**Chapter 5 Earthquakes**
**Study Guide**

**Terms:**

Tension
The Modified Mercalli Scale
The Richter Scale
The Ring of Fire
Anticline
Focus
Stress
Compression
Magnitude
Seismic Waves
Shearing
Plateau
P waves

**Concepts:**

Name the first wave to arrive.
Name the second wave to arrive.
Name the waves that travel through a solid and liquid.
Name two ways that earthquakes are measured.
Know how plate movement creates new landforms.
Know how a geologist locates earthquake's epicenter.
Know where earthquakes often occur.
Know what can cause damage days or months after a large earthquake.
Know what a footwall is.
Know what type of force produces reverse faults.
Know the speed of S and P waves.
Know the 3 types of stress that has changed the shape and volume of rock over million of years.
Know what wave can make the ground roll or building shake.
Know what The Moment Magnitude Scale is.
Know what an aftershock is.
Know where a footwall and hanging wall are in normal faults.
Know that type of stress that produce reverse faults.
Know another name for S waves.

**Skills:**

Be able to identify tension, compression and shearing
Be able to identify normal faults, reverse faults, and strike-slip faults
Be able to identify the different types of waves

This study guide must be signed by a parent and returned the day of the test. Please remember to review what you highlighted in class in the text, worksheets, and use the study guide found in your text on page 166.

Dear Parents/Guardians,

Please verify the amount of time your student studied for our Ch. 5 Test.

Date: _____ Amount of time studied: _____
Date: _____ Amount of time studied: _____
Date: _____ Amount of time studied: _____
Date: _____ Amount of time studied: _____
Date: _____ Amount of time studied: _____

Parent Signature: _____

*Study guides are general guidelines as to what will be on the test and are not test specific.*

Name: _____

Ch. 5 Vocabulary (RH)

stress -

tension -

compression -

shearing -

normal fault -

reverse fault -

strike-slip fault -

plateau -

earthquake -

focus -

epicenter -

P wave -

S wave -

surface wave -

seismograph -

Modified Mercalli Scale -

magnitude -

Richter Scale -

moment magnitude scale -

seismograph -

Name: _____ Date: _____ Class Period: _____

**Chapter 5 Virtual Lab: Finding the Epicenter**

**Objective**: Determine the epicenter of an earthquake, using seismograph readouts and a distance graph.

**Directions**:

1. Open up lab activity.
2. Read the introduction in the column on the left side.
3. After reading the column on the left side, read the news flash going across the map.
4. Click on each letter on the map. Fill in the table below.

Table 1

| Seismograph Station | P Wave Arrival Time | S Wave Arrival Time |
|---|---|---|
| A | | |
| B | | |
| C | | |
| D | | |
| E | | |

5. Find the difference between the P wave arrival time and the S wave arrival time for each seismograph station from Table 1. (P wave time- S wave time) Round your findings to the nearest 15 seconds. There is a calculator in the bottom left hand corner.

Table 2

| Seismograph Station | P Wave Arrival Time – S Wave Arrival Time (From table above) | Distance from Epicenter (in km) |
|---|---|---|
| A | | |
| B | | |
| C | | |
| D | | |
| E | | |

6. Click on the distance graph. Use the difference between the P wave arrival time and the S wave arrival time and find that number on the Y-axis. Then, use the line on the graph to determine the distance from the epicenter- found on the x axis. Fill in the distance from the epicenter into Table 2.
7. Click on the pencil and drag it to the notch that corresponds to the distance you found using the distance graph. (You put this information in Table 2)
8. Click on the draw circle button to place the circle around the station. If you make a mistake, you can click on the Erase Circle button.
9. Repeat until you have at least 3 stations.
10. Click check.
11. If your circles are correct, the epicenter star will highlight. Click and drag the star to the epicenter- the intersection of the circles.

**Questions**:

1. Which state was the epicenter found in?

2. Why does the time difference between the arrival of primary and secondary waves grow longer at Seismograph stations that are farther away from the epicenter?

3. How can the epicenter of an earthquake be accurately located?

Name _____ Date _____ Class _____

Reading Essentials and Notebook

# Forces in Earth's Crust Ch. 5 Sec. 1

## Understanding Main Ideas

Use the diagrams below to complete items 1–9.

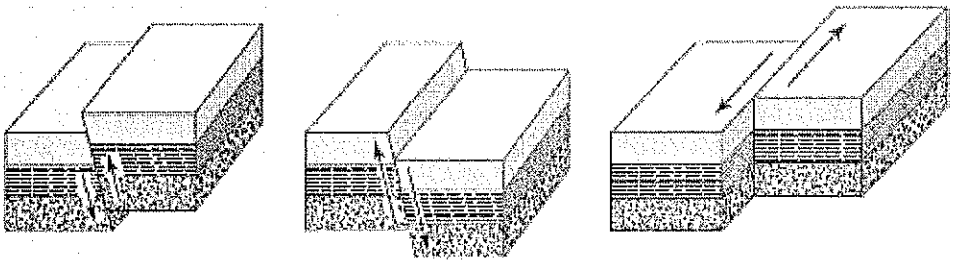

*Diagram A* *Diagram B* *Diagram C*

### Diagram A

1. Type of Fault: _____
2. Stress Force: _____
3. Movement Along Fault: _____

### Diagram B

4. Type of Fault: _____
5. Stress Force: _____
6. Movement Along Fault: _____

### Diagram C

7. Type of Fault: _____
8. Stress Force: _____
9. Movement Along Fault: _____

## Building Vocabulary

Write a definition for each of these terms on a separate sheet of paper.

10. shearing
11. plateau

Name _____ Date _____ Class _____

Key Concept Summaries

# Forces in Earth's Crust

## How Does Stress Change Earth's Crust?

As Earth's plates move, they can bend or fold rock. Forces created by movement of the Earth's plates are examples of **stress.** Stress adds energy to rock until the rock changes shape or breaks. Three kinds of stress can occur in the Earth's crust. **Tension, compression, and shearing work over millions of years to change the shape and volume of rock.**

**Tension** is the stress force that pulls on the crust and thins the rock in the middle. It happens where two plates pull apart. **Compression** is the stress force that squeezes rock until it folds or breaks. It happens where two plates come together and push against each other. **Shearing** is the stress force that pushes rock in two opposite directions. It happens where two plates slip past each other.

## How Do Faults Form?

**When enough stress builds up in rock, the rock breaks and makes a fault.** The three main types of faults are normal faults, reverse faults, and strike-slip faults. **Normal faults** form where rock is pulled apart by tension in Earth's crust. The block above the angled fault is called the hanging wall. The rock below the fault is called the footwall. The hanging wall slips downward when rock moves along the fault.

A **reverse fault** has the same structures as a normal fault, but the hanging wall moves up and the footwall moves down. Reverse faults form where compression pushes the rock of the crust together. Shearing produces strike-slip faults. The rocks on either side of a **strike-slip fault** slip past each other and have little up or down motion. A strike-slip fault that forms the boundary between two plates is called a transform boundary.

## How Does Plate Movement Create New Landforms?

**Over millions of years, the forces of plate movement can change a flat plain into features such as anticlines and synclines, folded mountains, fault-block mountains, and plateaus.** Folds are bends in rock that form when Earth's crust is compressed and gets shorter and thicker. A fold in rock that bends upward into an arch is an anticline. A fold that bends downward in a V shape is a syncline.

Tension forces create normal faults where two plates move away from each other. A fault-block mountain forms when the hanging walls of two normal faults drop down on either side of the footwall. Forces can also raise plateaus. A **plateau** is a large area of flat land that was lifted up high above sea level. Some plateaus form when forces in Earth's crust push up a large, flat block of rock.

**On a separate sheet of paper, explain how stress causes movement at faults.**

Name _____ Date _____ Class _____

Review and Reinforce Ch. 5 Sec 2

# Earthquakes and Seismic Waves

## Understanding Main Ideas

Answer the following questions on a separate sheet of paper.

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 movement?
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 | **a.** records ground movements caused by seismic waves as they move through Earth |
| 7. ____ epicenter | **b.** slowest seismic waves |
| 8. ____ surface waves | **c.** the point beneath Earth's surface at which rock under stress breaks and triggers an earthquake |
| 9. ____ seismograph | **d.** the point on the surface directly above the point at which an earthquake occurs |

Name _____ Date _____ Class _____

Key Earth Science Concepts

# Earthquakes and Seismic Waves

## What Are Seismic Waves?

Plate movement increases the stress along a fault until the rock slips or breaks and an earthquake begins. An **earthquake** is the shaking and trembling that happens when rock under Earth's surface moves. The **focus** is the place under Earth's surface where rock starts to move. The point on the surface directly above the focus is called the **epicenter**. Some of the energy released during an earthquake travels through Earth in the form of seismic waves. **Seismic waves are vibrations that are similar to sound waves. They travel through Earth carrying energy released by an earthquake.**

There are three main types of seismic waves: P waves, S waves, and surface waves. P waves move the ground like you would pull and stretch a slinky. S waves move the ground from side to side or up and down like you would wiggle or shake a jump rope with a friend. When P and S waves reach the surface, some of them become surface waves. Surface waves can make the ground pitch and roll like ocean waves.

## How Are Earthquakes Measured?

Geologists monitor earthquakes by measuring the seismic waves they produce. **The amount of earthquake damage or shaking that is felt is rated using the Modified Mercalli scale. The magnitude, or size, of an earthquake is measured on a seismograph using the Richter scale or moment magnitude scale.** An earthquake's **magnitude** is a number geologists give to an earthquake based on its size. Magnitude scales, like the **Richter scale**, rate earthquakes based on the size of the seismic waves recorded by a **seismograph**.

The **moment magnitude scale** rates the total energy an earthquake releases. Geologists use data from seismographs and other sources to give an earthquake a magnitude.

Each one-point increase in moment magnitude equals the release of about 32 times more energy. Earthquakes with a magnitude below 5 are small and cause little damage, while those with a magnitude above 6 can cause great damage.

## How Is an Epicenter Located?

**Geologists use seismic waves to locate an earthquake's epicenter.** The difference between arrival times of P and S waves at a seismograph station can be used to tell the distance of an earthquake's epicenter. The farther away an earthquake is, the greater the difference of arrival times between the two waves. Geologists can then map the distance of the earthquake from at least three seismograph stations to focus in on the epicenter.

**On a separate sheet of paper, identify the three types of seismic waves and how they are used to locate the epicenter of an earthquake.**

Name _____ Date _____ Class _____

Reinforcement Resources

# Monitoring Earthquakes Ch. 5 Sec 3.

## Understanding Main Ideas

Answer the following questions in the spaces provided.

1. How does a seismogram show earthquake waves?

2. What data do geologists use to see where earthquakes are most common?

3. What is the main factor in determining the risk that a location might have an earthquake?

4. What is the Ring of Fire?

## Building Vocabulary

Write a definition for the following term on the lines below.

5. Seismogram

Name _____ Date _____ Class _____

Key Concepts and Terms

# Monitoring Earthquakes

## How Do Seismographs Work?

Many seismographs are complex electronic devices, however a simple seismograph can record earthquakes too. A heavy weight with a pen hangs from a frame over a turning drum. **Seismic waves cause a simple seismograph's drum to vibrate, which in turn causes the pen to record the drum's vibrations.** As the seismic waves arrive at a measuring station, the seismograph vibrates with the ground. The hanging weight resists the motion and tends to stay at rest. The pen records the vibrations as the paper moves under it.

A seismogram is the record of an earthquake's seismic waves, produced by a seismograph. The height of the lines drawn by the seismograph tell geologist about the earthquake. If the lines are taller, the earthquake is more severe or is closer to the seismograph.

## What Patterns Do Seismographic Data Reveal?

**Using past seismographic data, geologists have created maps of where earthquakes occur around the world. The maps show that earthquakes often occur along plate boundaries.** Earthquake risk largely depends on how close a given location is to a plate boundary. In the United States, two plates meet along the Pacific coast. An earthquake risk map shows that most serious earthquakes occur in this area.

Many of the world's earthquakes occur in an area of geologic activity called the Ring of Fire. In this area, plate boundaries form a ring around the Pacific Ocean. Earthquakes are also common in area where two plates pull apart, like the Arabian Peninsula and the northeast coast of Africa.

**On a separate sheet of paper, explain why earthquakes do not happen everywhere on Earth.**

P- Waves

S-Waves

Surface Waves

P waves move in a _____ motion.

P waves can travel through
(check all that apply)
□Solids
□Liquids

In order of arrival, P waves arrive (check all that apply)

□First
□Second
□None of the above

Provide one additional detail about P waves.
_____
_____
_____

S waves move in a _____ motion.

S waves can travel through
(check all that apply)
□Solids
□Liquids

In order of arrival, S waves arrive (check all that apply)

□First
□Second
□None of the above

Provide one additional detail about S waves.
_____
_____
_____

Surface waves move in a _____ motion.

Surface waves can travel through
(check all that apply)
□Solids
□Liquids

In order of arrival, Surface waves arrive
(check all that apply)

□First
□Second
□None of the above

Provide one additional detail about Surface waves.
_____
_____
_____