Unit 1.6: Earth and Space Science – Plate Tectonics

Weekly Focus: Reading for Comprehension
Weekly Skill: Compare and Contrast with Venn Diagram

Lesson Summary: This week students will continue to learn about Earth and its structure, specifically plate tectonics and plate boundaries.

Materials Needed:

- Reading on Plate Tectonics **Unit 1.6 handout 1**
- Compare and Contrast Visual Information **Unit 1.6 Handout 2**
- Homework **Unit 1.6 Handout 3** (6-way Paragraphs, Advanced Level, pages 84-85)

Objectives: Students will be able to…

- Understand key concepts of plate tectonics
- State three types of tectonic plate boundaries

College and Career Readiness Standards: RI, RST, WHST

ACES Skills Addressed: DFP, LS, AL, CT, SM

Notes: Explain to students the importance reading for comprehension. It is the reason for most reading we do at home, at work, and in college. Remind students that while they are reading new material, they need to comprehend what they are reading. If they do not understand a sentence or an idea, they should reread it. Reading and rereading a passage for comprehension is a skill needed on many modules or portions of the GED test as well as a college skill.

GED 2014 Science Test Overview – For Teachers and Students

The GED Science Test will be 90 minutes long and include approximately 34 questions with a total score value of 40. The questions will have focus on three content areas: life science (~40%), physical science (~40%), and Earth and space science (~20%). Students may be asked to read, analyze, understand, and extract information from a scientific reading, a news brief, a diagram, graph, table, or other material with scientific data and concepts or ideas.

The online test may consist of multiple choice, drop down menu, and fill-in-the-blank questions. There will also be a short answer portion (suggested 10 minutes) where students may have to summarize, find evidence (supporting details), and reason or make a conclusion from the information (data) presented.

The work students are doing in class will help them with the GED Science Test. They are also learning skills that will help in many other areas of their lives.

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Unit 1.6: Earth and Space Science – Plate Tectonics

Activities:

Warm-Up: Quick Review of Scientific Method	Time: 10 minutes

- As students enter the class, have the following written on the board or overhead **"Earthquakes are caused by movements in the Earth's tectonic plates as they move and build up pressure."** Have students create a **"KWL"** chart on a piece of notebook paper (below). This helps to activate students' prior knowledge by asking them what they already **K**now (column 1); students (collaborating as a classroom unit or within small groups) set goals specifying what they **W**ant to learn (column 2); and after reading students discuss what they have **L**earned (column 3). Students apply higher-order thinking strategies which help them construct meaning from what they read and help them monitor their progress toward their goals.

KWL Chart:

K - What (else) do I KNOW?	W - What do I WANT to know?	L - What did I LEARN?

Activity 1: Reading for Comprehension (Unit 1.6 Handout 1)	Time: 40 - 50 minutes

1) Hand out **(Unit 1.6 Handout 1)** to students. **2)** discuss with students that when reading for comprehension, there are many strategies to use: read the title to predict what the reading is about; look at the words in bold and their definitions on different parts of the pages; if there are images, look at them to get a better understanding; while reading remember to ask "What is this all about?" **3)** Have students read the passage and answer the questions independently **4)** circulate class while they are reading to make sure they understand the information presented and see if there are any questions **5)** review answers as a whole class – note: some answers may vary – ask students with different answers to discuss theirs with the class. **6)** If there is time remaining before break, have students read passages in pairs to practice their fluency.

Break: 10 minutes

Activity 2: Compare and Contrast with Venn Diagram (Unit 1.6 Handout 2)	Time: 45 - 50 minutes

1) Hand out **(Unit 1.6 Handout 2)** to students. **2)** Explain how compare and contrast to students and how to use Venn diagram. **3)** Explain to students that they should examine the two diagrams and use the Venn diagram to note what is the same and what is different in the diagrams. Students should work individually then share their Venn diagrams with pairs or table groups. Circulate the room to assist students with the activity, especially new students who may not have worked with a Venn diagram **4)** Review answers as a whole class. **5)** Ask for students to share their answers if they would like. Remind students that there can be different possible answers.

Wrap-Up: Summarize	Time: 5 - 10 minutes
Have students turn to a partner (or write in their journals) about what they have learned today about plate tectonics and plate boundaries. Another option is to have students come up with one question or wondering they still have about the subject that they could research and report back to the class. *Note: Use* ***Routine 4 Handout: Summarizing***	

Extra Work/Homework: The Earth Moved (Unit 1.6 Handout 3)	Time: 20 minutes outside of class
Students can read and answer questions from the **6-way Paragraphs** (Advanced Level) reading #42 (pages 84-85) "The Earth Moved". This is an excellent opportunity for students to review today's material in an independent manner.	

Differentiated Instruction/ELL Accommodation Suggestions	Activity
If some student groups finish early, they can use the time to practice summarizing a multi-paragraph reading.	**Unit 1.6 Handout 1**
You may need to explicitly instruct or review how to use a Venn diagram. One example is to have two students stand at the front of the room. Ask for what is the *same* (i.e.: students, study for GED, live in MN,) and what is *different* (i.e.: male, from Africa, married, etc.) and put the information in a Venn diagram on the board. Explain how this helps to organize information from passages in order to make a conclusion with evidence.	**Unit 1.6 Handout 2**

Online Resources:

This is a **great** interactive website to use if you have an Internet connection. Students may really like the hands on opportunity to continue with the work. It is also excellent practice for "drag and drop" work that will be required for GED 2014.
http://www.learner.org/interactives/dynamicearth/plate.html

Suggested Teacher Readings:

- GED Testing Service – GED Science Item Sample (to get an idea of what the test *may* be like)

http://www.gedtestingservice.com/itemsamplerscience/

- Assessment Guide for Educators: A guide to the 2014 assessment content from GED Testing Service:

http://www.riaepdc.org/Documents/ALALBAASSESSMENT%20GUIDE%20CHAPTER%203.pdf

- Minnesota is getting ready for the 2014 GED test! – website with updated information on the professional development in Minnesota regarding the 2014 GED.

http://abe.mpls.k12.mn.us/ged_2014_2

Unit 1.6 Handout 1 (5 pages total)

Plate Tectonics

Brief #1: The Layers of the Earth

Focus

The Earth is made up of three distinct layers.

When you look at the surface of the Earth, you can see that it is not just a large piece of flat land. The Earth is full of high mountains, low valleys, canyons, cracks, and slopes. The form of the land has many shapes and sizes.

The Earth is made up of three different layers:

- ✓ the crust
- ✓ the mantle
- ✓ the core

Vocabulary

1. crust
2. mantle
3. core
4. lithosphere

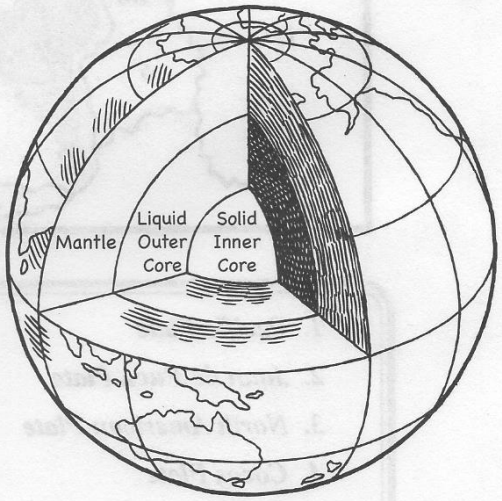
The Crust

The outermost layer of the Earth is called the crust. The crust is where life on Earth exists. The crust of the Earth is made of rock and soil. In addition, there are other kinds of elements—like iron, sodium, and silicon—in the Earth's crust.

The thickness of the crust of the Earth is different in different places. For example, the part of the crust beneath the ocean is about six and a half miles thick. The part that is dry land is about 25 miles thick. The crust is only a small part of the material that makes up the planet.

The Mantle

The part of the Earth located beneath the crust is called the mantle. The mantle is the largest part of the planet. The part of the mantle just beneath the crust is made of solid rock. But the deeper you go in the mantle, the hotter it becomes. It is so hot that the inner part of the mantle is made up of molten rock that flows inside of the Earth. The mantle of the Earth is about 1,800 miles thick.



The Core

The core is at the center of the Earth. The core of the Earth has a radius of about 758 miles. Its temperature is about 7,000 degrees Celsius. The inner part of the Earth's core is solid iron. The outer part of the core is liquid iron and nickel.

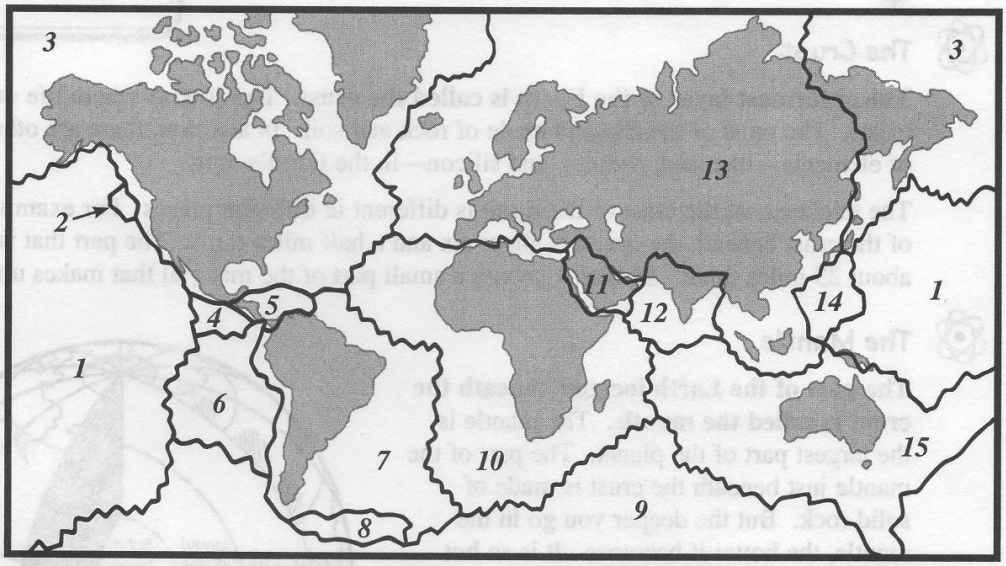
Plate Tectonics

Brief #1: The Layers of the Earth *(cont.)*

The Lithosphere

The crust of the Earth is like a giant shell. But it is not a single solid piece of shell. **The crust of the Earth and the upper mantle is called the lithosphere.** This lithosphere is really a collection of large pieces of solid rock, not that different from the pieces of a puzzle. These giant pieces of crust and mantle are called plates. You can see the Earth's plates on the map below.

The plates are not the same size or shape as the continents. In fact, whole continents and parts of vast oceans can rest on top of a single plate. The lithosphere floats on top of the liquid part of the mantle.



1. *Pacific Plate*
2. *Juan de Fuca Plate*
3. *North American Plate*
4. *Cocos Plate*
5. *Caribbean Plate*
6. *Nazca Plate*
7. *South American Plate*
8. *Scotia Plate*
9. *Antarctic Plate*
10. *African Plate*
11. *Arabian Plate*
12. *Indian Plate*
13. *Eurasian Plate*
14. *Philippine Plate*
15. *Indo-Australian Plate*

Plate Tectonics

Brief #3: The Theory of Plate Tectonics

Focus

Plate tectonics explain how the Earth's plates move and the landforms they create.

You have read earlier in the unit that the Earth's lithosphere is made up of moving plates. There are about 20 of these plates on our planet. Because the plates are resting on top of the molten part of the mantle, they are always moving. Of course, they move slowly and very little, but they move in all different directions.

As the plates move, they create the features that we can see on the crust of the Earth. Things like canyons, mountains, and valleys are a result of the constantly moving plates. **The study of the Earth's plates and the features they produce is called plate tectonics.**

Vocabulary

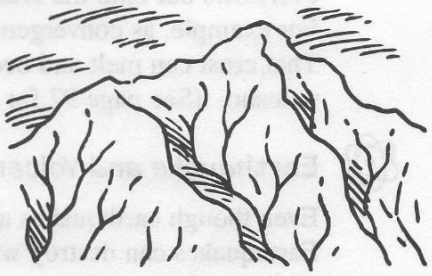
1. plate tectonics
2. plate boundary
3. transform boundary
4. divergent boundary
5. convergent boundary
6. fault

Plate Boundaries

A plate boundary is the place where two of the Earth's plates meet. The plates can move away from each other, move towards each other, or slide past each other. There are three different types of plate boundaries:

- ✓ **A transform boundary is when two plates slide past each other.**
- ✓ **A divergent boundary is when two plates move away from each other.**
- ✓ **A convergent boundary is when two plates crash into each other.**

At transform boundaries, faults are created. **A fault is a huge break in the crust of the Earth.** The San Andreas Fault in California is an example of a transform boundary. At divergent boundaries, large valleys can be formed. The Great Rift Valley in Africa is an example of a spreading valley. At convergent boundaries, mountain ranges can be produced. The Andes Mountains in South America is an example of a convergent boundary.



Scientists use GPS (global positioning system) satellites to map the Earth's plates and to measure how the plates are moving relative to one another. Using this kind of technology, they can make predictions about where the continents may be in 100 years to 1,000 years—or even one million years from now! Some of the Earth's plates are moving toward each other at a rate of about four inches per year, and others are moving away from each other. Some scientists say that millions of years in the future, the Earth's continents could come together once again and reform something similar to the ancient Pangaea.

Plate Tectonics

Brief #4: Earthquakes and Volcanoes

Focus

Earthquakes and volcanoes are natural forces that occur in the Earth's crust and mantle.

Earthquakes

Earthquakes are caused by the movement of the Earth's tectonic plates. When plates slide past each other, bump into each other, or move away from each other, pressure builds up in the Earth's crust.

Eventually, that pressure will be released in the form of an earthquake.

Vocabulary

1. focus
2. epicenter

The place beneath the ground where the earthquake begins is called the focus. The area above the focus on the crust of the Earth is called the epicenter.

When an earthquake happens, the energy from it is carried out away from the epicenter. The seismic waves can make the ground move back and forth. Other seismic waves can make the ground move up and down, like a wave in the ocean.

Earthquake strength is measured in magnitude on the Richter scale. The scale measures magnitude from 1 to 10. Each increase of one number on the Richter scale means that the earthquake releases about 31 times more energy. So an earthquake with a magnitude of 7.0 is 31 times more powerful than an earthquake with a magnitude of 6.0.

Volcano

Volcanoes are openings in the surface of the Earth's plates where hot magma rises and overflows out onto the crust of the Earth. Many volcanoes occur at the boundaries of plates. For example, as convergent plates crash into each other, one can slide underneath the other. That crust can melt and become magma, which can then explode through the crust as a volcano. (See page 97 for a diagram of a volcano's parts.)

Earthquake and Volcano Safety

Even though earthquakes and volcanoes are natural events, they can cause a lot of damage. Earthquakes can destroy whole cities, and the hot lava that flows from volcanoes can destroy all living things in its path.

Fortunately, there are tools that scientists can use to better our understanding about when these natural events may happen. Seismographs are instruments that can detect tremors in the ground. A tiltmeter can show changes in the slope of land. Tremors and a change in the land can be an indication of a volcano or an earthquake.

Unit 1.6: Earth and Space Science – Plate Tectonics

Unit 1.6 Handout 1 Name: _____

Read the information from the passages on Plate Tectonics to answer the following questions.

1. What are the three different layers that make up Earth?

2. Which layer is the largest?

3. In which plate is Minnesota located?

4. What is plate tectonics?

5. What is the different between a divergent boundary and a convergent boundary?

6. What is a fault?

7. What is the epicenter?

8. Where do many volcanoes occur and why? *(extra: Highlight on the map (p.92) where many volcanoes are found.)*

Unit 1.6 Handout 1 **TEACHER ANSWER KEY** **(Note, answers may vary)**

Read the information from the passages on Plate Tectonics to answer the following questions.

1. What are the three different layers that make up Earth?

The Earth is formed by three layers. The center is the core, the middle is the mantle and the outside is called the crust.

2. Which layer is the largest?

The largest layer that forms Earth is mantle. It is about 1,800 thick.

3. In which plate is Minnesota located?

Minnesota is located in the North American plate.

4. What is plate tectonics?

Plate tectonics is the study of the plates that make up Earth, their features, and what they make or produce.

5. What is the different between a divergent boundary and a convergent boundary?

The difference between the two kinds of boundaries that the divergent boundary move away from each other and the convergent boundary moves towards or collides with each other.

6. What is a fault?

A fault is a large break or crack in the crust or last layer of Earth where transform boundaries meet and slide past each other

7. What is the epicenter?

The epicenter is the place at the crust of the Earth that is above the focus, or where the earthquake began.

8. Where do many volcanoes occur and why? *(extra: Highlight on the map (p.5) where many volcanoes are found)*

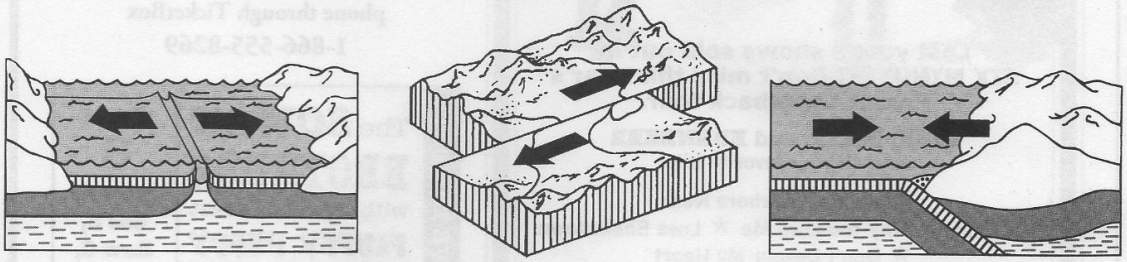
Many volcanoes happen where plates meet, or plate boundaries. (Highlighted areas are the boundaries between plates)

Unit 1.6 Handout 2 – page 1 of 3– **Graphic 1**

READ THE DIAGRAM Study the illustrations and the captions to help you visualize tectonic movement.

Earth's surface is shaped by the movement of tectonic plates that move into, against, or away from one another. Scientists study what happens to Earth's crust at the boundaries of these plates. There are three types of boundaries: **divergent** boundaries, **transform** boundaries, and **convergent** boundaries.

When the plates move, they cause earthquakes. The strongest earthquakes occur at convergent boundaries, while the weakest earthquakes occur at divergent boundaries. Earthquakes at transform boundaries are usually stronger than those at divergent boundaries, but weaker than those at convergent boundaries.



divergent boundary | transform boundary | convergent boundary

SKILL PRACTICE Read each question. Fill in the bubble next to the correct answer.

1. What do the illustrations show?
   - Ⓐ the way water moves
   - Ⓑ the way glaciers move
   - Ⓒ the way Earth's crust moves
   - Ⓓ the way mountains move

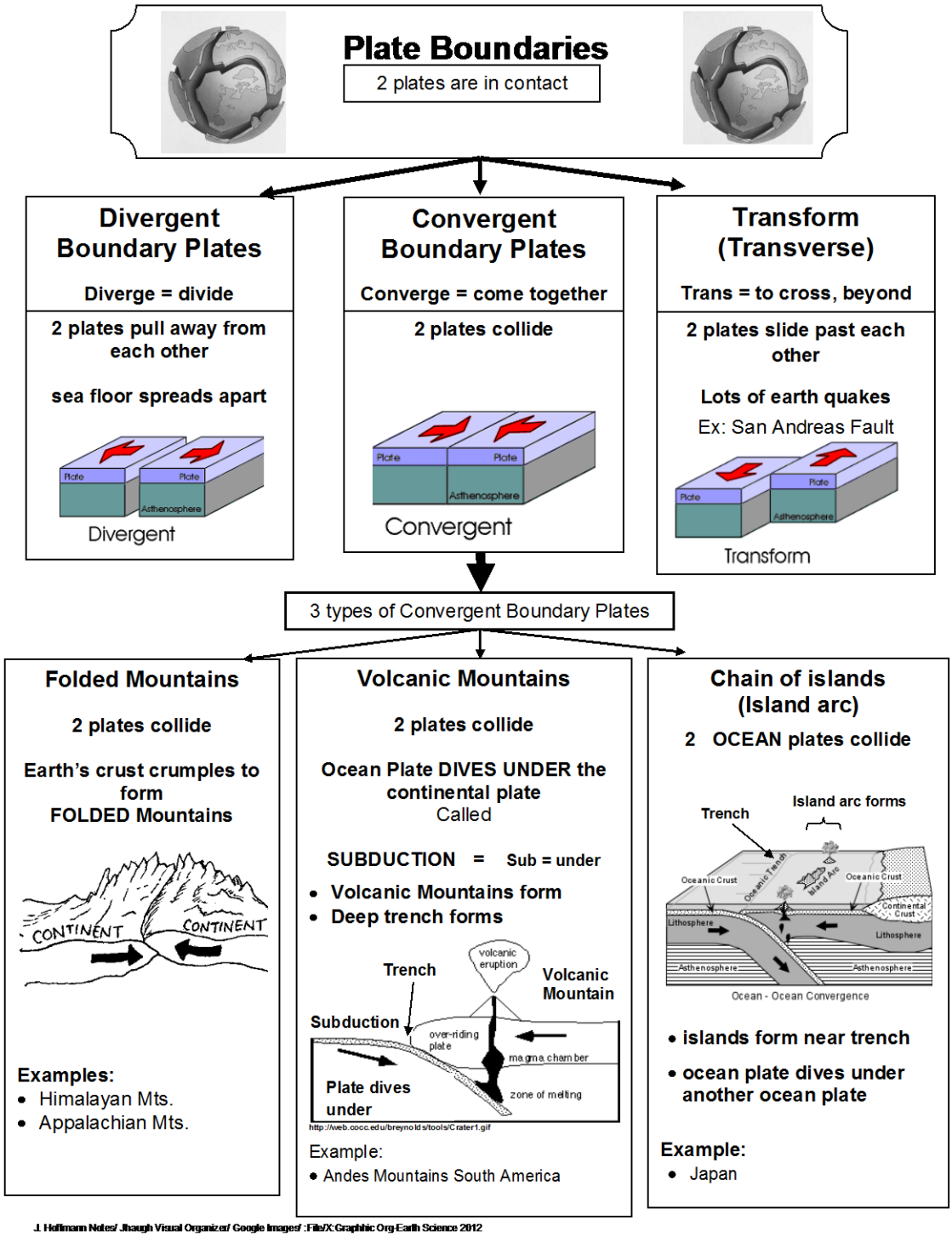
2. Where might you find illustrations like the ones in the passage?
   - Ⓐ in a history textbook
   - Ⓑ in a science textbook
   - Ⓒ in a gardening magazine
   - Ⓓ in a sailing magazine

3. In which direction do convergent boundaries move?
   - Ⓐ toward each other
   - Ⓑ away from each other
   - Ⓒ from north to south only
   - Ⓓ from east to west only

4. What does the label below each illustration tell?
   - Ⓐ the scientific name for Earth's crust
   - Ⓑ the land features that are created
   - Ⓒ the direction that the boundary moves
   - Ⓓ the type of boundary that is illustrated

STRATEGY PRACTICE What visual information from the illustrations was most important in helping you understand how the boundaries are different?

 Graphic 2



J. Hoffmann Notes/ Jhaugh Visual Organizer/ Google Images/ :File/X:Graphic Org-Earth Science 2012

Unit 1.6 Handout 2 – page 3 of 3

The **Venn Diagram** is an organizational tool made of two overlapping circles for charting similarities and differences between characters, stories, or other elements.

Directions:

1. Write the characteristics of graphic 1 in the first space on the left.

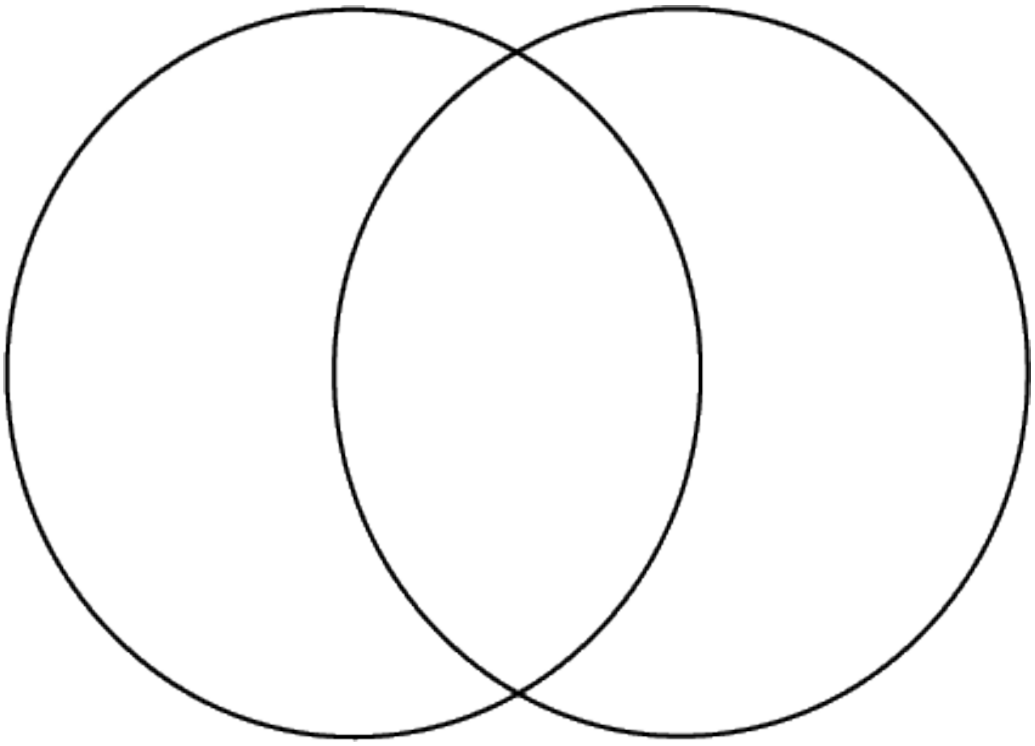
2. Write the characteristics of graphic 2 in the last space on the right.

3. Write the characteristics that both graphics have in common in the space in the center.

5. Analyze the data you have entered.

6. Write your conclusion in the space below.

Diagram 1 **Diagram 2**



Conclusion:

Unit 1.6 Handout 2 **ANSWER KEY**

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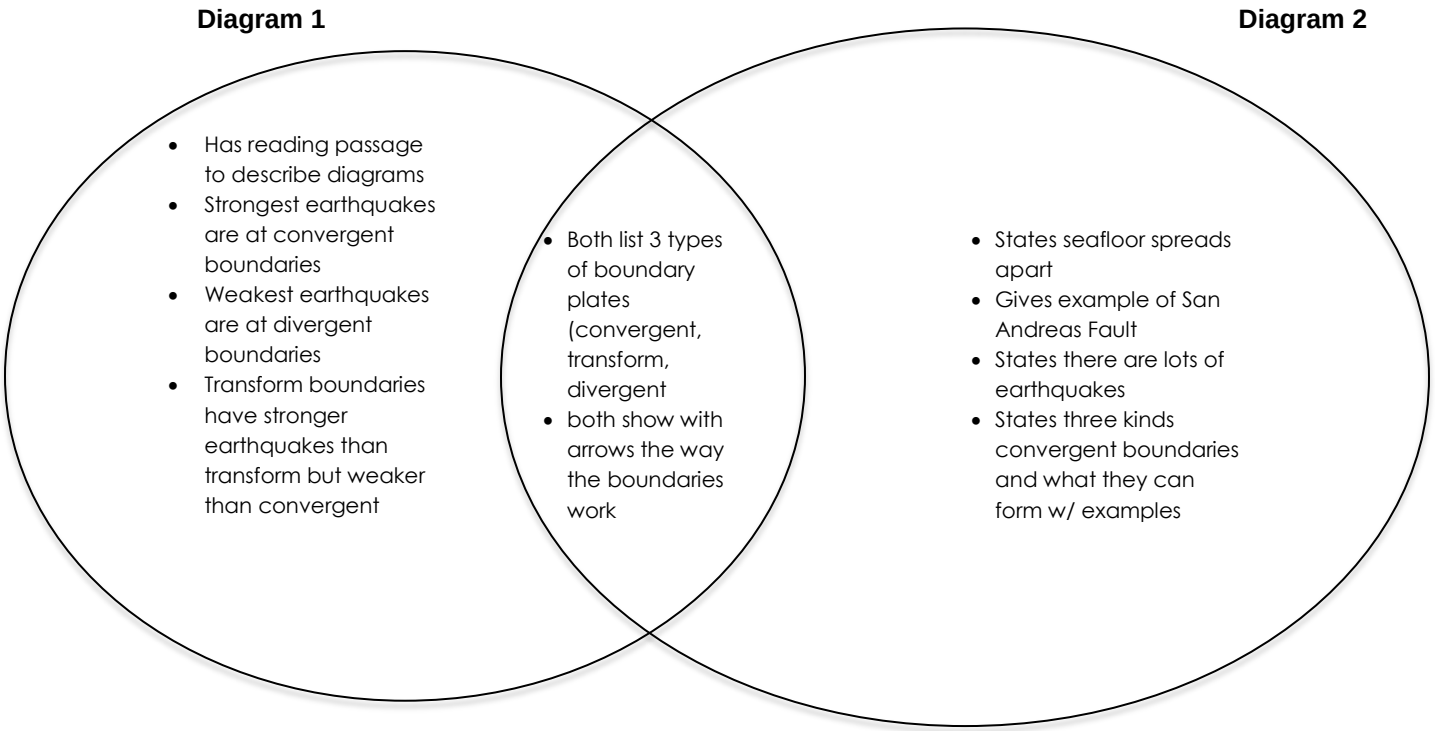

Conclusion: (Students' answers may vary, this is a possible conclusion.)

According to both diagrams, there are three kinds of boundary plates which have different movements. One could conclude that no matter what kind of plate boundary, there are many earthquakes where they meet.

Unit 1.6 Handout 3

ANSWER KEY

1. Main Idea
   a. N
   b. M
   c. B

2. D

3. A

4. B

5. A

6. B