Name _____ Class _____ Date _____

Skills Practice Lab

Finding an Epicenter

An earthquake releases energy that travels through Earth in all directions. This energy is in the form of waves. Two kinds of seismic waves are P waves and S waves. P waves travel faster than S waves and are the first to be recorded at a seismograph station. The S waves arrive after the P waves. The time difference between the arrival of the P waves and the S waves increases as the waves travel farther from their origin. This difference in arrival time, called *lag time*, can be used to find the distance to the epicenter of the earthquake. Once the distance from three different locations is determined, scientists can find the approximate location of the epicenter.

OBJECTIVES

Using Scientific Methods **Analyze** P waves and S waves to determine the distance from a city to the epicenter of an earthquake.

Determine the location of an earthquake epicenter using the distance from three different cities to the epicenter of an earthquake.

MATERIALS

- calculator
- drawing compass
- ruler

PROCEDURE

1. The average speed of P waves is 6.1 km/s. The average speed of S waves is 4.1 km/s. Calculate the lag time between the arrival of P waves and S waves over a distance of 100 km.

Finding an Epicenter *continued*

2. The graph below shows seismic records made in three cities following an earthquake. These traces begin at the left. The arrows indicate the arrival of the P waves. The beginning of the next wave on each seismograph record indicates the arrival of the S wave. Use the time scale to find the lag time between the P waves and the S waves for each city.

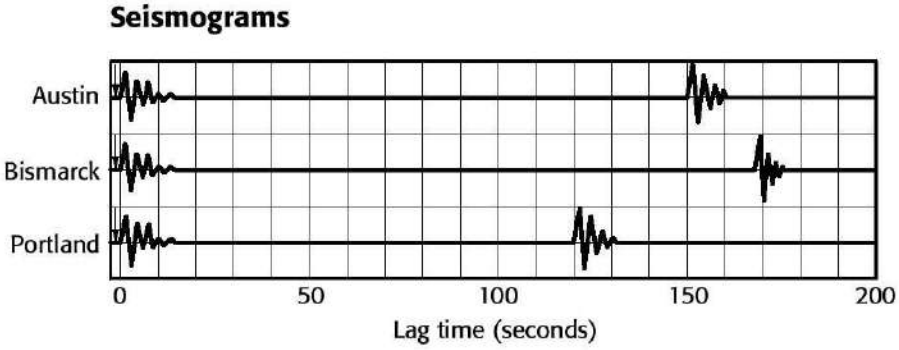

TABLE 1

City	Lag time (seconds)	Distance from city to epicenter
Austin		
Bismarck		
Portland		

3. Record lag time for each city in Table 1.

4. Use the lag times found in step 2 and the lag time per 100 km found in step 1 to calculate the distance from each city to the epicenter of the earthquake by using the equation below.

$$distance = \frac{measured\ lag\ time(s) \times 100\ km}{lag\ time\ for\ 100\ km}$$

5. Record distances in Table 1.

Finding an Epicenter *continued*

6. The map at right shows the location of the three cities. Using the map scale on the map, adjust the compass so that the radius of the circle with Austin at the center is equal to the calculation for Austin in step 2. Put the point of the compass on Austin. Draw a circle on the map.
7. Repeat step 6 for Bismarck and for Portland. The epicenter of the earthquake is located near the point at which the three circles intersect.

ANALYSIS AND CONCLUSION

1. **Evaluating Data** Describe the location of the earthquake's epicenter. To which city is the earthquake epicenter closest?

2. **Analyzing Processes** Why must measurements from three locations be used to find the epicenter of an earthquake?

EXTENSION

1. **Evaluating Data** Research earthquakes in the United States. What is the probability of a major earthquake occurring in the area where you live? If an earthquake did occur in your area, what would most likely cause the earthquake?