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Investigating the Speed of Earthquake Waves

Background Information

When an earthquake occurs, waves are produced that travel outward away from the focus of the earthquake, in much the same way that ripples move across the surface of water when a pebble is thrown into a pond.

Primary waves and secondary waves are two different types of waves produced by an earthquake. They are usually referred to as P waves and S waves. The graphic relationship between how far P and S waves travel and the length of time that they have traveled is an important tool used by scientists who investigate earthquakes.

In this investigation, you will construct a P and S wave travel-time graph. You will then use the graph to answer some questions about earthquakes.

Problem

What is an earthquake wave travel-time graph and how is it used?

Materials *(per group)*

Pen or pencil

Procedure

1. An earthquake recently occurred producing P and S waves that were recorded by instruments located at the stations identified in the Data Table. The Data Table also indicates the distance traveled and the travel time for each wave. Using the information contained in the Data Table, construct a graph showing the relationship between the distance traveled by P and S waves and their travel time. There will be two slightly curved lines on your graph. Label the curves appropriately as either P wave or S wave.
2. Use the graph that you constructed to answer the questions in Conclusions.

Observations

DATA TABLE

Wave type	Distance traveled from the epicenter (<i>km</i>)	Travel time	
		(<i>min</i>)	(<i>sec</i>)
P	1600	3	20
P	6500	9	50
P	5400	8	40
P	2000	4	00
P	9600	12	40
P	700	1	30
P	7000	10	20
P	3400	6	10
P	8800	12	00
P	4000	7	00
S	2200	8	00
S	4000	12	40
S	5200	15	20
S	1700	6	30
S	6000	17	00
S	1100	4	20
S	7400	19	40
S	8200	21	00
S	500	2	10
S	9000	22	10



Global Science
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NAME:
DATE:
PERIOD:

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Use the graph that you constructed to answer the following questions

1. Looking at your data and graph, calculate the average speed that P waves travel at. (Show your work)
2. Looking at your data and graph, calculate the average speed that S waves travel at. (Show your work)
3. How long would it take for a P wave to travel from an earthquake epicenter to a location 8000 km away?
4. How long would it take for an S wave to travel the same distance?
5. Approximately how far must an observer be from an earthquake epicenter if he or she received a P wave 8 minutes after it was produced by the earthquake?
6. Explain how you could tell which of two observers was farthest from an earthquake epicenter by comparing the arrival times of P and S waves for the two locations.
7. If a recording station is 4600 km from a earthquake's epicenter, what is the difference in arrival times of P and S waves?
8. If the difference in arrival times of P and S waves at a certain location is 3 minutes, how far from that location is the earthquake's epicenter?

A blank graph grid with a vertical y-axis labeled from 500 to 10,100 in increments of 200 and a horizontal x-axis labeled from 1 to 30. The grid consists of 30 columns and 50 rows of squares.