Name _____ Date _____ Class _____

Earthquakes and Seismic Waves

Key Concepts

- How does the energy of an earthquake travel through Earth?
- What are the scales used to measure the strength of an earthquake?
- How do scientists locate the epicenter of an earthquake?

An **earthquake** is the shaking and trembling that results from the movement of rock beneath Earth's surface. The point beneath Earth's surface where rock under stress breaks to cause an earthquake is called the **focus.** The point on the surface directly above the focus is called the **epicenter.** During an earthquake, vibrations called seismic waves move out from the focus in all directions. **Seismic waves carry the energy of an earthquake away from the focus, through Earth's interior, and across the surface.**

There are three categories of seismic waves: P waves, S waves, and surface waves. **P waves** compress and expand the ground like an accordion. **S waves** vibrate from side to side and up and down. When P waves and S waves reach the surface, some become surface waves. **Surface waves** move more slowly than P waves and S waves.

Three commonly used methods of measuring earthquakes are the Mercalli scale, the Richter scale, and the moment magnitude scale. The **Mercalli scale** was developed to rate earthquakes according to the level of damage at a given place. An earthquake's **magnitude** is a number that geologists assign to an earthquake based on the earthquake's strength. The **Richter scale** is a rating of an earthquake's magnitude based on the size of the earthquake's seismic waves. The seismic waves are measured by a **seismograph.** A seismograph is an instrument that records and measures seismic waves. Geologists today often use the **moment magnitude scale,** a rating system that estimates the total energy released by an earthquake. An earthquake's magnitude tells geologists how much energy was released by the earthquake. The effects of an earthquake increase with magnitude.

Geologists use seismic waves to locate an earthquake's epicenter. When an earthquake strikes, P waves arrive at a seismograph first and S waves next. The farther away the epicenter is, the greater the difference between the two arrival times. This time difference tells scientists how far from the seismograph the epicenter is. The scientists then use the information from three different seismograph stations to plot circles on a map. Each circle shows the distance from one seismograph station to all the points where the epicenter could be located. The single point where the three circles intersect is the location of the earthquake's epicenter.

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Understanding Main Ideas

Answer the following questions in the spaces provided.

1. What are seismic waves?

_____

_____

2. In what order do the three types of seismic waves arrive at a seismograph?

_____

_____

3. Which type of seismic wave produces the most severe ground movements?

_____

4. Describe the moment magnitude scale, and explain why it is useful in measuring earthquakes.

_____

_____

_____

5. How do geologists locate the epicenter of an earthquake?

_____

_____

_____

Building Vocabulary

Match each term with its definition by writing the letter of the correct definition in the right column on the line beside the term in the left column.

____ 6. focus

____ 7. epicenter

____ 8. surface waves

____ 9. seismograph

____ 10. magnitude

a. records ground movements caused by seismic waves as they move through the Earth

b. slowest seismic waves that produce the most severe ground movements

c. the point beneath Earth's surface at which rock under stress breaks and triggers an earthquake

d. a measurement of earthquake strength

e. the point on the surface directly above the point at which an earthquake occurs