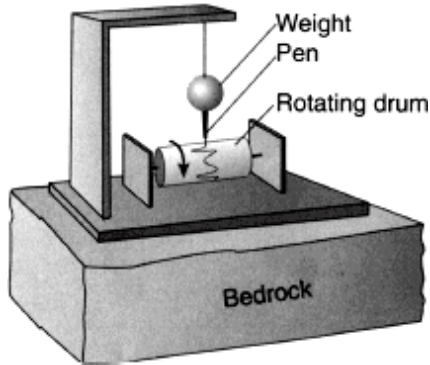


EArthQUakeName _____
December 05, 2012

1. Base your answer on the accompanying diagram, which shows a seismograph that recorded seismic waves from an earthquake located 4000 kilometers from this seismic station.

How long does the first S-wave take to travel from the earthquake epicenter to this seismograph? [1]



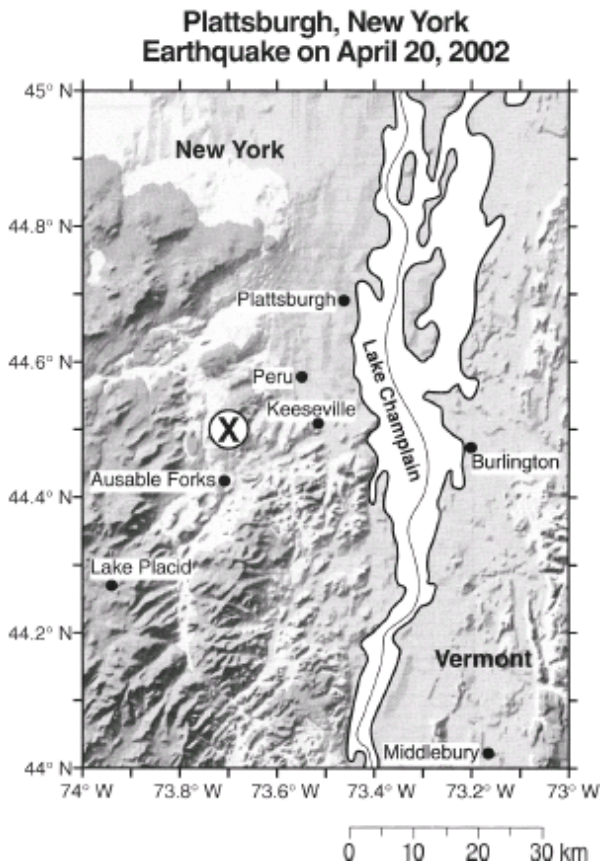
2. A seismic station in Massena, New York, recorded the arrival of the first *P*-wave at 1:30:00 (1 hour, 30 minutes, 00 seconds) and the first *S*-wave from the same earthquake at 1:34:30.

a Determine the distance, in kilometers, from Massena to the epicenter of this earthquake. [1]

b State what additional information is needed to determine the location of the epicenter of this earthquake. [1]

3. Base your answer on the accompanying map and on your knowledge of Earth science. The map shows the location of the epicenter, **X**, of an earthquake that occurred on April 20, 2002, about 29 kilometers southwest of Plattsburgh, New York.

A seismic station located 1,800 kilometers from the epicenter recorded the *P*-wave and *S*-wave arrival times for this earthquake. In minutes and seconds, what was the difference in the arrival time of the first *P*-wave and the first *S*-wave?

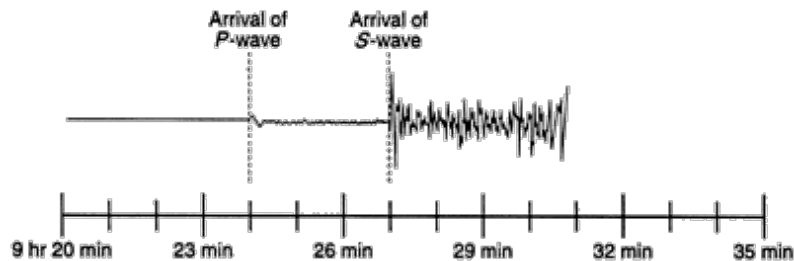


4. A *P*-wave takes 8 minutes and 20 seconds to travel from the epicenter of an earthquake to a seismic station. Approximately how long will an *S*-wave take to travel from the epicenter of the same earthquake to this seismic station?

- | | |
|-----------------|------------------|
| 1. 6 min 40 sec | 3. 15 min 00 sec |
| 2. 9 min 40 sec | 4. 19 min 00 sec |

5. In the accompanying diagram, the seismogram shows the arrival times of an earthquake's *P*-wave and *S*-wave recorded at a seismic station in Portland, Oregon.

What was the distance from Portland to the earthquake's epicenter?



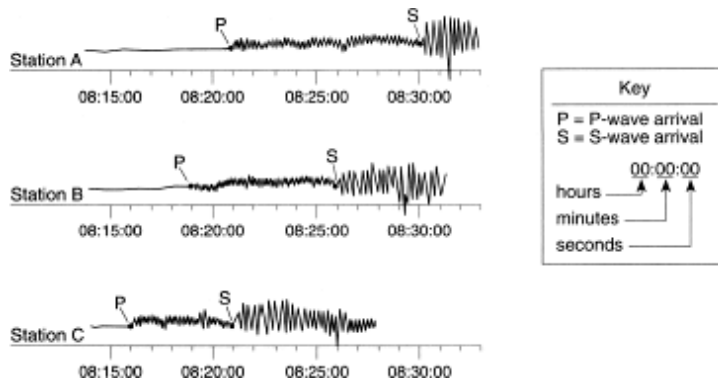
- | | |
|------------|------------|
| 1. 1800 km | 3. 3200 km |
| 2. 2500 km | 4. 4100 km |

6. What is the average velocity of an earthquake's S-wave in its first 4 minutes of travel?

- 1. 1 km/min
- 2. 250 km/min
- 3. 500 km/min
- 4. 4 km/min

7. The diagram (see image) represents three seismograms showing the same earthquake as it was recorded at three different seismic stations, A, B, and C.

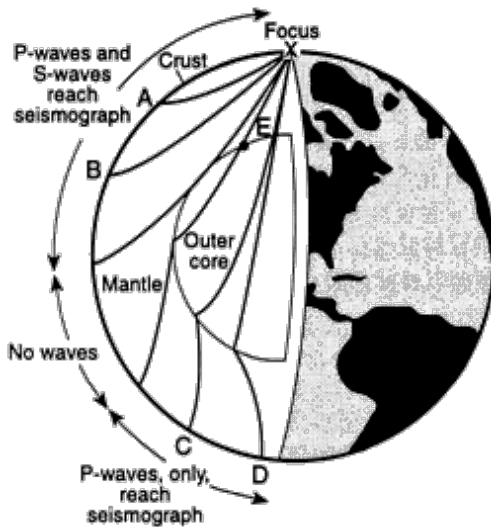
Which statement correctly describes the distance between the earthquake epicenter and these seismic stations?



- 1. A is closest to the epicenter, and C is farthest from the epicenter.
- 2. B is closest to the epicenter, and C is farthest from the epicenter.
- 3. C is closest to the epicenter, and A is farthest from the epicenter.
- 4. A is closest to the epicenter, and B is farthest from the epicenter.

8. Base your answer on the diagram, which 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.

The actual rock temperature at point E is inferred to be approximately

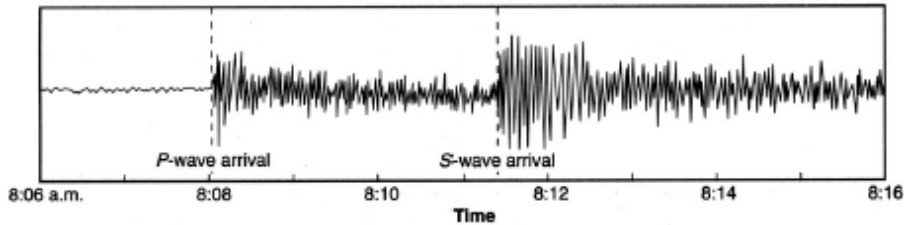


1. 1,500°C
2. 2,900°C

3. 5,000°C
4. 6,200°C

9. Base your answer on the accompanying seismogram. The seismogram was recorded at a seismic station and shows the arrival times of the first *P*-wave and *S*-wave from an earthquake.

Which part of this seismogram is used to find the distance to the epicenter of the earthquake?

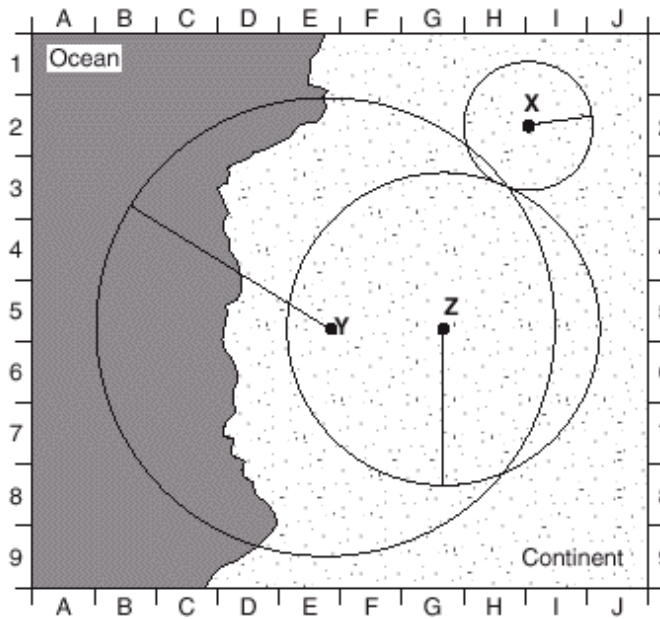
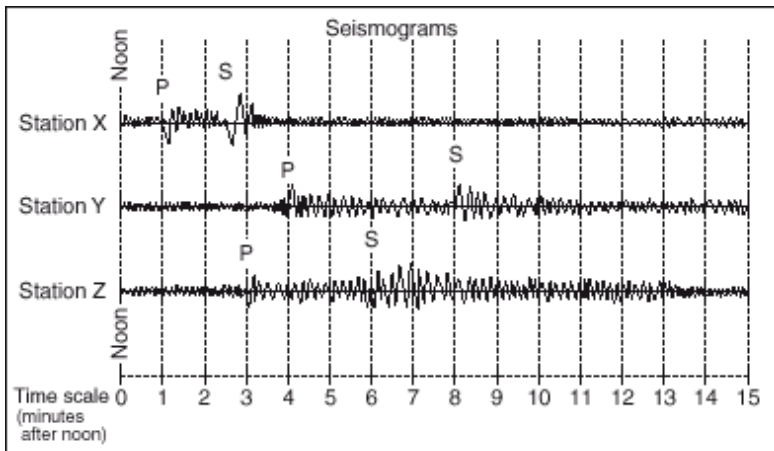


1. *P*-wave arrival time, only
2. *S*-wave arrival time, only

3. difference in the arrival time of the *P*-wave and *S*-wave
4. difference in the height of the *P*-wave and *S*-wave

10. Base your answer on the diagram and map shown. The diagram 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.

Seismic station Z is 1,700 kilometers from the epicenter. Approximately how long did it take the *P*-wave to travel to station Z?

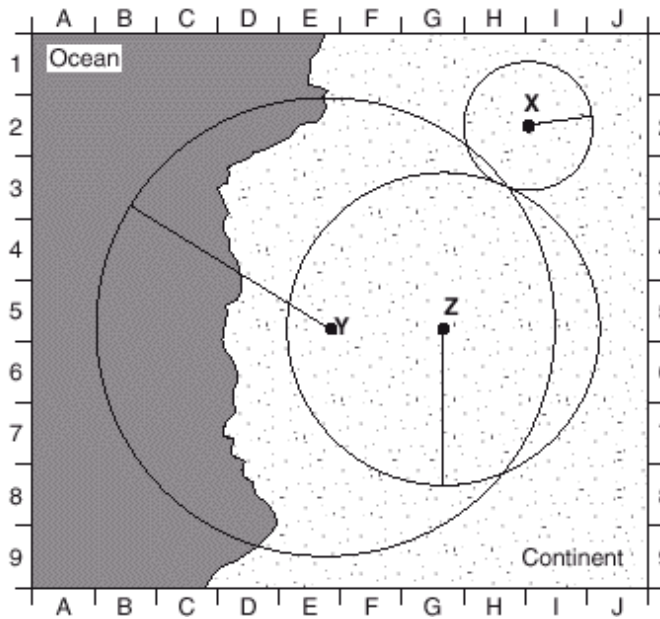
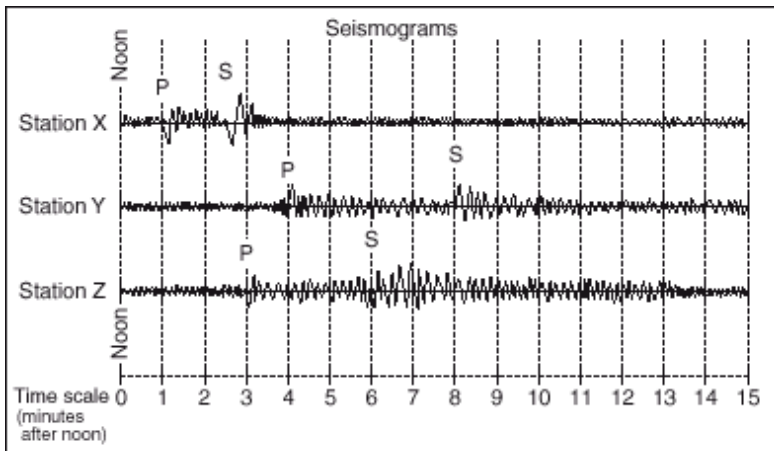


- 1. 1 min 50 sec
- 2. 2 min 50 sec

- 3. 3 min 30 sec
- 4. 6 min 30 sec

11. Base your answer on the diagram and map shown. The diagram 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.

On the map, which location is closest to the epicenter of the earthquake?

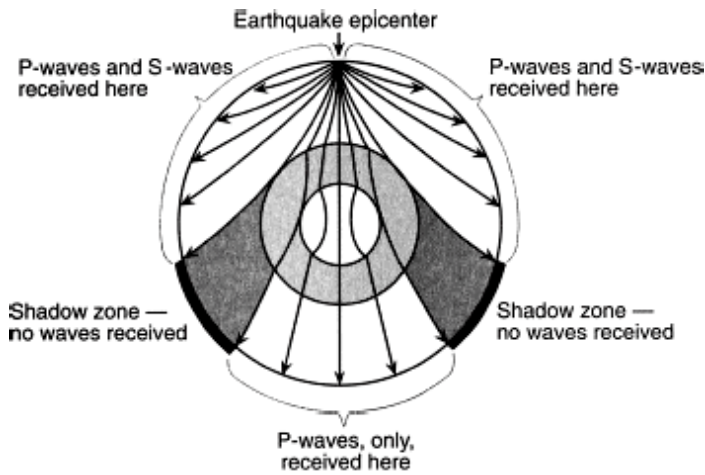


- 1. E-5
- 2. G-1

- 3. H-3
- 4. H-8

12. Base your answer on the accompanying cross section, which shows the paths of seismic waves traveling from an earthquake epicenter through the different layers of Earth's interior.

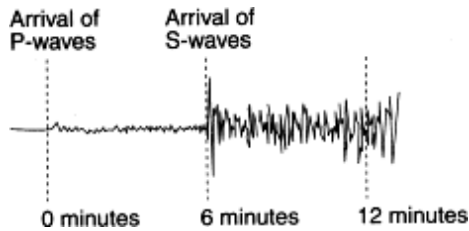
The distance from Albany, New York, to the epicenter of this earthquake is 5600 km. Approximately how much longer did it take for the S-wave to arrive at Albany than the P-wave?



- | | |
|-----------------------------|------------------------------|
| 1. 4 minutes and 20 seconds | 3. 9 minutes and 0 seconds |
| 2. 7 minutes and 10 seconds | 4. 16 minutes and 10 seconds |

13. The seismogram (see image) shows *P*-wave and *S*-wave arrival times at a seismic station following an earthquake.

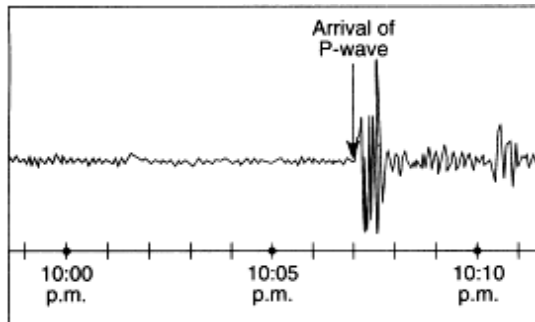
The distance from this seismic station to the epicenter of the earthquake is approximately



- | | |
|-------------|-------------|
| 1. 1,600 km | 3. 4,400 km |
| 2. 3,200 km | 4. 5,600 km |

14. The seismogram (see image) shows the time that an earthquake *P*-wave arrived at a seismic station in Albany, New York.

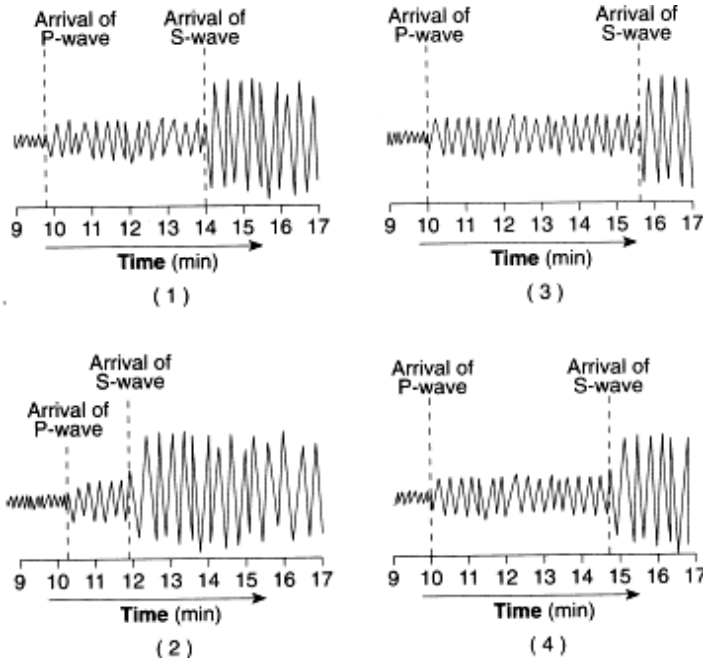
If the earthquake occurred at exactly 10:00 p.m., approximately how far from the earthquake epicenter was Albany, New York?



- 1. 1,900 km
- 2. 3,200 km

- 3. 4,000 km
- 4. 5,200 km

15. Which seismogram (see image) was recorded approximately 4,000 kilometers from an earthquake epicenter?

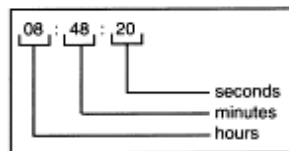


16. Base your answer on the data table (see image), which gives information collected at seismic stations A, B, C, and D for the same earthquake. Some of the data has been deliberately omitted.

How long did it take the P-wave to travel from the epicenter of the earthquake to seismic station D?

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

Key for Reading Time on the Table



- 1. 00:46:30
- 2. 00:39:20

- 3. 00:17:20
- 4. 00:09:40

17. A seismic station 4000 kilometers from the epicenter of an earthquake records the arrival time of the first P-wave at 10:00:00. At what time did the first S-wave arrive at this station?

1. 9:55:00

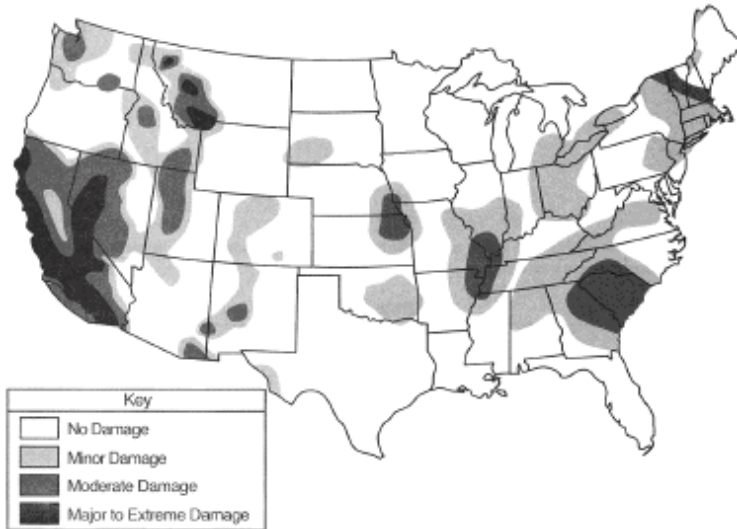
3. 10:07:05

2. 10:05:40

4. 10:12:40

18. Base your answer on the accompanying map, which shows the risk of damage from seismic activity in the United States.

In the United States, most of the major damage expected from a future earthquake is predicted to occur near a



1. divergent plate boundary, only

3. mid-ocean ridge and a divergent plate boundary

2. convergent plate boundary, only

4. transform plate boundary and a hot spot

19. An earthquake's *P*-wave arrived at a seismograph station at 02 hours 40 minutes 00 seconds. The earthquake's *S*-wave arrived at the same station 2 minutes later. What is the approximate distance from the seismograph station to the epicenter of the earthquake?

1. 1,100 km

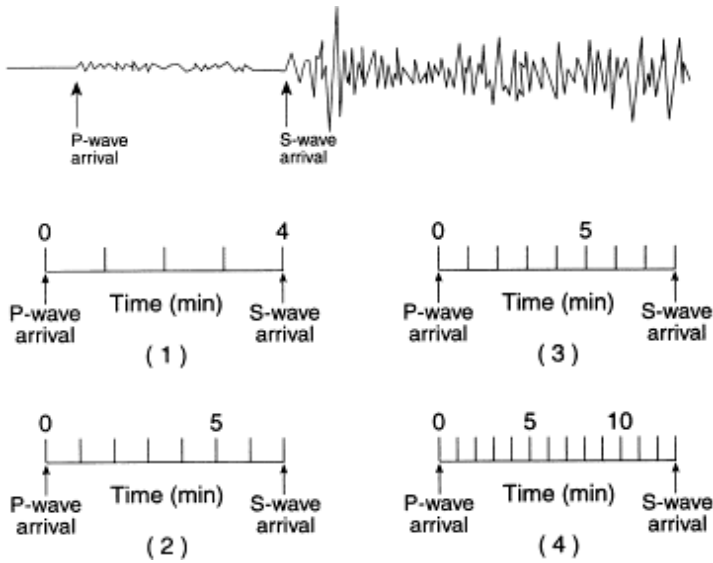
3. 3,100 km

2. 2,400 km

4. 4,000 km

20. The diagram shown is a seismogram of the famous San Francisco earthquake of 1906, recorded at a seismic station located 6,400 kilometers from San Francisco.

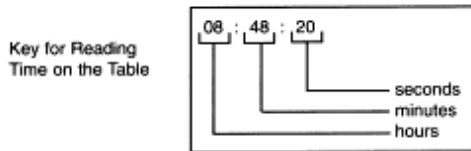
Which time scale best represents the arrival-time difference between *P*-waves and *S*-waves at this station?



21. Base your answer on the data table (see image), which gives information collected at seismic stations *A*, *B*, *C*, and *D* for the same earthquake. Some of the data has been deliberately omitted.

What is the most probable reason for the absence of S-waves at station *A*?

Seismic Station	P-Wave Arrival Time	S-Wave Arrival Time	Difference in Arrival Times	Distance to Epicenter
<i>A</i>	08:48:20	No S-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



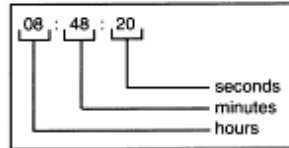
- 1. S-waves cannot travel through liquids.
- 2. S-waves were not generated at the epicenter.
- 3. Station *A* was located on solid bedrock.
- 4. Station *A* was located too close to the epicenter.

22. Base your answer on the data table (see image), which gives information collected at seismic stations *A*, *B*, *C*, and *D* for the same earthquake. Some of the data has been deliberately omitted.

What is the approximate distance from station *C* to the earthquake epicenter?

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

Key for Reading
Time on the Table



1. 3,200 km
2. 2,400 km

3. 1,600 km
4. 1,000 km