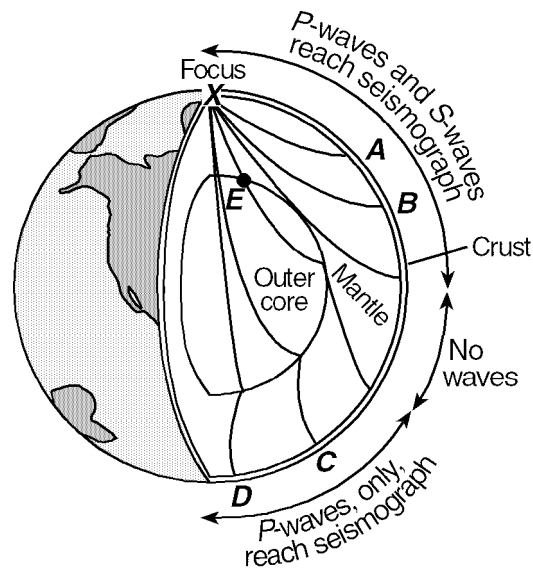
- ___ 19) The diagram below represents three seismograms showing the same earthquake as it was recorded at three different seismic stations, *A*, *B*, and *C*.



Which statement correctly describes the distance between the earthquake epicenter and these seismic stations?

- A) *A* is closest to the epicenter, and *B* is farthest from the epicenter.
- B) *C* is closest to the epicenter, and *A* is farthest from the epicenter.
- C) *B* is closest to the epicenter, and *C* is farthest from the epicenter.
- D) *A* is closest to the epicenter, and *C* is farthest from the epicenter.

- 20) The diagram below shows a cutaway view of Earth in which the interior layers are visible. The paths of earthquake waves generated at point *X* are shown. *A*, *B*, *C*, and *D* are locations of seismic stations on Earth's surface, and point *E* is located in Earth's interior.

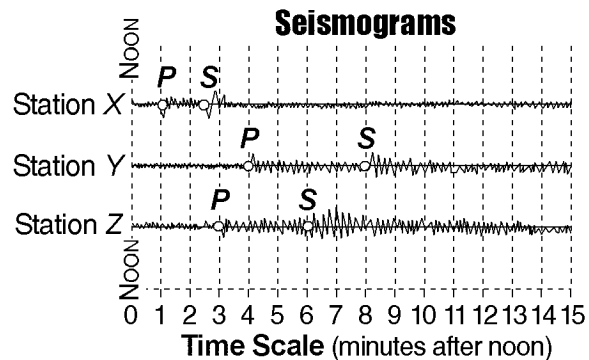
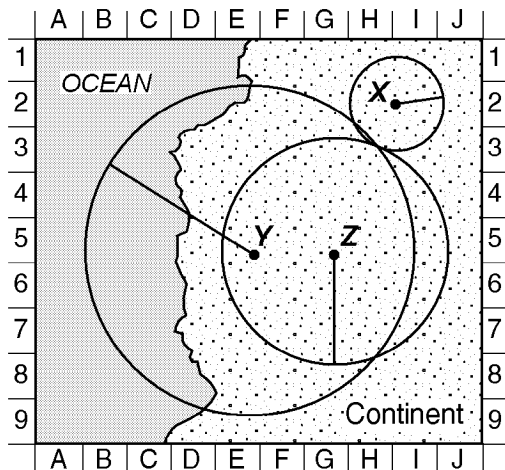


Both *P*-waves and *S*-waves were received at seismic stations *A* and *B* in the given diagram, but only *P*-waves were received at seismic stations *C* and *D*. Which one of the following statements *best* explains why this occurred?

- A) *S*-waves travel faster than *P*-waves.
- B) *S*-waves are much weaker than *P*-waves.
- C) The liquid outer core prevents *S*-waves from traveling to seismic stations *C* and *D*.
- D) The solid outer core prevents *S*-waves from traveling to seismic stations *C* and *D*.

Questions 21 through 24 refer to the following:

The diagram below shows three seismograms of the same earthquake recorded at three different seismic stations, *X*, *Y*, and *Z*. The distances from each seismic station to the earthquake epicenter have been drawn on the map. A coordinate system has been placed on the map to describe locations. [*The map scale has not been included.*]



- ___ 21) Seismic station *Z* is 1,700 kilometers from the epicenter. Approximately how long did it take the *P*-wave to travel to station *Z*?
- A) 3 min 30 sec
 B) 1 min 50 sec
 C) 2 min 50 sec
 D) 6 min 30 sec
- ___ 22) On the map, which location is *closest* to the epicenter of the earthquake?
- A) *G*-1
 B) *E*-5
 C) *H*-8
 D) *H*-3
- ___ 23) The *S*-waves from this earthquake that travel toward Earth's center will
- A) be absorbed by the liquid outer core
 B) be deflected by Earth's magnetic field
 C) reach the other side of Earth faster than those that travel around Earth in the crust
 D) be totally reflected off the crust-mantle interface
- ___ 24) Approximately how far away from station *Y* is the epicenter?
- A) 1,300 km
 B) 5,200 km
 C) 2,600 km
 D) 3,900 km