12.2 Package

Science 10
12.2 Sheet
Name: _____
Date: _____

***Instructions: Read pages 518-534 in BC Science 10 and answer the following questions in point form***

1. When did geologists really begin to understand the nature of the earth's interior?
2. When did the earth form?
3. Explain how the earth formed in terms of where the lighter and heavier materials ended up.
4. What is the crust made mostly of?
5. What are tectonic plates made up of?
6. How thick are the plates? How many major plates are there?
7. What are the two main types of plates and what type of rock makes up most of each type?
8. Study figure 12.13 on page 519 and complete the chart below.

| Earth's layer | Description |
|---|---|
| | |
| | |
| | |
| | |



9. What is the asthenosphere? Describe it.
10. At what rate do plates move per year?
11. What is the driving force behind plate movement? Describe how it works.
12. What's another name for a spreading centre?
13. What happens to magma as it reaches the earth's surface?
14. What is subduction?
15. What types of "geologic events" tend to occur at subduction zones?
16. Describe "slab pull."
17. Make a quick sketch of figure 12.16 and label where slab pull is occurring and where convection currents are causing plates to spread apart.
18. What is a plate boundary? What are the three main types of plate boundaries?

19. What two things does plate interaction depend on?

20. What's occurring at a divergent plate boundary? Give an example of one.

21. What's the largest mountain range on earth?

22. What occurs at a convergent plate boundary?

23. Read page 524 and fill in the chart below: The first one is done for you

| Plate types interacting | Describe interaction | Types of features formed here |
|---|---|---|
| Ocean – continent plates | Ocean plate slides under the continent plate | Trenches and volcanic mountains |
| | | |
| | | |

24. What happens at a transform plate boundary? What two features occur at these types of boundaries?

25. What causes earthquakes? Where do 95% of them occur?



26. How often in B.C. are there major earthquakes?

27. According to First Nation's history when did a major earthquake occur in our region?

28. What is the focus of an earthquake? The epicentre?

29. What does the amount of damage an earthquake causes depend on?

30. Do deeper earthquakes cause more or less damage? Why?

31. What is seismology?

32. What's the difference between body waves and surface waves?

33. Describe what surface (L) waves are like.

34. What are the two types of body waves?

35. Describe P waves. Make a quick sketch of their movement.

36. Describe S waves. Make a quick sketch of their movement.

37. What type of material do S waves NOT travel through?

38. What are some ways that waves are affected as they move through the earth's interior?

39. Why do S-waves disappear at the bottom of the mantle?

40. What are seismometers? What types of movement do they measure?

41. What's a seismogram? What type of information do they provide?

42. What is meant by an earthquake's magnitude?

43. How does a 1 step increase on the magnitude scale relate to the size of seismic waves?

44. What are three types of volcanoes?

45. Describe a composite volcano.

46. What is the magma like in a composite volcano?

47. Are composite volcanoes usually explosive? If so, explain why.



48. Where are composite volcanoes typically found?

49. Where do shield volcanoes typically form?

50. What's the magma like in shield volcanoes?

51. Are shield volcanoes typically explosive?

52. Give three specific examples of shield volcanoes.

53. Where do rift eruptions occur? Are they explosive?

54. Give an example of a place where rift eruptions occur.

Read "Career Connect" on page 536 and answer the three questions on page 536 in the space below

1.

2.

3.

Name Date

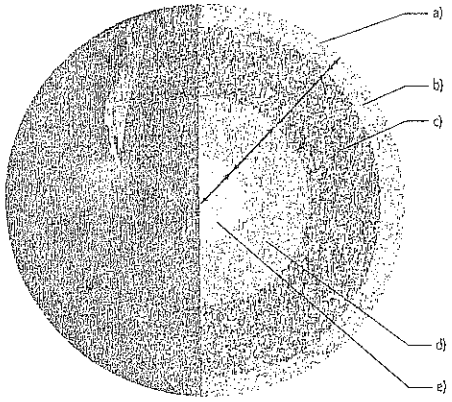
**Interpreting Illustrations**
Section 12.2

*Use with textbook pages 520–522.*

# Layers of the Earth

Earth is made up of layers with distinct characteristics.

1. Label the layers of the Earth on the following diagram.




Layers of the Earth

2. Each layer of the earth has a varying thickness, state (solid, liquid, gas) and composition. Fill in the following table beginning with the innermost layer in the order that you would find the layers from the inside to the outside of earth.

| Layer | Thickness | State | General composition |
|---|---|---|---|
| (a) | | | |
| (b) | | | |
| (c) | | | |
| (d) | | | |
| (e) | | | |

3. What is the difference between the lithosphere and the asthenosphere?




(7)

Name Date

**Comprehention**
Section 12.2

*Use with textbook pages 522-- 528*

# Features of plate tectonics

1. What do geologists believe heats the upper mantle portion of the asthenosphere?

2. What is one of the driving forces behind plate movement?

3. What is the difference between a rift valley and a spreading ridge?

4. What occurs when dense oceanic plates collide with a continental plate?

5. What events commonly occur at subduction zones?

6. When geologists record plate boundaries on a map, symbols are used to represent the three main types of plate interactions. Draw and label the three main symbols representing plate interactions.

(a) _____

(b) _____

(c) _____

7. Describe the type of plate interactions that have occurred at the following geographic locations.

| Geographic location | Plate interaction |
|---|---|
| 1. East African Rift | |
| 2. Juan de Fuca plate<br>3. Islands of Japan | |
| 4. Himalayan mountains | |
| 5. San Andreas Fault | |

8. When continental plates collide, does subduction occur? Explain your answer.




(8)

Name _____ Date _____

**Applying Knowledge**
Section 12.2

*Use with textbook pages 528–536.*

# Seismic waves, earthquakes, and volcanoes

Seismic waves can be either body waves that travel underground or surface waves that travel along the surface of the Earth.

1. Fill in the table below, summarizing the different types of seismic waves.

| Seismic wave | Abbreviation | General diagram of wave | Description of action | Type of material it travels through | Speed it travels at |
|---|---|---|---|---|---|
| primary wave | | | | | |
| secondary wave | | | | | |
| surface wave | | | | | |

## Measurement of Earthquakes

2. What is a seismometer?

3. How does the term magnitude relate to how earthquake activity is recorded?

4. What scale is often used to measure the magnitude of an earthquake?

5. What is the difference between the focus of an earthquake and the epicentre?

6. Explain the classification scale used to describe the depth of origin of earthquakes.

7. For the three geographic locations listed below, classify the type of volcano found there and describe what type of events led to its formation.

| Geographic location | Type of volcano | Description of events |
|---|---|---|
| Mount Garibaldi volcano | | |
| Anahim Volcanic Belt | | |
| Kraflla volcano | | |




(9)

12.2 Notes

- Earth has 4 distinct layers.
  - _____ – outer solid rock layer (granite on land, basalt in oceans)
  - _____ – thickest layer, mostly solid except for upper mantle being able to flow like "thick toothpaste"
  - _____ core – composed of liquid iron and nickel
  - _____ core – mostly solid iron, at tremendous temperature and pressure
- Tectonic plates make up the _____ (crust) which floats on the _____ (mantle)

See pages 518 - 521

- As magma is heated in the asthenosphere, _____ form and push tectonic plates apart at ridges (in the _____) or rifts (on _____).
- There are _____ large tectonic plates and many smaller ones.
- Where continent and ocean plates meet, _____ occurs.
  - The denser oceanic plate subducts under the lighter continental plate.
  - By "_____," the rest of the plate follows.
- Large _____ and _____ are found in subduction zones.

See pages 520 - 521

1. Divergent plate boundaries are areas where plates are _____ apart.
   - Ocean ridges and continental rifts are examples.
2. Convergent plate boundaries are areas where plates _____.
   A. Ocean-continent plate convergence
   - The ocean plate _____, under the continent plate, forming a trench.
   - Cone-shaped v_____ can form from magma seeping to the surface.
   - _____ ranges also form from the collision.
   - Earthquakes can occur when subducting plate gets stuck and tension builds

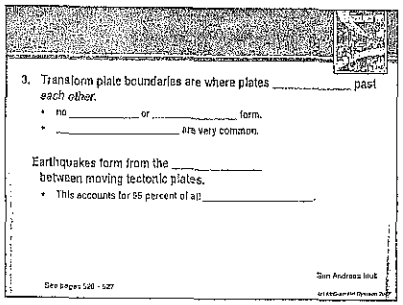
See pages 522 - 525

B. Ocean-ocean plate convergence
- The cooler, denser plate will _____ under the less dense plate.
- Convergence may produce a _____ island arc.

C. Continent-continent plate convergence
- As they collide, they crumple, forming _____ ranges.

See pages 523 - 525

(10)

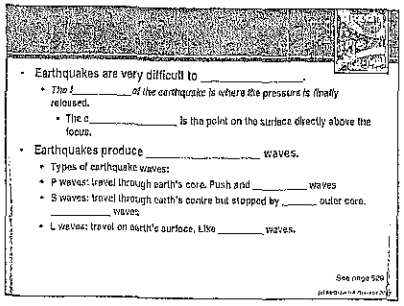


3. Transform plate boundaries are where plates _____ past *each other.*
   - no _____ or _____ form.
   - _____ are very common.

Earthquakes form from the _____ between moving tectonic plates.
- This accounts for 95 percent of all _____.

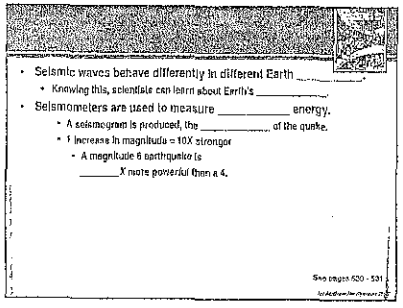
San Andreas fault

See pages 526 - 527



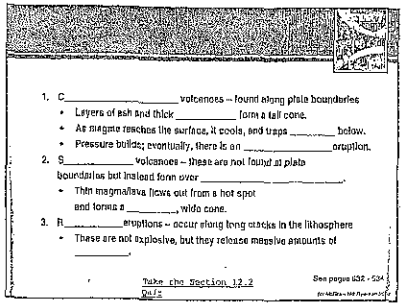
- Earthquakes are very difficult to _____.
  - *The f_____ of the earthquake is where the pressure is finally released.*
    - The e_____ is the point on the surface directly above the focus.
- Earthquakes produce _____ waves.
  - Types of earthquake waves:
  - P waves: travel through earth's core. Push and _____ waves
  - S waves: travel through earth's centre but stopped by _____ outer core. _____ waves
  - L waves: travel on earth's surface. Like _____ waves.

See page 529



- Seismic waves behave differently in different Earth _____.
  - Knowing this, scientists can learn about Earth's _____.
- Seismometers are used to measure _____ energy.
  - A seismogram is produced, the _____ of the quake.
  - 1 increase in magnitude = 10X stronger
    - A magnitude 6 earthquake is _____X more powerful than a 4.

See pages 530 - 531



1. C_____ volcanoes – found along plate boundaries
   - Layers of ash and thick _____ form a tall cone.
   - As magma reaches the surface, it cools, and traps _____ below.
   - Pressure builds; eventually, there is an _____ eruption.
2. S_____ volcanoes – these are not found at plate boundaries but instead form over _____.
   - Thin magma/lava flows out from a hot spot and forms a _____, wide cone.
3. F_____ eruptions – occur along long cracks in the lithosphere
   - These are not explosive, but they release massive amounts of _____.

Take the Section 12.2 Quiz

See pages 532 - 534

(11)2

# Science 10
## Section 12.2 "Plate Tectonics" Video Clips

**Name:** _____

**Date:** _____

**Instructions:** *Watch the following video clips and fill out this sheet as you watch*

1. Comment on: Plate Tectonics, Volcanoes and Earthquakes

2. Comment on: Fault Lines, Stress, and Earthquakes

3. Comment on: Seismology and the science of Earthquakes

4. Comment on: Types of Volcanoes

(12)

# Section 12.2
# Features of Plate Tectonics
# Check Your Understanding

## Checking Concepts

1. List three kinds of plate boundaries.

2. What is ridge push?

3. How is the worldwide pattern of earthquakes and volcanoes related to tectonic plates?

4. (a) What are convection currents?

   (b) Name the region of Earth's interior where convection currents occur.

   (c) How do convection currents affect tectonic plates?

5. (a) Name the type of island chain that forms over geologic hot spots.

   (b) How does an island chain form over a geologic hot spot?

6. What geologic feature is associated with rift eruptions?

7. Which type of seismic waves can travel through Earth's outer core?



8. What do seismometers detect and record?

9. What does a time-distance graph of seismic waves show?

10. After an earthquake, what type of seismic wave is the first to reach earthquake monitoring stations?

## Understanding Key Ideas

11. Describe the movement of tectonic plates in the following locations.

    (a) a mid-ocean ridge

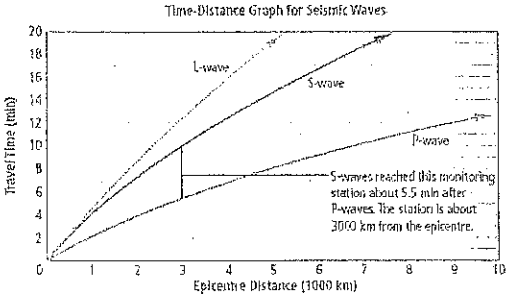
    (b) a convergent boundary

    (c) a transform boundary

12. Why do volcanoes usually form at subduction zones but not at transform boundaries?

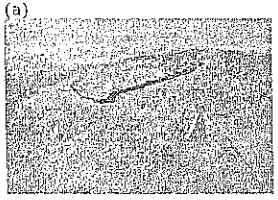
13. How does the ground motion produced by a P-wave compare to the ground motion produced by a surface-wave?

14. Refer to the time-distance graph (Figure 12.25) shown on the next page (and on text page 531). How far does each seismic wave (P, S, and L) travel in 8 min?

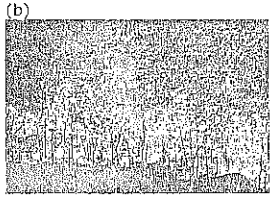



15. What are the correct names for the types of volcanoes shown below (and on text page 537)?

(a)



(b)



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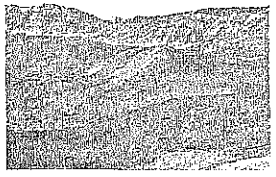



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# Plate Tectonics PhET

Learning Objectives:

- I can describe the differences between continental and oceanic crust.
- I can identify and describe the three types of plate boundaries .
- I can describe the geologic features created by each type of plate boundary.

Go to www.phet.colorado.edu. Click on the orange "Play With Sims" button. On the right side of the screen, choose the "Earth Science" category. Run the "Plate Tectonics simulation.

**Part I:**

1. Begin with the "Crust" tab. Under "View," check "Both" and "Show Labels." Use the tools in the lower left corner to qualitatively compare the thickness, density, and temperature of the oceanic and continental crust samples. Complete the table below.

| Crust Type | Thickness | Density | Temperature |
|---|---|---|---|
| Oceanic | | | |
| Continental | | | |

2. Which property do you think causes continental crust to have a higher elevation (on average) than oceanic crust? Explain.

Experiment with making your own crust using the sliders in the center of the screen. Note that the middle crust sample will turn blue or green depending on whether it is considered oceanic or continental crust.

3. See what happens when you adjust the thickness of the crust. What kind of crust is very thick crust? What kind of crust is very thin crust?

4. See what happens when you change the composition of the crust? Does oceanic crust have more iron or more silica? Does continental crust have more iron or more silica?





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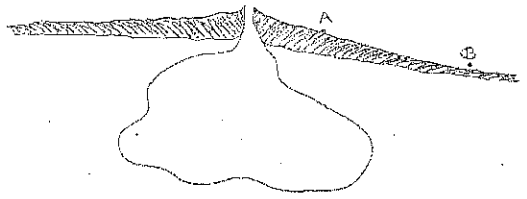
5. Set the thickness and composition of your crust somewhere in the middle. Write down what type of crust you have: _____. See what happens when you change the temperature of the crust. What happens to very cool crust? What happens to very warm crust?

6. Based on your answers to # 3 – 5, complete the table below.

| Crustal Property | Result | |
|---|---|---|
| Thickness | thick: | thin: |
| Composition | more iron: | more silica: |
| Temperature | warm: | cool: |

7. Based on what you know about sea-floor spreading, mark where you think the crustal properties of points A and B would fall on the continua below.




| Property | |
|---|---|
| Thickness | thin.....thick |
| Composition | iron.....silica |
| Temperature | cool.....warm |
| Age | young.....old |







**Part II:**
Now go to the "Plate Motion" tab. Under "View, check "Both," "Show Labels," and "Show Sea Water." Experiment with different types of crust at the plate boundary.

Note the following vocabulary terms:

| | |
|---|---|
| *Convergent Plate Boundary* | A boundary at which two plates move toward each other ⇨⇦ |
| *Divergent Plate Boundary* | A boundary at which two plates move away from each other ⇦⇨ |
| *Transform Plate Boundary* | A boundary at which two plates move parallel to each other in opposite directions ⇧⇩ |
| *Subduction* | One plate moves under another ⇘⇦ |

8. Reset the simulation and set it up with a continental and an oceanic (young or old) crust.
   a. Drag the plate in the direction of the green arrow. What type of boundary is this?

   b. Sketch a time series of this process with at least three diagrams. Label the two types of crust and show the direction of motion.

   c. Which plate subducts beneath the other? Why do you think this is (hint: think of the properties you explored in part I)?

   d. What feature is created on the continental crust parallel to the plate boundary?

9. Reset the simulation and set it up with two old oceanic crusts.
   a. Drag the plate in the direction of the red arrow. What type of boundary is this?

   b. Sketch a time series of this process with at least three diagrams. Label the two types of crust and show the direction of motion.

   c. What feature is created at the plate boundary?

10. Reset the simulation and set it up with two continental crusts.
    a. Drag the plate in the direction of the blue arrow. What type of boundary is this?

    b. Sketch a time series of this process with at least three diagrams. Label the two types of crust and show the direction of motion.

11. Reset the simulation and set it up with two continental crusts.
    a. Drag the plate in the direction of the green arrow. What type of boundary is this?

    b. Sketch a time series of this process with at least three diagrams. Label the two types of crust and show the direction of motion.

    c. What feature is created at the plate boundary? Why does neither plate subduct?

12. Experiment and find two additional scenarios not yet described in this activity. Complete the table below.

| Types of Crust | Type of Boundary | What Happens/New Features |
|---|---|---|
| | | |
| | | |

13. New crust is created at a divergent boundary. Where does this new crust come from? What happens to the old crust?





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