Name _____ Class _____ Date _____

CHAPTER 11

ACTIVITY ■ **Earthquakes and Volcanoes**

Earthquake Search

Wherever an earthquake occurs, two types of shock waves spread out in all directions. Each type of wave travels at a different speed. The earthquake waves that travel fastest are known as P, or primary, waves. The waves that travel more slowly are called S, or secondary, waves. After an earthquake occurs, P waves reach places sooner than S waves do.

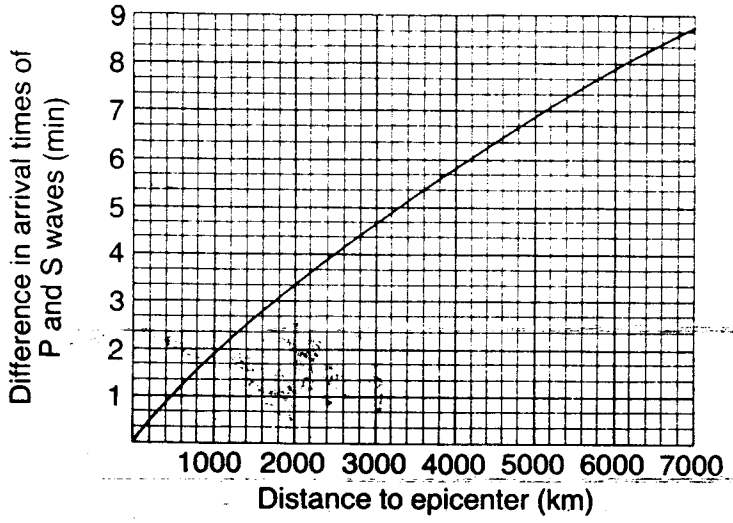
Both types of waves start out from the earthquake's focus. The focus is the underground point of origin of an earthquake. The point on the surface of the Earth directly above the focus is called the earthquake's epicenter.

To detect an earthquake, seismologists use an instrument called a seismograph. By using this instrument, scientists figure out when the first P and S waves from the earthquake arrive at the seismograph's location.

The difference between the arrival times of P and S waves is used to find the location of the earthquake's epicenter. This information must be obtained from at least three locations.

Now it is your turn to determine where an earthquake's epicenter is located. To do this, you will need a drawing compass and the map that follows.

Carefully study the graph on this page. It shows the relationship between the difference in arrival times of P and S waves and the distance to the epicenter of an earthquake. The time is in minutes. The distance is in kilometers. Use the graph to answer the questions that follow.



1. 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? _____

_____

2. If a recording station is 4600 km from an earthquake's epicenter, what is the difference in arrival times of P and S waves? _____

Now suppose an earthquake has occurred somewhere in the United States. Its P and S waves are recorded by seismographs located at the three cities shown in the Data Table.

DATA TABLE

City	Difference in Arrival Times of P and S Waves
Denver	2 min 25 sec
Houston	4 min 10 sec
Miami	5 min 40 sec

3. What is the distance in kilometers from the epicenter to Denver, Colorado? _____

4. What is the distance in kilometers from the epicenter to Houston, Texas? _____

5. What is the distance in kilometers from the epicenter to Miami, Florida? _____

Place the map on page 13 on your desk. Use the scale on the map to set the compass points apart at a distance equal to 1400 km, the distance from Denver to the earthquake's epicenter. Place the sharp point of the compass in Denver. Draw a circle with the pencil point. Repeat, but this time set the compass for 2700 km, the distance from Houston to the earthquake's epicenter. Repeat, but this time set the compass for 4000 km, the distance from Miami to the earthquake's epicenter.

6. Which city on the map is closest to the earthquake's epicenter? _____

How far is this city from the epicenter? _____

7. Of the scientists at the three cities in the Data Table, which would have become aware of the earthquake first? _____

Second? _____

Third? _____

8. Why is it necessary to have data from at least three recording stations? _____

_____

_____

9. Suppose the epicenter of this earthquake is located in San Francisco. What will be the difference in arrival times of P and S waves in New York City? _____

10. As the distance between an observer and an earthquake decreases, does the difference in arrival times of P and S waves increase, decrease, or remain the same?

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