Glencoe Science

Chapter Resources

Earthquakes

Includes:

Reproducible Student Pages

ASSESSMENT

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- ✔ Chapter Review

HANDS-ON ACTIVITIES

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- ✔ Laboratory Activities
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- ✔ Spanish Resources
- ✔ Teacher Guide and Answers

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Additional Assessment Resources available with Glencoe Science:

- Exam*View*® Pro Testmaker
- Assessment Transparencies
- Performance Assessment in the Science Classroom
- Standardized Test Practice Booklet
- MindJogger Videoquizzes
- Vocabulary PuzzleMaker at **msscience.com**
- Interactive Chalkboard
- The Glencoe Science Web site at: **msscience.com**
- An interactive version of this textbook along with assessment resources are available online at: **mhln.com**

To the Teacher

This chapter-based booklet contains all of the resource materials to help you teach this chapter more effectively. Within you will find:

Reproducible pages for

- Student Assessment
- Hands-on Activities
- Meeting Individual Needs (Extension and Intervention)
- Transparency Activities

A teacher support and planning section including

- Content Outline of the chapter
- Spanish Resources
- Answers and teacher notes for the worksheets

Hands-On Activities

MiniLAB and Lab Worksheets: Each of these worksheets is an expanded version of each lab and MiniLAB found in the Student Edition. The materials lists, procedures, and questions are repeated so that students do not need their texts open during the lab. Write-on rules are included for any questions. Tables/charts/graphs are often included for students to record their observations. Additional lab preparation information is provided in the *Teacher Guide and Answers* section.

Laboratory Activities: These activities do not require elaborate supplies or extensive pre-lab preparations. These student-oriented labs are designed to explore science through a stimulating yet simple and relaxed approach to each topic. Helpful comments, suggestions, and answers to all questions are provided in the *Teacher Guide and Answers* section.

Foldables: At the beginning of each chapter there is a *Foldables: Reading & Study Skills* activity written by renowned educator, Dinah Zike, that provides students with a tool that they can make themselves to organize some of the information in the chapter. Students may make an organizational study fold, a cause and effect study fold, or a compare and contrast study fold, to name a few. The accompanying *Foldables* worksheet found in this resource booklet provides an additional resource to help students demonstrate their grasp of the concepts. The worksheet may contain titles, subtitles, text, or graphics students need to complete the study fold.

Meeting Individual Needs (Extension and Intervention)

Directed Reading for Content Mastery: These worksheets are designed to provide students with learning difficulties with an aid to learning and understanding the vocabulary and major concepts of each chapter. The *Content Mastery* worksheets contain a variety of formats to engage students as they master the basics of the chapter. Answers are provided in the *Teacher Guide and Answers* section.

Directed Reading for Content Mastery (in Spanish): A Spanish version of the *Directed Reading for Content Mastery* is provided for those Spanish-speaking students who are learning English.

Reinforcement: These worksheets provide an additional resource for reviewing the concepts of the chapter. There is one worksheet for each section, or lesson, of the chapter. The *Reinforcement* worksheets are designed to focus primarily on science content and less on vocabulary, although knowledge of the section vocabulary supports understanding of the content. The worksheets are designed for the full range of students; however, they will be more challenging for your lower-ability students. Answers are provided in the *Teacher Guide and Answers* section.

Enrichment: These worksheets are directed toward above-average students and allow them to explore further the information and concepts introduced in the section. A variety of formats are used for these worksheets: readings to analyze; problems to solve; diagrams to examine and analyze; or a simple activity or lab which students can complete in the classroom or at home. Answers are provided in the *Teacher Guide and Answers* section.

Note-taking Worksheet: The *Note-taking Worksheet* mirrors the content contained in the teacher version—*Content Outline for Teaching*. They can be used to allow students to take notes during class, as an additional review of the material in the chapter, or as study notes for students who have been absent.

Assessment

Chapter Review: These worksheets prepare students for the chapter test. The *Chapter Review* worksheets cover all major vocabulary, concepts, and objectives of the chapter. The first part is a vocabulary review and the second part is a concept review. Answers and objective correlations are provided in the *Teacher Guide and Answers* section.

Chapter Test: The *Chapter Test* requires students to use process skills and understand content. Although all questions involve memory to some degree, you will find that your students will need to discover relationships among facts and concepts in some questions, and to use higher levels of critical thinking to apply concepts in other questions. Each chapter test normally consists of four parts: Testing Concepts measures recall and recognition of vocabulary and facts in the chapter; Understanding Concepts requires interpreting information and more comprehension than recognition and recall—students will interpret basic information and demonstrate their ability to determine relationships among facts, generalizations, definitions, and skills; Applying Concepts calls for the highest level of comprehension and inference; Writing Skills requires students to define or describe concepts in multiple sentence answers. Answers and objective correlations are provided in the *Teacher Guide and Answers* section.

Transparency Activities

Section Focus Transparencies: These transparencies are designed to generate interest and focus students' attention on the topics presented in the sections and/or to assess prior knowledge. There is a transparency for each section, or lesson, in the Student Edition. The reproducible student masters are located in the *Transparency Activities* section. The teacher material, located in the *Teacher Guide and Answers* section, includes Transparency Teaching Tips, a Content Background section, and Answers for each transparency.

Teaching Transparencies: These transparencies relate to major concepts that will benefit from an extra visual learning aid. Most of these transparencies contain diagrams/photos from the Student Edition. There is one *Teaching Transparency* for each chapter. The *Teaching Transparency Activity* includes a black-and-white reproducible master of the transparency accompanied by a student worksheet that reviews the concept shown in the transparency. These masters are found in the *Transparency Activities* section. The teacher material includes Transparency Teaching Tips, a Reteaching Suggestion, Extensions, and Answers to Student Worksheet. This teacher material is located in the *Teacher Guide and Answers* section.

Assessment Transparencies: An *Assessment Transparency* extends the chapter content and gives students the opportunity to practice interpreting and analyzing data presented in charts, graphs, and tables. Test-taking tips that help prepare students for success on standardized tests and answers to questions on the transparencies are provided in the *Teacher Guide and Answers* section.

Teacher Support and Planning

Content Outline for Teaching: These pages provide a synopsis of the chapter by section, including suggested discussion questions. Also included are the terms that fill in the blanks in the students' *Note-taking Worksheets.*

Spanish Resources: A Spanish version of the following chapter features are included in this section: objectives, vocabulary words and definitions, a chapter purpose, the chapter Activities, and content overviews for each section of the chapter.

Reproducible Student Pages

Reproducible Student Pages

■ Hands-On Activities

■ Meeting Individual Needs

Extension and Intervention

■ Assessment

■ Transparency Activities

Hands-On Activities

Mini LAB

Interpreting Seismic Wave Data

Procedure

1. Use the **graph** in **Figure 11** in your **textbook** to determine the difference in arrival times for primary and secondary waves at the distances listed in the data table below. Two examples are provided for you.
2. Use the graph to determine the differences in arrival times for the other distances in the table.

Data and Observations

Table 1

Wave Data

Distance (km)	Difference in Arrival Time
1,500	2 min, 50 s
2,250	
2,750	
3,000	
4,000	5 min, 55 s
7,000	
9,000	

Analysis

1. What happens to the difference in arrival times as the distance from the earthquake increases?

2. If the difference in arrival times at a seismographic station is 6 min, 30 s, how far away is the epicenter?

TRY AT HOME Mini LAB

Modeling Seismic-Safe Structures

Procedure

1. On a **tabletop,** build a structure out of **building blocks** by simply placing one block on top of another.
2. Build a second structure by wrapping sections of three blocks together with **rubber bands**. Then, wrap larger rubber bands around the entire completed structure.
3. Set the second structure on the tabletop next to the first one and pound on the side of the table with a slow, steady rhythm.

Analysis

1. Which of your two structures was better able to withstand the "earthquake" caused by pounding on the table?

2. How might the idea of wrapping the blocks with rubber bands be used in construction of supports for elevated highways?

Epicenter Location

Lab Preview

Directions: *Answer these questions before you begin the Lab.*

1. What is the difference between primary and secondary waves?

2. What do you use to measure the circumference of the globe?

In this lab you can plot the distance of seismograph stations from the epicenter of earthquakes and determine the earthquake epicenters.

Real-World Question

How can plotting the distance of several seismograph stations from an earthquake epicenter allow you to determine the locations of the epicenter?

Materials

string
metric ruler
globe
chalk

Goals

- **Plot** the distances of several seismograph stations based on primary and secondary wave arrival times.
- **Interpret** the location of earthquake epicenters from these plots.

Procedure

1. Determine the difference in arrival time between the primary and secondary waves at each station for each earthquake from Table 1 in the Data and Observations section.

2. After you determine the arrival time differences for each seismograph station, use the graph in **Figure 11** in your textbook to determine the distance in kilometers of each seismograph from the epicenter of each earthquake. Record these data in Table 2. For example, the difference in arrival times in Paris for earthquake B is 9 min, 30 s. On the graph, the primary and secondary waves are separated along the vertical axis by 9 min, 30 s at a distance of 8,975 km.

3. Using the string, measure the circumference of the globe. Determine a scale of centimeters of string to kilometers on Earth's surface. (Earth's circumference is 40,000 km.)

4. For each earthquake, place one end of the string at each seismic station location on the globe. Use the chalk to draw a circle with a radius equal to the distance to the earthquake's epicenter.

5. **Identify** the epicenter for each earthquake.

LAB (continued)

Data and Observations

Table 1

Earthquake Data

Location of Seismograph	Wave	Wave Arrival Times	
		Earthquake A	Earthquake B
New York, New York	P	2:24:05 P.M.	1:19:42 P.M.
	S	2:29:15 P.M.	1:25:27 P.M.
Seattle, Washington	P	2:24:40 P.M.	1:14:37 P.M.
	S	2:30:10 P.M.	1:16:57 P.M.
Rio de Janeiro, Brazil	P	2:29:10 P.M.	_____
	S	2:37:50 P.M.	_____
Paris, France	P	2:30:30 P.M.	1:24:57 P.M.
	S	2:40:10 P.M.	1:34:27 P.M.
Tokyo, Japan	P	_____	1:24:27 P.M.
	S	_____	1:33:27 P.M.

Table 2

Earthquake Distances

Quake	Calculated Distance to Epicenter (km) from Each Seismograph Location				
	New York	Seattle	Rio de Janeiro	Paris	Tokyo
A					
B					

Conclude and Apply

1. How is the distance of a seismograph from the earthquake related to the arrival times of the waves?

_____

_____

2. **Identify** the location of the epicenter for each earthquake.

_____

3. How many stations were needed to locate each epicenter accurately? _____

4. **Explain** why some seismographs didn't receive seismic waves from some quakes.

_____

Earthquake Depths

Lab Preview

Directions: *Answer these questions before you begin the Lab.*

1. What information is contained in the table?

2. Scan the data table to answer this question: Which earthquake originated at the deepest level?

You learned in this chapter that Earth's crust is broken into sections called plates. Stresses caused by movement of plates generate energy within rocks that must be released. When this release is sudden and rocks break, an earthquake occurs.

Real-World Question

Can a study of the foci of earthquakes tell you about plate movement in a particular region?

Materials

graph paper
pencil

Goals

- **Observe** any connection between earthquake-focus depth and epicenter location using the data provided on the next page.
- **Describe** any observed relationship between earthquake-focus depth and the movement of plates at Earth's surface.

Analyze Your Data

1. Use graph paper and the data table in your textbook to make a graph in your Science Journal plotting the depths of earthquake foci and the distances from the coast of a continent for each earthquake epicenter.
2. Follow the graph in your textbook. Place *Distance from the coast* and units on the *x*-axis. Begin labeling at the far left with 100 km west. To the right of it should be 0 km, then 100 km east, 200 km east, 300 km east, and so on through 700 km east. What point on your graph represents the coast?
3. Label the *y*-axis *Depth below Earth's surface.* Label the top of the graph *0 km* to represent Earth's surface. Label the bottom of the *y*-axis *–800 km.*
4. **Plot** the focus depths against the distance and direction from the coast for each earthquake in the table.

LAB (continued)

Data and Observations

Refer to the Focus and Epicenter Data Table in your textbook.

Conclude and Apply

1. **Describe** any observed relationship between the location of earthquake epicenters and the depth of foci.

2. **Explain** why none of the plotted earthquakes occurred below 700 km.

3. Based on your graph, form a hypothesis to explain what is happening to the plates at Earth's surface in the vicinity of the plotted earthquake foci. In what direction are the plates moving relative to each other?

4. **Infer** what process is causing the earthquakes you plotted on your graph.

5. **Infer** whether these earthquakes are occurring along the eastern side of a continent or along the western side of a continent.

6. **Draw and label** a cross section of the Earth beneath this coast. Label the eastern plate, the western plate, and use arrows to show the directions the plates are moving.

7. **Form a hypothesis** to predict which continent these data might apply to. Apply what you have learned in this lab and the information in **Figure 2.** Explain your answer.

Communicating Your Data

Compare your graph with those of other members of your class. **For more help, refer to the Science Skill Handbook**.

LAB 1 Laboratory Activity

Using the Modified Mercalli Scale to Locate an Epicenter

Earthquakes are classified using different scales. The Richter scale is a measure of the energy released during the earthquake. The Modified Mercalli scale is a measure of the amount of damage done by the earthquake. Scientists record responses from many people who experience the earthquake and assign a value from I (1) to XII (12). These numbers are plotted on a map and used to locate the epicenter of the earthquake. This method is based on the idea that the area closest to the epicenter will suffer the most damage.

Strategy

You will read simulated reports of people's earthquake experiences and then assign Modified Mercalli scale values to these reports.

You will plot these values on a map and locate the epicenter of the earthquake.

Materials

colored pencils

Procedure

1. Read the Modified Mercalli scale in Table 1 so you become familiar with the descriptions.
2. Read the list of experiences from the various cities in Table 2. Assign a Mercalli value to each of the descriptions. Then write each value on the map (Figure 1) next to the corresponding city.
3. Use colored pencils to draw lines that connect cities having the same Mercalli value.
4. Use the pattern you have drawn to estimate where the epicenter is located.

Laboratory Activity 1 (continued)

Data and Observations

Table 1

		Modified Mercalli Scale
I.	(1)	Earth movement is not felt by people.
II.	(2)	A few people may feel movement if they are sitting still. Hanging objects may sway.
III.	(3)	Felt noticeably indoors, especially on upper floors. May not be recognized as an earthquake.
IV.	(4)	During the day, felt indoors by many people, outdoors by few. At night, some are awakened. Dishes, windows, and doors rattle.
V.	(5)	Felt by almost everyone. Sleeping people are awakened. Some windows are broken and plaster cracked. Some unstable objects are overturned. Bells ring.
VI.	(6)	Felt by everyone. Many people are frightened and run outdoors. Some heavy furniture is moved, and some plaster may fall. Overall damage is slight.
VII.	(7)	People run outdoors. Earth movement is noticed by people driving cars. Damage is slight in well-built buildings and considerable in poorly built structures. Some chimneys are broken.
VIII.	(8)	Damage is slight in well-designed buildings and extreme in poorly built structures. Chimneys and walls may fall.
IX.	(9)	Damage is considerable in well-designed buildings. Buildings shift from their foundations and partly collapse. Ground may crack, and underground pipes are broken.
X.	(10)	Some well-built wooden structures are destroyed. Most masonry structures destroyed. Ground is badly cracked.
XI.	(11)	Few, if any, structures remain standing. Broad open cracks in the ground.
XII.	(12)	Complete destruction. Waves are seen on the ground surface.

Laboratory Activity 1 (continued)

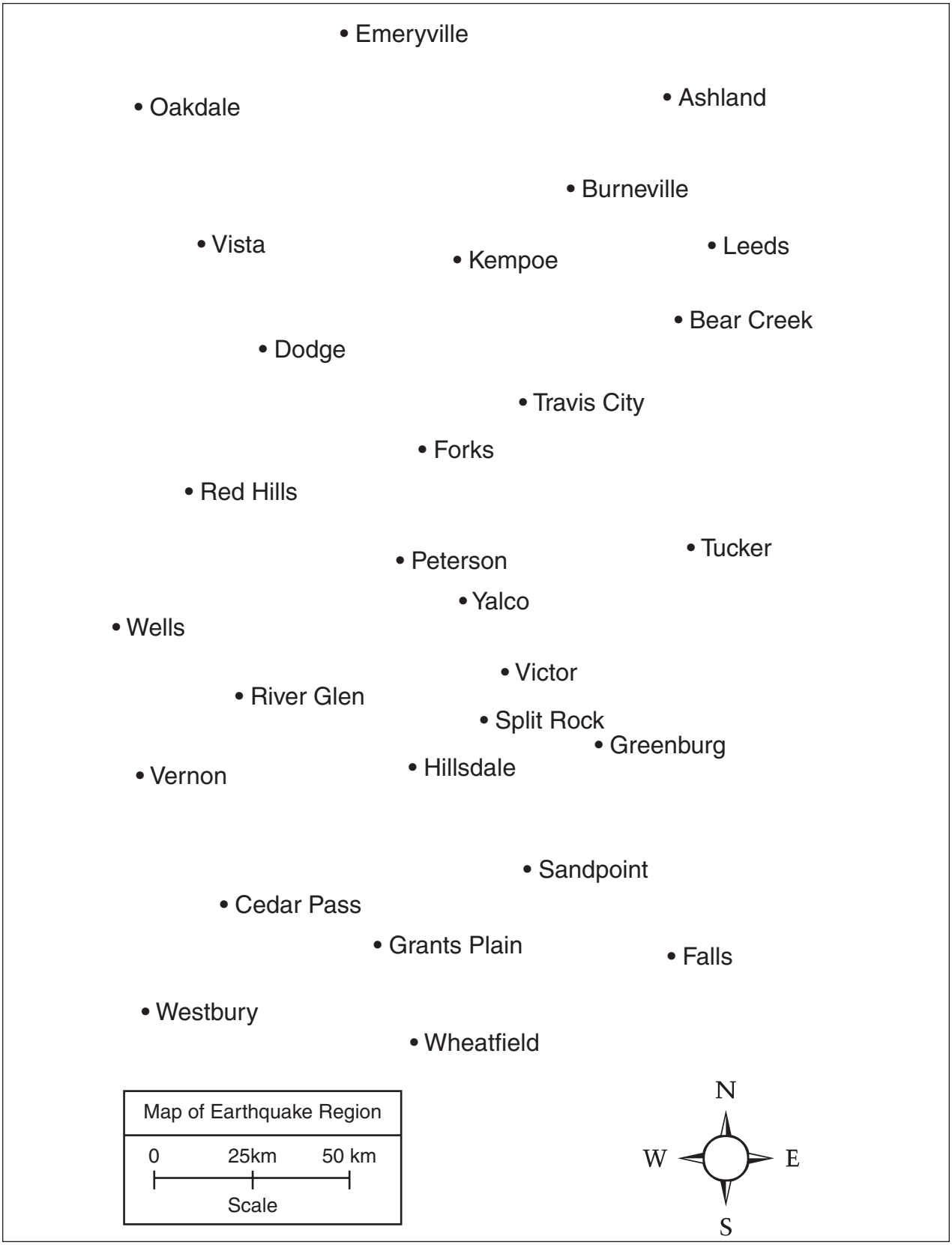
Table 2

Earthquake Observations and Data

1.	Ashland	Hanging lamps swayed.
2.	Bear Creek	People outdoors did not notice anything, but windows and doors rattled.
3.	Burneville	Felt by people sitting at dinner.
4.	Cedar Pass	Families sitting at dinner noticed the dishes rattling.
5.	Dodge	Dishes, windows, and doors rattled.
6.	Emeryville	Not felt.
7.	Falls	Felt by nearly everybody. A few windows were broken.
8.	Forks	Big windows in stores downtown were broken.
9.	Grants Plain	Church bells rang all over town. Plaster walls developed cracks. Candlesticks fell off the mantel.
10.	Greenburg	Not much damage but felt by everyone.
11.	Hillsdale	Some plaster ceilings fell. Many people were scared.
12.	Kempoe	Felt by some people on upper floors. Some windows rattled.
13.	Leeds	Noticed by many people working late in tall buildings.
14.	Oakdale	Felt by a few people.
15.	Peterson	Felt by almost everyone. Some plaster ceilings fell down.
16.	Red Hills	Some people are awakened out of their sleep.
17.	River Glen	Felt by almost everybody in town.
18.	Sandpoint	Many windows were broken. Some people were scared.
19.	Split Rock	Poorly built structures were badly damaged. A few drivers noticed their cars moving strangely for a moment.
20.	Travis City	Almost everyone felt it. Church bells rang.
21.	Tucker	Books fell off the shelves in the main library, and some windows were broken.
22.	Vernon	Dishes in the cupboard rattled. Felt by people indoors.
23.	Victor	Most people were alarmed and ran outside. Chimneys were broken.
24.	Vista	Felt by people in upper floors of tall buildings.
25.	Wells	Noticed by people on the third floor. Some windows rattled.
26.	Westbury	Some people noticed the vibration but thought it was a freight train.
27.	Wheatfield	People sitting at the dinner table noticed doors and windows rattling.
28.	Yalco	Many people ran outside. Many windows were broken.

Laboratory Activity 1 (continued)

Figure 1



Laboratory Activity 1 (continued)

Questions and Conclusions

1. What cities were closest to the epicenter of the earthquake? How did you determine this?

2. Approximately how wide was the zone with a rating of V or higher?

3. What are some possible sources of error when using the Modified Mercalli scale to locate the epicenter of an earthquake?

Strategy Check

_____ Can you determine Mercalli values?

_____ Can you locate earthquake epicenters?

LAB 2 Laboratory Activity

Earthquakes

Seismologists—the scientists who study earthquakes—have found that certain areas are more likely to have earthquakes than others. The risk is greater in these areas because they lie over active geologic faults. Maps that pinpoint earthquakes all over the world show that the greatest seismic belt borders the Pacific Ocean. Every state in the United States has had at least one earthquake, but some states have had stronger and more frequent earthquakes than others.

A magnitude-5 earthquake is classified as moderate, a magnitude-6 earthquake is large, and a magnitude-7 earthquake is major. An earthquake with a magnitude of 8 or larger is classified as great.

Strategy

You will study the occurrence of strong earthquakes in the United States by plotting earthquakes on a map.

You will determine which areas of the United States are most likely to have strong earthquakes.

Procedure

1. Plot the data from Table 1 in the Data and Observations section on Map 1. Place one dot in the state for each recorded earthquake. Use an atlas or other reference to help you locate the states.
2. Count the number of dots within each state and write that number within the state's borders.

Data and Observations

Table 1

Some Earthquakes in the United States with a Magnitude of 7 and Above

State	Year	Magnitude	State	Year	Magnitude
Alaska	1964	9.2	California	1872	7.8
Alaska	1957	8.8	California	1892	7.8
Alaska	1965	8.7	Missouri	1811	7.7
Alaska	1938	8.3	California	1906	7.7
Alaska	1958	8.3	Nevada	1915	7.7
Alaska	1899	8.2	Missouri	1812	7.6
Alaska	1899	8.2	California	1992	7.6
Alaska	1986	8.0	California	1952	7.5
Missouri	1812	7.9	California	1927	7.3
California	1857	7.9	Nevada	1954	7.3
Hawaii	1868	7.9	Montana	1959	7.3
Alaska	1900	7.9	Idaho	1983	7.3
Alaska	1987	7.9	California	1922	7.3

Laboratory Activity 2 (continued)

Questions and Conclusions

1. In what regions have damaging earthquakes been concentrated?

2. From the table, which earthquake(s) can be classified as great?

3. What does a concentration of damaging earthquakes indicate about the underlying rock structure of the area?

4. Can you be sure that an earthquake could not occur in any area?

5. According to the map, is it likely that a damaging earthquake will occur in your state?

6. The earthquakes in 1811 and 1812 in Missouri occurred near the Mississippi River. The soil near the river tends to be wet. Do you think liquefaction took place during the earthquakes? Why or why not?

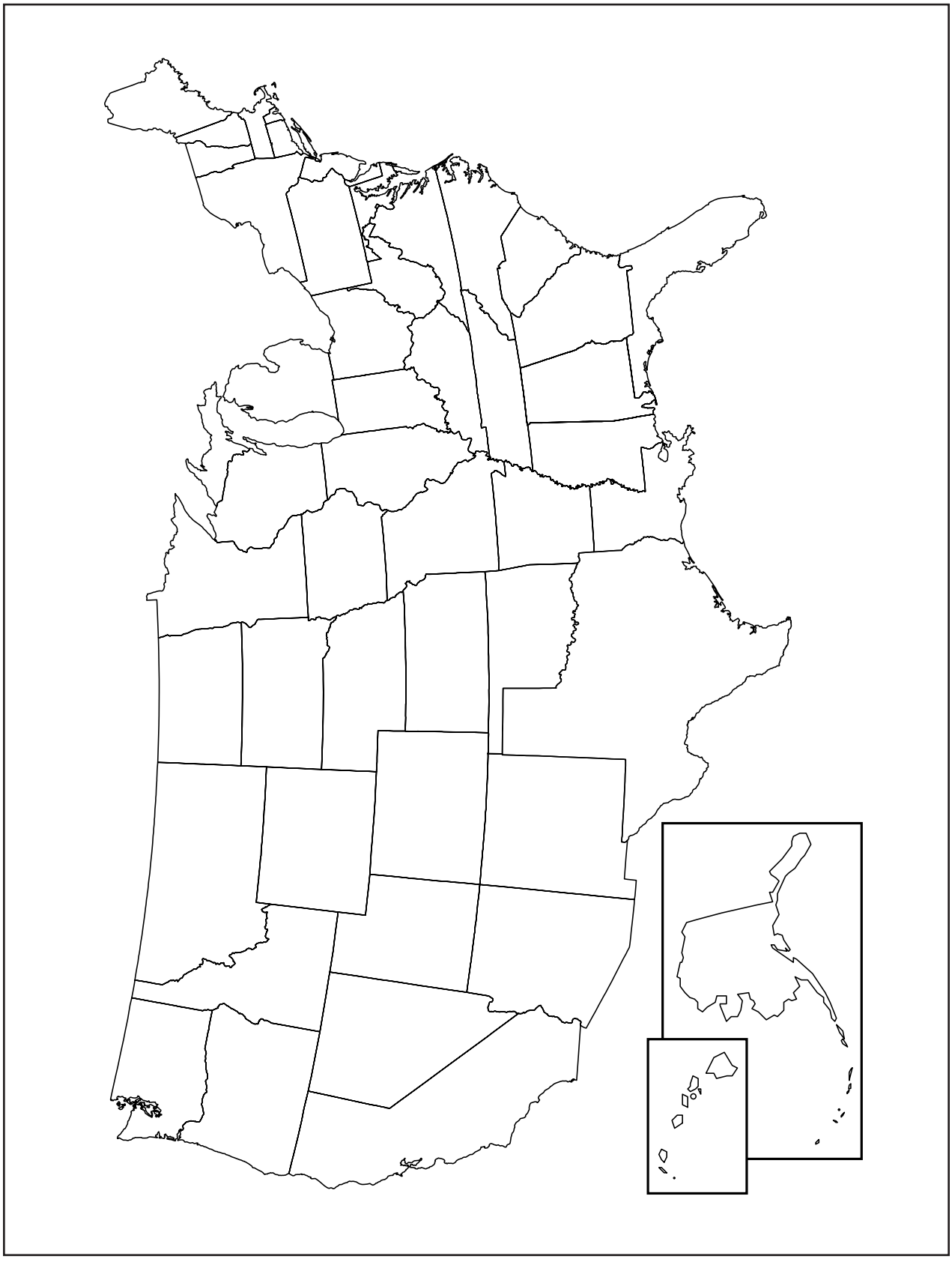
Strategy Check

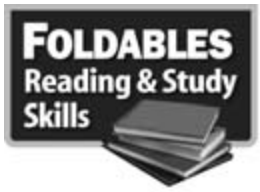
_____ Can you observe where most damaging earthquakes have occurred in the United States?

_____ Can you predict the parts of the United States most likely to experience strong earthquakes?

Laboratory Activity 2 (continued)

Map 1





Earthquakes

Directions: *Use this page to label your Foldable at the beginning of the chapter.*

Cause

Effect

Rocks along a fault are stretched beyond their elastic limit and break.

Forces inside Earth cause Earth's plates to move, putting stress on rocks at the edge of the plates.

caused by rocks moving along different types of faults, such as a strike-slip fault

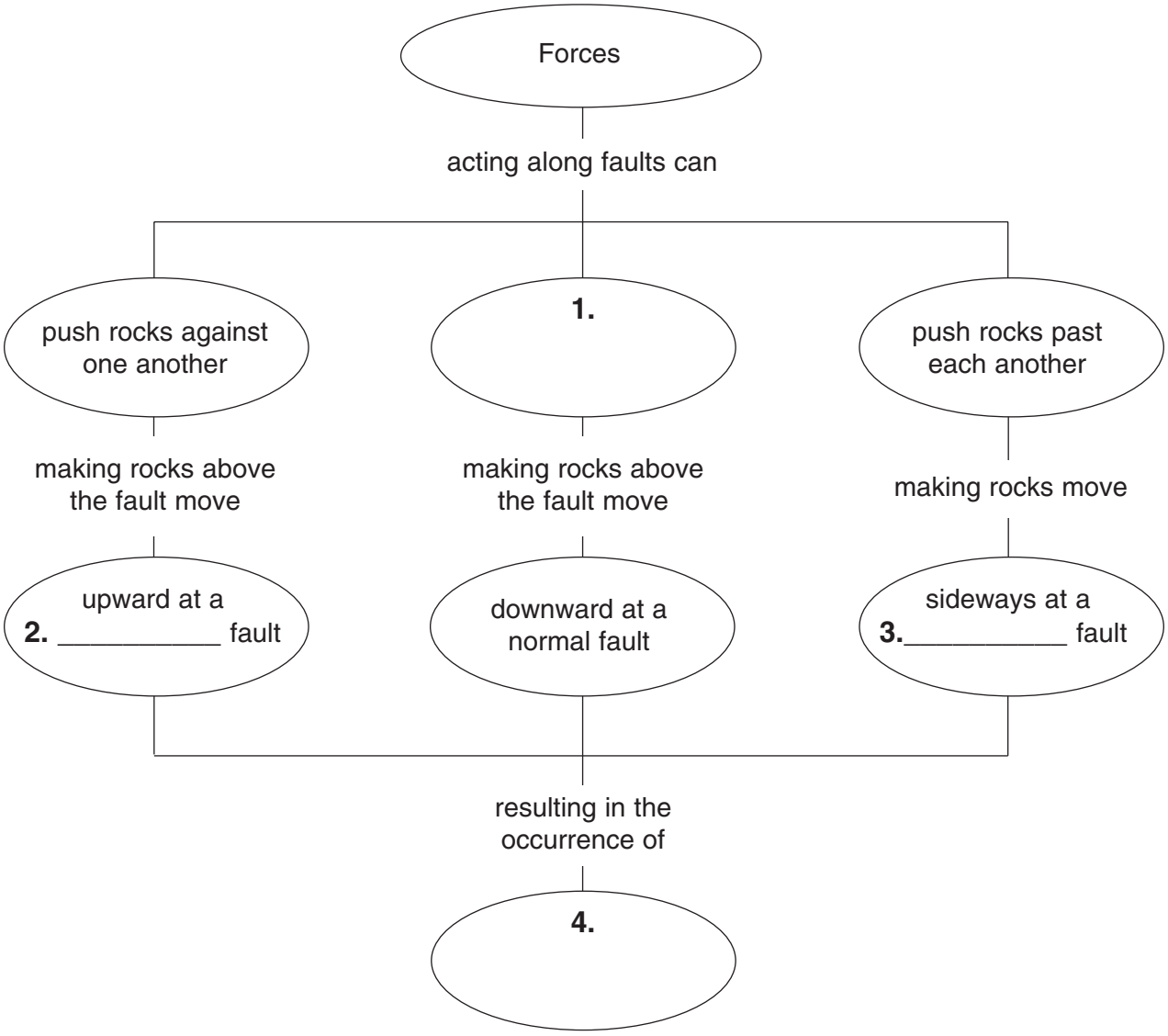
Meeting Individual Needs

Directed Reading for Content Mastery

Overview Earthquakes

Directions: *Complete the concept map using the terms in the list below.*

reverse **strike-slip** **earthquakes** **pull rocks apart**



Directions: *Answer the following questions on the lines provided.*

5. What kind of waves are responsible for all the damage an earthquake causes?

_____

6. The _____ scale is used to describe the strength of an earthquake.

7. The _____ scale is used to describe the amount of damage an earthquake causes.

Name Date Class

Directed Reading for Content Mastery

Section 1 ▪ Forces Inside Earth

Directions: *Unscramble the terms in italics to complete the sentences below. Write the terms on the lines provided.*

_____ **1.** Forces cause sections of Earth's surface, called *petals*, to move.

_____ **2.** When rocks break, they move along surfaces called *stufla.*

_____ **3.** To relieve the *srests* caused by plate movement, rocks tend to bend, compress, or stretch.

_____ **4.** When rocks are stressed beyond their *staleci* limit they break, move along the fault, and return to their original shapes.

_____ **5.** An *akquethera* is the vibrations produced by the breaking of rock.

_____ **6.** At a *roamnl* fault, tension pulls rocks apart.

_____ **7.** At a *riskte-pils* fault, rocks move past each other.

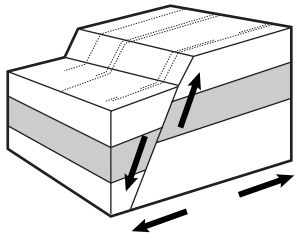
_____ **8.** At a normal fault, rock above the fault surface moves *ddwwoanr* in relation to rock below the fault surface.

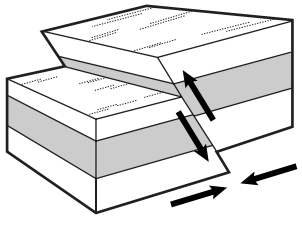
_____ **9.** At a *rreeesv* fault, rocks above the fault surface move up and over the rocks below the fault surface.

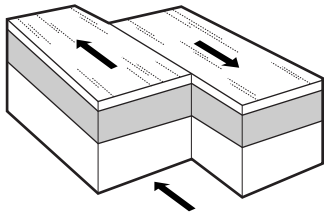
_____ **10.** At a reverse fault, *mnopsericos* forces pushes on rocks from opposite directions.

_____ **11.** *earsh* forces can cause strike-slip faults.

Directions: *Identify the faults shown below as* **reverse**, **normal,** *or* **strike-slip.**







12. _____ **13.** _____ **14.** _____

Meeting Individual Needs

Directed Reading for Content Mastery

Section 2 ▪ Features of Earthquakes
Section 3 ▪ People and Earthquakes

Directions: *For each of the following, write the letter of the term or phrase the best completes the sentence or answers the question.*

_____ **1.** When an earthquake occurs, energy is released in the form of _____.
a. seismic waves **b.** faults

_____ **2.** What kind of waves cause particles in rocks to move at right angles to the direction of the wave?
a. primary waves **b.** secondary waves

_____ **3.** What kind of waves cause particles in rocks to move back and forth in the same direction?
a. primary waves **b.** faults

_____ **4.** An earthquake's _____ is the point on Earth's surface directly above the earthquake focus.
a. elastic limit **b.** epicenter

_____ **5.** _____ waves cause the most destruction.
a. Secondary **b.** Surface

_____ **6.** _____ waves are the fastest.
a. Primary **b.** Secondary

_____ **7.** At the very center of Earth is a _____.
a. liquid layer of minerals **b.** solid, dense inner core

_____ **8.** Earth's largest layer is the _____.
a. mantle **b.** crust

_____ **9.** The Richter scale measures the _____ of an earthquake.
a. magnitude **b.** intensity

_____ **10.** An earthquake that measured X on the modified Mercalli scale would cause _____ damage.
a. very little **b.** considerable

_____ **11.** Suppose water along a shoreline moves rapidly toward the sea, exposing a large portion of land that is usually under the water. This is a clue that a _____ might strike.
a. tsunami **b.** liquefaction

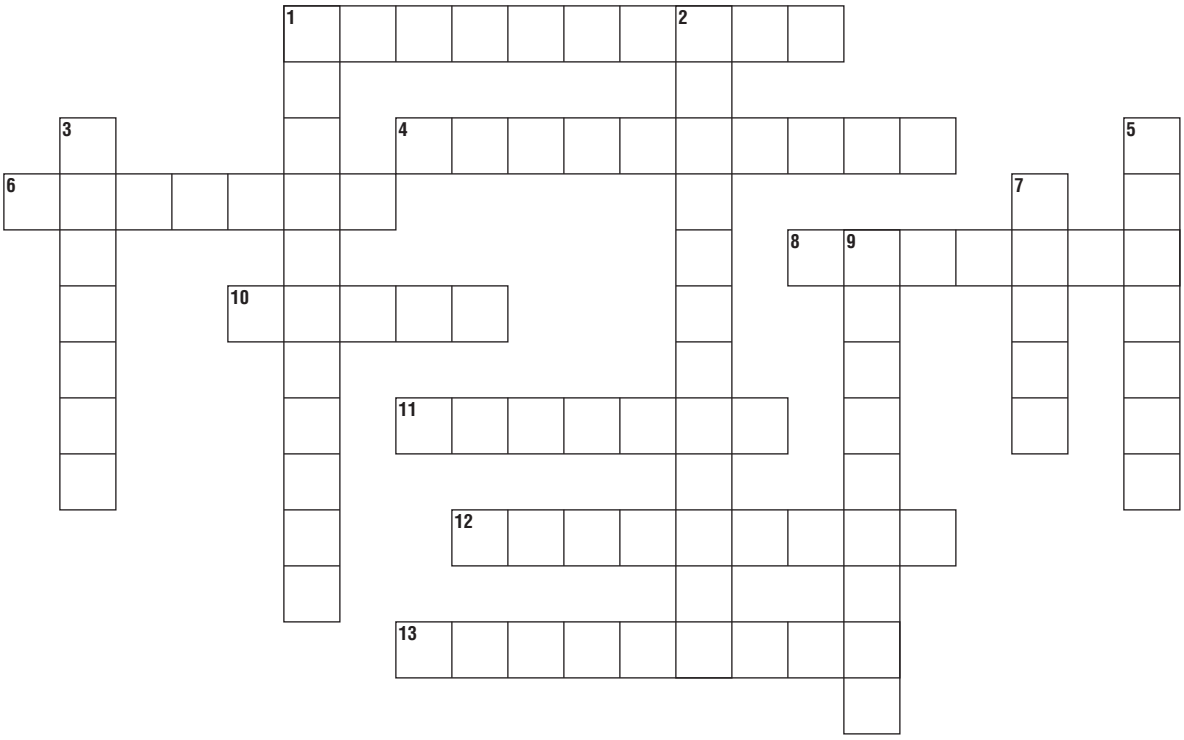
Meeting Individual Needs

Name Date Class

Directed Reading for Content Mastery

Key Terms
Earthquakes

Directions: *Use the clues below to complete the crossword puzzle.*



Across

1. The rocks on either side of a _____ fault move sideways past each other.
4. Vibrations produced by the breaking of rock
6. The rocks above a _____ fault are forced up and over the rocks below the fault.
8. Ocean wave caused by an earthquake
10. The point where rocks break and release energy in the form of seismic waves
11. Wave that moves rock particles in a backward rolling motion and a side-to-side swaying motion
12. A measure of the energy released by an earthquake
13. The point on the surface of Earth directly above the earthquake's focus

Down

1. Instrument that measures seismic waves
2. When the soil becomes more liquid
3. The waves of energy that an earthquake produces
5. Kind of wave that causes particles in rocks to move back and forth in the same direction that the wave is traveling
7. The rocks on either side of a _____ move in different directions.
9. Kind of wave that causes particles in rocks to move at right angles to the direction of the wave

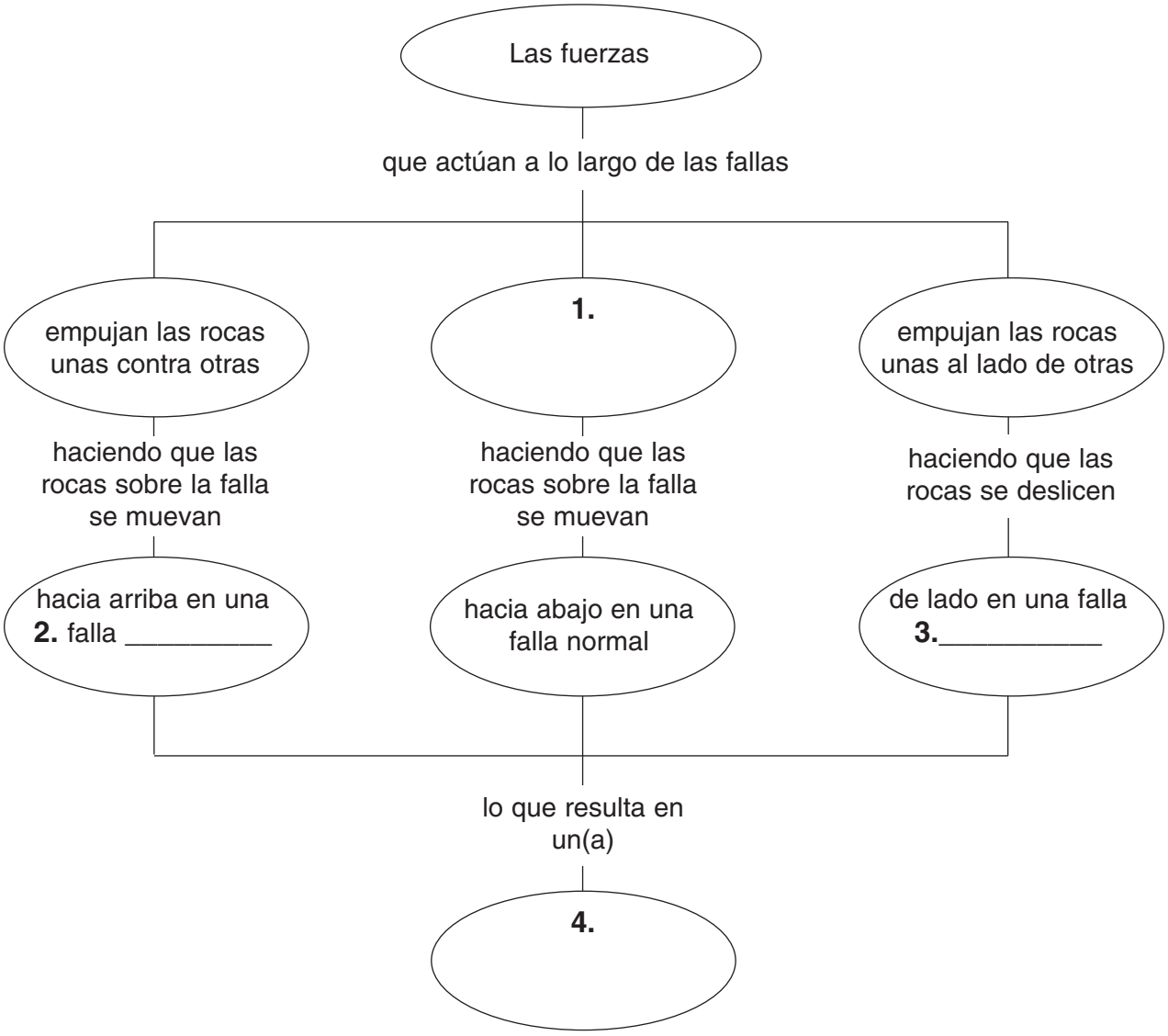
Meeting Individual Needs

Lectura dirigida para Dominio del contenido

Sinopsis Terremotos

Instrucciones: *Completa el mapa de conceptos usando los siguientes términos.*

invertida **transformante** **terremotos** **separan las rocas**



Instrucciones: *Responde las preguntas en los espacios dados.*

5. ¿Qué tipo de ondas son responsables de todo el daño que causan los terremotos?

_____

6. La escala _____ se usa para describir la fuerza de un terremoto.

7. La escala _____ se usa para describir la cantidad de daño que causa un terremoto.

Satisface las necesidades individuales

Lectura dirigida para Dominio del contenido

Sección 1 ▪ Las fuerzas dentro de la Tierra

Instrucciones: *Ordena las letras de los términos y completa las oraciones. Escribe los términos en las líneas dadas.*

_____ **1.** Fuerzas que causan el movimiento de secciones de la superficie terrestre llamadas *casalp*.

_____ **2.** Cuando las rocas se quiebran, se mueven a lo largo de superficies llamadas *flaals*.

_____ **3.** Para liberar la *sótienn* causada por el movimiento de las placas, las rocas tienden a doblarse, comprimirse o estirarse.

_____ **4.** Las rocas se quiebran cuando experimentan tensión más allá de su límite de *dadcitisale*, se mueven a lo largo de la falla y retornan a su forma original.

_____ **5.** Un *mrotoreet* es la vibración producida al quebrarse las rocas.

_____ **6.** En una falla *roamnl* , la tensión separa las rocas.

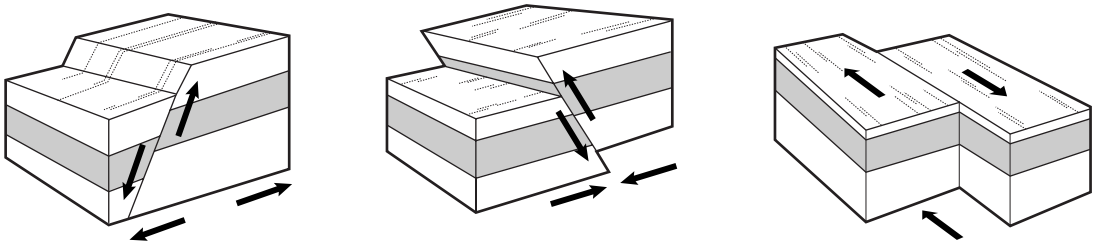
_____ **7.** En una falla *mtrrofasntane*, las rocas se deslizan unas al lado de las otras.

_____ **8.** En una falla normal, la roca sobre la superficie de la falla se mueve hacia *jabao* en relación a la roca que está bajo la superficie de la falla.

_____ **9.** En una falla *dativerin*, las rocas sobre la superficie de la falla se mueven hacia arriba y sobre las rocas que están bajo la superficie de la falla.

_____ **10.** En una falla invertida, fuerzas de *prósicemon* empujan las rocas desde direcciones opuestas.

_____ **11.** Las fuerzas de *mientollazaci* pueden causar fallas transformantes.



Instrucciones: *Identifica las fallas como* **invertida**, **normal** *o* **transformante.**

12. _____ **13.** _____ **14.** _____

Satisface las necesidades individuales

Lectura dirigida para Dominio del contenido

Sección 2 ▪ Características de los terremotos
Sección 3 ▪ La gente y los terremotos

Instrucciones: *Escribe la letra del término o frase que complete mejor cada oración.*

_____ **1.** Cuando ocurre un terremoto, la energía se libera en forma de _____.
a. ondas sísmicas **b.** fallas

_____ **2.** ¿Qué tipo de onda hace que las partículas en las rocas se muevan en ángulo recto a la dirección de la onda?
a. ondas primarias **b.** ondas secundarias

_____ **3.** ¿Qué tipo de onda ocasiona que las partículas en las rocas se muevan hacia adelante y hacia atrás en la misma dirección de la onda?
a. ondas primarias **b.** fallas

_____ **4.** El _____ de un terremoto es el punto sobre la superficie terrestre directamente encima del foco del terremoto.
a. límite de elasticidad **b.** epicentro

_____ **5.** Las ondas _____ causan la mayor destrucción.
a. secundarias **b.** de superficie

_____ **6.** Las ondas _____ son las más rápidas.
a. primarias **b.** secundarias

_____ **7.** En el centro de la Tierra hay un(a) _____.
a. capa líquida de minerales **b.** capa líquida de minerales

_____ **8.** La capa más grande de la Tierra es el(la) _____.
a. manto **b.** corteza

_____ **9.** La escala Richter mide la _____ de un terremoto.
a. magnitud **b.** intensidad

_____ **10.** Un terremoto que midió una intensidad de X en la escala modificada de Mercalli causaría _____ daños.
a. muy pocos **b.** considerables

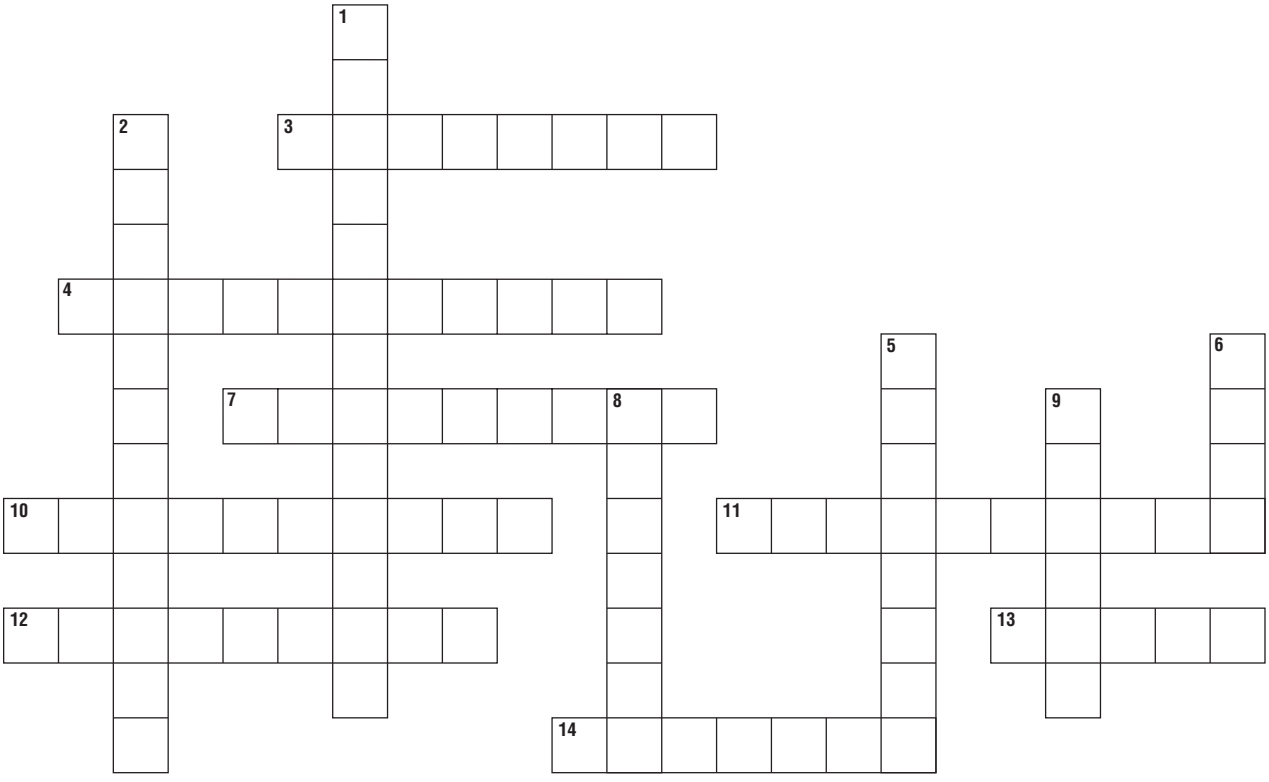
_____ **11.** Supongamos que el agua a lo largo de la costa se mueve rápidamente hacia el mar, dejando expuesta una gran porción de tierra que generalmente está bajo el agua. Esto es una clave de que podría suceder un(a)_____.
a. tsunami **b.** licuefacción

Satisface las necesidades individuales

Lectura dirigida para Dominio del contenido

Términos claves Terremotos

Instrucciones: *Usa las siguientes claves para completar el crucigrama.*



Horizontales

3. Medida de la energía liberada por un terremoto

4. Onda que mueve las partículas de las rocas en un movimiento circular hacia atrás y las mece de lado a lado.

7. Vibraciones producidas cuando las rocas se quiebran.

10. Tipo de onda que mueve las partículas de las rocas a ángulo recto de la dirección de la onda.

11. Instrumento que mide las ondas sísmicas

12. Punto sobre la superficie terrestre que está directamente encima del foco de un terremoto.

13. Las rocas a ambos lados de un(a) _____ se mueven en direcciones diferentes.

14. Ondas de energía producidas por los terremotos

Verticales

1. Las rocas a ambos lados de una falla _____ se mueven lateralmente.

2. Cuando el suelo se hace más líquido

5. Tipo de onda que hace que las partículas de las rocas se muevan hacia atrás y hacia adelante en la misma dirección en que viaja la onda

6. Punto en el cual se quiebran las rocas y liberan energía en forma de ondas sísmicas

8. Ola oceánica causada por un terremoto.

9. Las rocas sobre una falla _____ son forzadas hacia arriba y sobre las rocas debajo de la falla

Satisface las necesidades individuales

Name Date Class

SECTION 1 Reinforcement

Forces Inside Earth

Directions: *Write the term that matches each description below on the spaces provided. Then rearrange the letters in the boxes to form a word for the force that creates reverse faults.*

1. This is the name for the vibrations that rocks produce when they break. ☐ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___

2. Earthquakes happen when these sections of Earth's crust move. ___ ___ ___ ___ ___ ☐

3. This force causes rocks on either side of a fault to slide past each other. ☐ ___ ___ ___ ___

4. Tension pulls rocks apart and creates this kind of fault. ___ ☐ ___ ☐ ___ ___

5. A bending and stretching rock will break when it reaches this point. ___ ___ ___ ___ ___ ___ ☐ ___ ___ ___ ___ ___

6. Rocks on either side of this kind of fault move past each other without much upward or downward movement. ___ ___ ___ ☐ ___ ___ - ___ ___ ___ ☐

7. Rocks above this kind of fault are forced up and over rocks below this fault. ___ ___ ___ ___ ☐ ___ ___

8. This force creates a normal fault. ___ ___ ☐ ___ ___ ☐ ___

9. Force that creates reverse faults: _____

Directions: *Find the mistakes in the statements below. Rewrite each statement correctly on the lines provided.*

10. The surface of Earth is in constant motion because of forces on the planet's surface.

_____

_____

11. As rocks move past each other along a fault, their rough surfaces catch and permanently halt movement along the fault.

_____

_____

_____

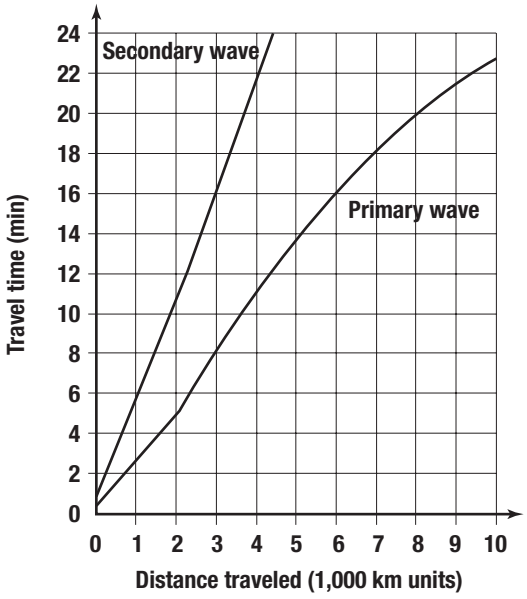
Meeting Individual Needs

Name Date Class

SECTION 2 Reinforcement

Features of Earthquakes

Directions: *The graph below shows travel time in minutes and distance traveled for primary and secondary waves. Primary and secondary waves start at the same time but do not travel at the same speed. Study the graph. Use the graph to help answer the questions that follow.*



1. How long does it take for a primary wave to travel 2,000 km?

_____

2. How long does it take for a secondary wave to travel 2,000 km?

_____

3. How far does a secondary wave travel in 10 min? _____

4. How far does a primary wave travel in 10 min? _____

5. What happens to the time difference between primary and secondary waves as the distance traveled gets longer?

_____

6. Suppose a primary and secondary wave both travel a distance of 4,000 km before they are picked up by a seismograph. Which wave will arrive first?

_____

7. How much time lag at 4,000 km will there be between these two waves?

_____

8. Suppose both a primary and secondary wave start together and travel for 5 min. Which wave will travel farther?

_____

Name Date Class

SECTION 3 Reinforcement

People and Earthquakes

Directions: *In the space provided, write* **R** *if the description refers to the Richter scale and* **M** *if it refers to the modified Mercalli scale.*

_____ **1.** based on the height of the lines traced by a seismograph

_____ **2.** describes the strength of an earthquake

_____ **3.** describes the amount of damage an earthquake causes

_____ **4.** an earthquake with an intensity of VII

_____ **5.** an earthquake with a magnitude of 8.5

Directions: *Write* **true** *if the statement is true. If the statement is false, rewrite the word or words in italics to make the statement true.*

_____ **6.** The paper record of a seismic event is called a *seismograph.*

_____ **7.** Far from shore, a large ship might ride over a seismic *sea wave* without anyone noticing it.

_____ **8.** A *seismogram* consists of a rotating drum of paper and a pendulum with an attached pen.

_____ **9.** An intensity-XII earthquake would cause *little* destruction.

_____ **10.** For safety's sake, people who live in earthquake regions *should* build their houses on loose soils.

_____ **11.** When liquefaction occurs, the soil becomes *more liquid* and buildings can sink into it and collapse.

_____ **12.** A seismic sea wave and a tsunami *are* the same thing.

_____ **13.** The water along a shoreline may flow *toward* the sea just before a tsunami crashes on shore.

_____ **14.** In some new buildings made of steel plates and rubber parts, the *steel* acts like a cushion to absorb earthquakes.

_____ **15.** One way to make your home earthquake-safe is to place heavy objects on *high* shelves so they won't fall on you.

Meeting Individual Needs

Name Date Class

SECTION 1 Enrichment

Earthquake Myths

Although we understand that earthquakes are natural, geological events caused by rocks moving over, under, or past each other along fault surfaces, this wasn't always common knowledge. Throughout the centuries, people believed that earthquakes were caused by everything from people and animals living below Earth's surface, to wild winds trapped underground struggling to escape, to giants and gods who held Earth, then let it go.

Modern Misconceptions

While these ancient stories seem silly to us now, there are some earthquake myths that still exist today. Modern-day myths, however, are not about how earthquakes are caused, but about when they occur and what happens during one. For example, many people believe when an earthquake hits, the ground opens up beneath the fault and swallows up people, buildings, cars, and so forth. In reality, an earthquake moves across a fault. Therefore the ground doesn't open as it might if the quake moved away from the fault. Small, shallow crevices can form, but there's no evidence to prove that anyone has ever been swallowed by Earth during a quake.

Some people also believe that the safest place to be during an earthquake is in a doorway. A doorway shouldn't be your first choice. You're safer under a desk or table. Doorways can collapse with the rest of a building.

Time and Place

Another modern-day myth is the belief that earthquakes happen only in California. Earthquakes can happen anywhere. They can also happen any time, contrary to the notion that major earthquakes happen only in the morning. Although some recent, major earthquakes have happened in the morning hours, there's no pattern to when earthquakes occur. Indeed, many major earthquakes also have occurred later in the day.

Directions: *Use the encyclopedia and other library resources to answer the following questions.*

1. How do you think the myths of earthquakes swallowing up people came about? Is there a geological phenomenon that does "swallow up" people?

2. What is the earthquake history of your state? Do scientists think earthquakes are likely to occur in your region in the future?

3. How can understanding modern-day earthquake myths help you to help keep your family safe in the event of an earthquake? Be specific.

Meeting Individual Needs

Name Date Class

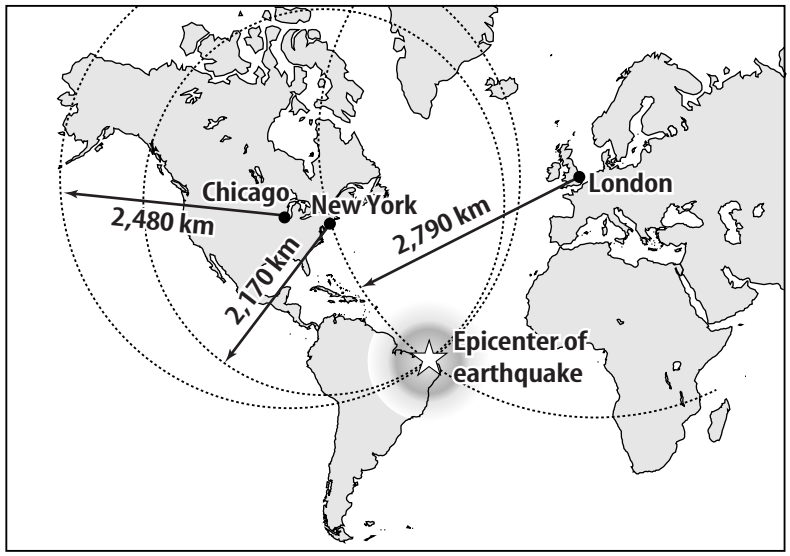
SECTION 2 Enrichment

Determining the Time of an Earthquake

Directions: *Read the information and study the table giving travel times of seismic waves from an earthquake. Then study the map identifying the epicenter of the earthquake to answer the questions below.*

Distance from epicenter (km)	Travel Time					
	Primary waves		Secondary waves		Surface waves	
	min	s	min	s	min	s
620	3	20	6	0	7	20
1,240	5	56	10	48	14	16
1,860	8	00	14	30	21	30
2,480	9	50	17	50	27	50
3,100	11	26	20	51	35	56
3,720	12	43	23	27	41	43

Seismologists use the distance from an epicenter plus the times of the arrival of primary, secondary, and surface waves to determine the time an earthquake begins.



1. On what continent did the earthquake occur?

_____

2. How far was the earthquake from London? New York? Chicago?

_____

_____

3. How long did it take the primary waves to reach Chicago?

_____

4. The primary waves reached Chicago at 9:00 A.M. When did the earthquake occur in Chicago time? What math operation did you use to determine the time of the earthquake?

_____

5. The earthquake epicenter was located two time zones east of Chicago. What time was it in the time zone containing the epicenter when the earthquake began? _____

Meeting Individual Needs

SECTION 3 Enrichment

The New Madrid Fault

Of all the states, California faces the highest risk of earthquakes. This is due, in part, to a major break in Earth's crust that runs through the state for approximately 1,050 km. This fracture, the San Andreas Fault, was responsible for the killer San Francisco earthquake in 1906 and countless others since.

Along Another Fault

A series of three earthquakes between December 16, 1811, and February 7, 1812, took place not in California, but in Missouri, along a quake zone called the New Madrid Fault. All three have been estimated to have measured 8.0 or above on the Richter scale, making them among the largest American earthquakes ever. Tremors were felt as far east as Boston. Aftershocks continued for more than a year. Besides devastating 7,800 to 13,000 km^2 of land, the earthquake caused the Mississippi River to reverse its direction temporarily and begin to flow upstream. The earthquake also caused the Mississippi to permanently change its course and create lakes and islands where there hadn't been any before.

The New Madrid Fault is 70 km wide, 300 km long, and located near New Madrid, Missouri. It runs primarily through Missouri, Arkansas, Kentucky, and Tennessee. If an earthquake happened, it could affect up to 17 states surrounding the fault zone. For a long time, geologists thought that a New Madrid earthquake was likely to happen only every 1,000 years or so.

Risk Managment

Unfortunately, earthquakes can and do happen anytime, anywhere. Scientists are still unable to predict them, so they're constantly working on ways to prepare for an earthquake and to minimize the damage to lives and property. In the fall of 2000, representatives from 26 earthquake-prone states met at the first-ever National Earthquake Risk Management Conference. They discussed, among other things, the New Madrid Fault and the need to make people aware that earthquakes don't just happen in California.

Scientists predict that a New Madrid earthquake could result in $20 billion in damages. And with increased land development and urban sprawl hitting all the communities located on the New Madrid Fault, it's likely the human cost would be very high, too.

1. Where could you find information on earthquake preparedness? Is this something you and your family need to think about? Give at least two reasons.

2. When the New Madrid earthquakes of 1811–1812 hit, there were very few people or buildings in the area. Now scientists predict that a similar earthquake would cause damage from St. Louis to Memphis, causing billions of dollars in property damage and the loss of hundreds of lives. What effect would a New Madrid earthquake have on the land itself?

3. List some safety measures your school could take to prepare for an earthquake.

Note-taking Worksheet

Earthquakes

Section 1 Forces Inside Earth

A. When rocks break they move along _____.

1. Applied forces cause rocks to undergo _____.

2. When elastic _____ are passed, rocks break.

3. Rock on one side of a fault can move _____, _____, or _____ in relation to rock on the other side of the fault.

B. Faults occur because forces inside the Earth cause Earth's _____ to move placing stress on or near the plate edge.

1. Rocks will bend, compress, _____, and possibly break.

2. _____—vibrations produced by breaking rock

a. Rocks break, move along the fault, return to original _____

b. Rock on one side of a fault can move over, under, or _____ each other along fault lines.

C. Three types of _____ act on rocks – tension, compression, and shear.

1. Tension forces; _____ **fault—**caused by rock above the fault moving downward in relation to the rock below the fault

2. _____ **fault**—compression forces squeeze rock above the fault up and over the rock below the fault.

3. Created by shear forces; _____ **fault**—rocks on either side of the fault move past each other without much upward or downward motion.

Section 2 Features of Earthquakes

A. _____—waves generated by an earthquake can move the ground forward and backward, up and down, and side to side.

1. Focus—an earthquake's point of _____

2. _____ **waves** (P-waves)—cause particles in rocks to move back and forth in the same direction that the wave is traveling

3. _____ **waves** (S-waves)—cause particles in rock to move at right angles to the direction of wave travel

4. _____ **waves**—move rock particles in a backward, rolling motion and a sideways swaying motion

5. The point on the Earth's surface directly above the earthquake focus is called the _____.

Note-taking Worksheet (continued)

B. The different _____ of seismic waves allow scientists to determine the epicenter.

1. _____ waves move fastest.

2. Secondary waves follow.

3. Surface waves move _____ and arrive at the seismograph station last.

4. _____—measures seismic waves

a. Consists of a rotating drum of paper and a pendulum with an attached _____.

b. The paper record of a seismic event is called a _____.

C. Earth's structure consists of an inner, mostly iron, solid core surrounded by a mostly iron liquid outer core surrounded by the mantle.

1. The crust is Earth's _____ layer, about 5 to 60 km thick.

2. A seismic wave's speed and direction change as the wave moves through different layers with _____.

a. Density generally _____ with depth as pressures increase.

b. _____ do not receive seismic waves because the waves are bent or stopped by materials of different density.

3. Changes in seismic wave _____ allowed detection of boundries between Earth's layers.

Section 3 People and Earthquakes

A. Although earthquakes are natural geologic events, they kill many people and cause a lot of _____.

1. _____—scientists who study earthquakes

2. **Magnitude**—measure of energy released by an earthquake; determined by the _____ and based on the height of the lines on a seismogram

a. The Richter scale has no _____ limit.

b. Most earthquakes have magnitudes too _____ to be felt by humans—3.0 to 4.9 on the Richter scale.

3. The modified _____ intensity scale describes earthquake intensity based on structural and geologic damage.

4. _____—shaking from an earthquake can make wet soil act like a liquid.

Meeting Individual Needs

Note-taking Worksheet (continued)

5. Ocean waves caused by earthquakes are called _____.
   - **a.** Caused when a sudden movement of the ocean floor _____ against the water
   - **b.** Can travel thousands of _____ in all directions

B. Earthquakes cannot be reliably _____.

1. Knowing how and where to _____ for earthquakes can help prevent death and damage.
2. Buildings can be _____ to withstand seismic vibrations.
   - **a.** Flexible, circular _____ are being placed under buildings; made of alternating layers of rubber and steel.
   - **b.** The rubber acts like a cushion to absorb earthquake waves.
3. Homes can be protected by careful placement of heavy objects and securing _____ appliances.
4. During an earthquake, crawl under a sturdy table or desk; outdoors, stay away from _____ and power lines.
5. After an earthquake, check for water or gas line damage; leave _____ if a gas smell is present.