Name Date

Topic 4.1 Summary

What ideas, observations, and evidence led to the theory of plate tectonics?

Use with textbook pages 272–287.

Check for Understanding

As you read, stop and reread any parts you do not understand. Highlight all the sentences that help you get a better understanding.

Reading Check

1. What are Earth's interior layers?

_____

_____

_____

2. What are two things that the theory of plate tectonics explains?

_____

_____

_____

The Theory of Plate Tectonics

The theory of plate tectonics states that the lithosphere (see below) is made up of huge, slowly moving rocky slabs called plates. The theory explains Earth processes such as the movement of the continents and the formation and occurrence of earthquakes, volcanoes, and mountains.

The Layers of Earth's Interior

Earth's interior is made up of three main layers.

- The crust is a thin layer of solid rock. The part under the oceans is called oceanic crust. The part under the continents is called continental crust.
- Most of the upper part of the mantle is solid rock. Most of the lower part of the mantle is also solid rock. Between the upper and lower parts of the mantle is a region that is partly melted, so it is able to flow.
- The outer part of the core is liquid. The inner part of the core is solid.

The Earth Layers That Are Important for Plate Tectonics

Together, Earth's crust and the upper part of the mantle are called the lithosphere. The lithosphere is solid rock.

The partly melted portion of the mantle is called the asthenosphere. The lithosphere floats on the asthenosphere.

Some of the Evidence for the Theory of Plate Tectonics

- The shape of the continents suggests that they were once joined together long ago as a single supercontinent. This huge land mass broke apart and its pieces (the continents) have been moving away from each other ever since. The continental drift hypothesis explains this idea.
- Evidence from sonar and other technologies shows that parts of the ocean floor are moving away from each other at mid-ocean ridges. New crust forms from lava erupting at these ridges. This process is called sea floor spreading. Continents are carried away from each other as part of this process.

Considering Evidence for Continental Drift

Use with textbook pages 284 and 285.

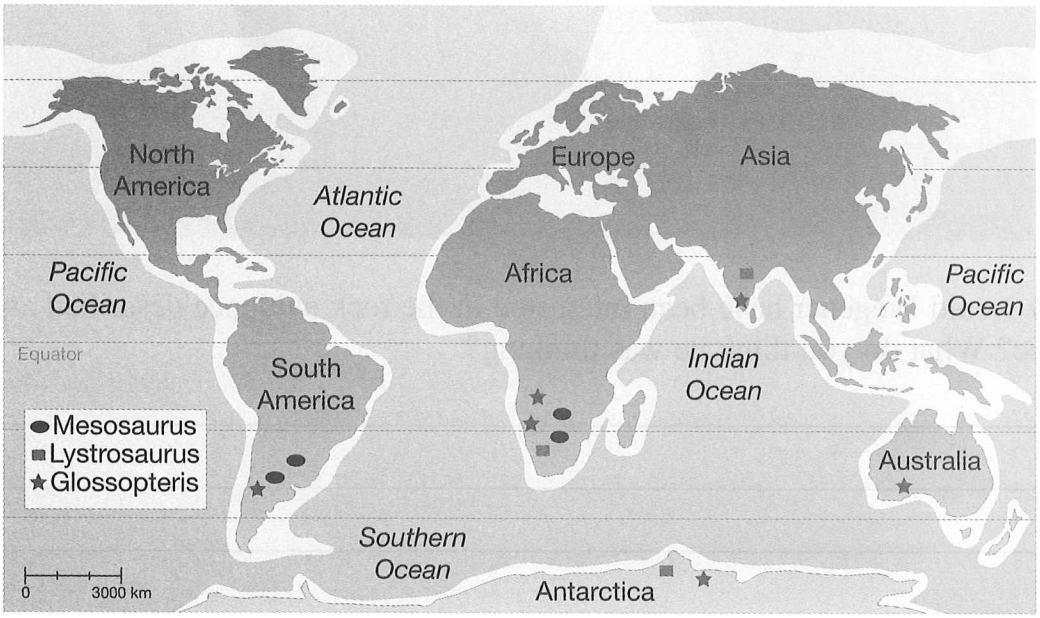
Read the information below, and answer the questions in the spaces provided.

Alfred Wegener noticed that the continents look like their coastlines match up like puzzle pieces. He hypothesized that all the continents were joined together long ago as a huge land mass called Pangaea. He suggested that Pangaea broke apart about 200 million years ago. The pieces of this land mass, which we know today as our continents, have been moving away from each other ever since.

This continental drift hypothesis depended on more than just the shape and fit of the continents. Wegener collected other kinds of evidence to support his ideas.

Fossil Evidence

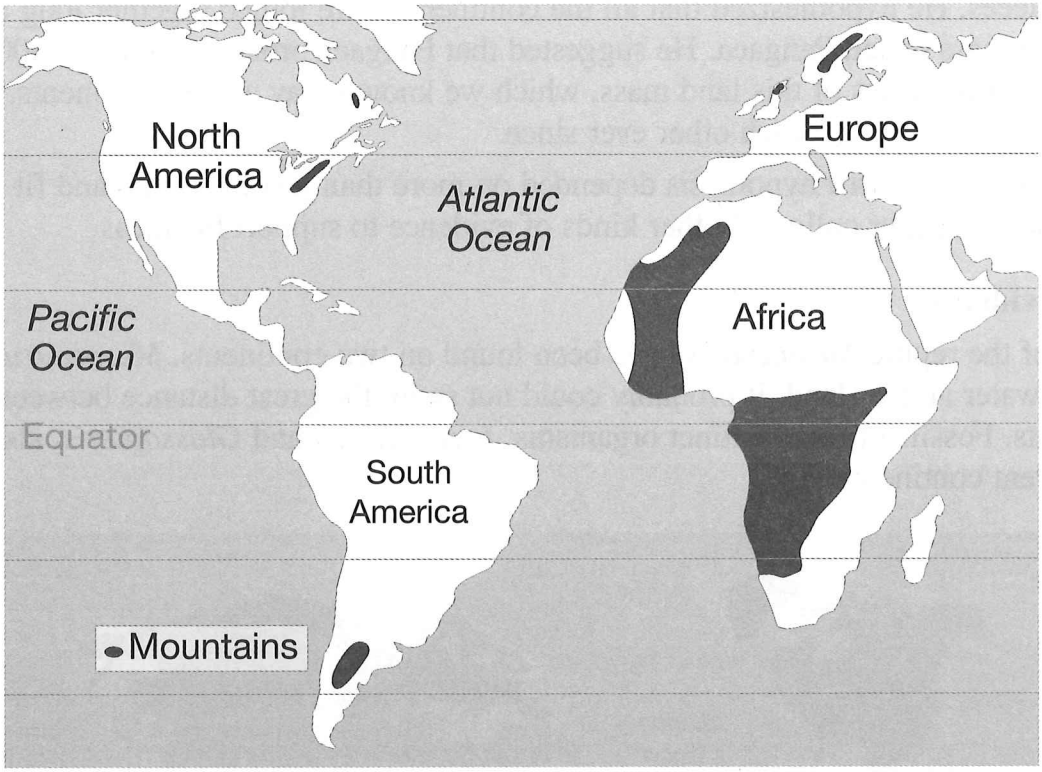
Fossils of the reptile *Mesosaurus* have been found on two continents. *Mesosaurus* lived in fresh water and on land. It probably could not swim the great distance between continents. Fossils of other extinct organisms, *Lystrosaurus* and *Glossopteris*, also appear on different continents.



1. Why would Wegener have been interested in the fossil evidence described and shown above? What do you think he was thinking?

Rock Evidence

The Appalachian Mountains in eastern North America are made of the same kind of rock as a mountain range in Britain and Norway. There are similarities between rock found in Quebec and rock found in northern Britain. There are also similarities between rock found in South America and rock found in Africa.



2. Why would Wegener have been interested in the rock evidence described and shown above? What do you think he was thinking?

Climate Evidence

In order for coal to form, there has to be lots of plant life in a tropical, swampy environment. When the plants die and are compressed under many layers of sediment for millions of years, coal is formed. Today, however coal deposits are found in moderate to cold environments. These include Canada, northern Europe, and Antarctica. Wegener also learned that some places that have warm environments today, such as Africa, India, and Australia, were partly covered long ago by glaciers.

3. What possible explanations are there for the information described above? What do you think Wegener was thinking?

Biological Evidence

Marsupials are mammals that are born before they develop completely. They continue to grow and develop in a pouch on their mother's body. Marsupials are found in Australia, North America, and South America. Kangaroos are examples of Australian marsupials. Opossums are North American marsupials.

Earthworms from the same biological families have been found on South America and Africa. Earthworms cannot swim and cannot survive the cold and salt of ocean water.

Similar kinds of coniferous trees are found in Australia, in South Africa, and in Brazil and Chile of South America.

4. What possible explanations are there for the information described above? What do you think Wegener was thinking?

Layers of Earth

Use with textbook page 277.

1. What is the difference between direct and indirect evidence?

2. Why was indirect evidence used to infer Earth's interior structure?

3. Why can we only infer details of the inner structure of Earth?

4. What was the indirect evidence used to infer Earth's layers?

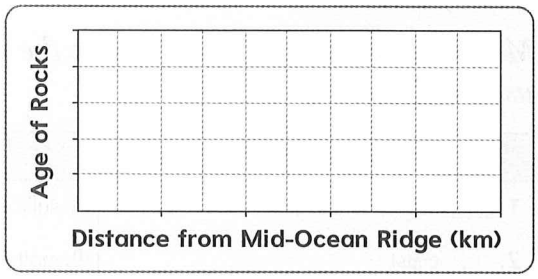
5. Use the table to summarize the structure and composition of Earth's four layers.

Layer (Outside to Inside)	State (Solid or Liquid)	Description

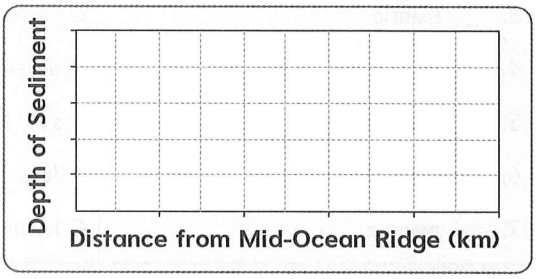
Sea Floor Spreading

Use with textbook pages 278–280.

1. Sketch a graph that shows how the age of rock changes as you move away from the mid-ocean ridge in both directions.



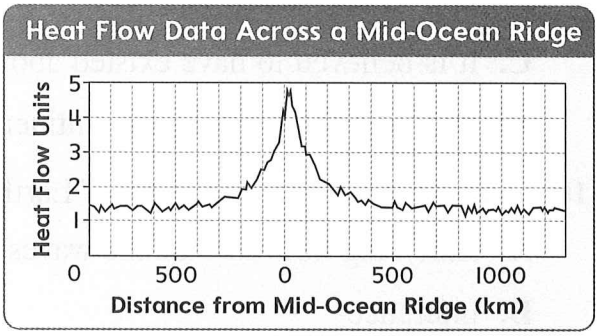
2. Sketch a graph that shows how the depth of sediment changes as you move away from the mid-ocean ridge in both directions.



3. How does the age of rocks at the mid-ocean ridge help explain how continents move?

4. How do changes in sediment depth at the mid-ocean ridge help explain how continents move?

5. The graph at right shows how heat (thermal energy) changes as it moves from below the crust at a mid-ocean ridge to the water surrounding the ridge. This change in the amount of heat is called heat flow. Interpret the graph. How does it help to explain what happens at a mid-ocean ridge?



6. Summarize the process of sea floor spreading.

4.1 Assessment

Match each term on the left with the best descriptor on the right. Each descriptor may be used only once.

Term	Descriptor
1. ____ asthenosphere	A. solid outer layer of Earth
2. ____ crust	B. molten rock from inside Earth
3. ____ mantle	C. partly melted part of the mantle
4. ____ outer core	D. deepest solid Earth layer
5. ____ inner core	E. solid Earth layer that is part of two other Earth layers
6. ____ lithosphere	F. deepest liquid Earth layer
7. ____ magma	G. Earth layer that has a portion that can flow

Circle the letter of the best answer for questions 8 to 18.

8. Which Earth process is explained by the theory of plate tectonics?

A. climate

B. mountain building

C. weathering

D. both B and C

9. Which of the following statements is true of the supercontinent Pangaea?

A. Its existence would support the idea of "fixism."

B. It sank into the ocean.

C. It is believed to have existed about 200 million years ago.

D. The present-day African continent was not a part of it.

10. Our scientific understanding of Earth's layers is based on

A. analyzing how earthquake waves travel through Earth's interior

B. inference

C. indirect evidence

D. all of the above

11. Earth's only liquid layer is called

A. the crust

B. the outer core

C. the mantle

D. the inner core

12. Identify the accurate statement(s).

A. The theory of plate tectonics and the continental drift hypothesis are the same idea.

B. The theory of plate tectonics includes the continental drift hypothesis.

C. The continental drift hypothesis includes the theory of plate tectonics.

D. A and C are both accurate.

13. The layer on which Earth's tectonic plates move is called

A. the lithosphere

B. the asthenosphere

C. the mantle

D. the crust

14. Earth's hottest layer is

A. solid

B. the outer core

C. able to flow

D. both B and C

15. Earth's thin, outer layer is called

A. the crust

B. the outer core

C. the mantle

D. the inner core

16. The age of ocean rocks as you move away from a mid-ocean ridge

A. increases in both directions

B. is constant

C. decreases in both directions

D. increases in one direction and decreases in the other

17. Sea floor spreading

A. supports the idea that continents move

B. explains how new oceanic crust is made

C. occurs at a mid-ocean ridge

D. all of the above are true

18. The theory of plate tectonics is a unifying theory because it explains

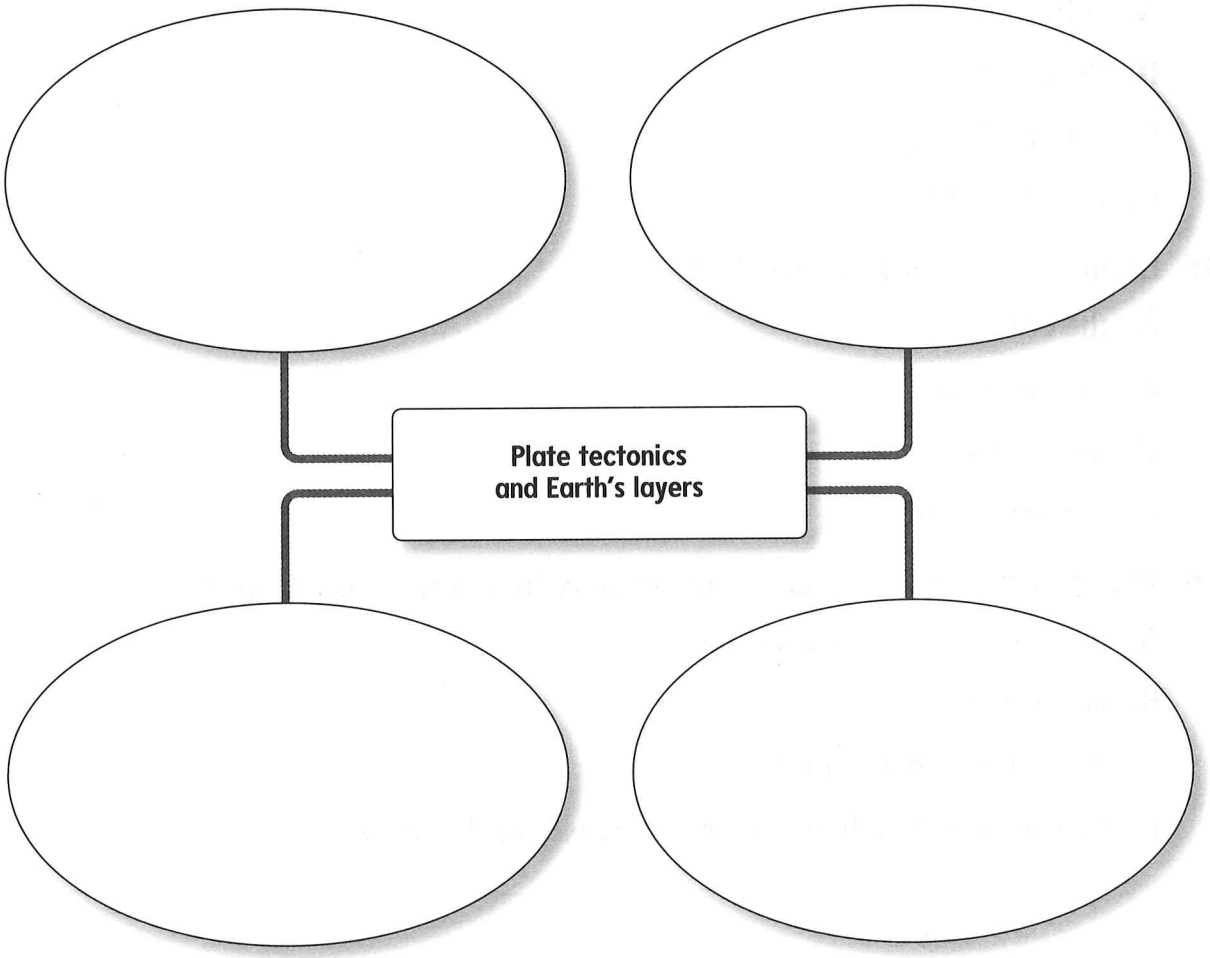
A. how and why continents move

B. why and where earthquakes occur

C. how and why sea floor spreading occurs

D. all of the above

19. Complete the graphic organizer below. Fill in examples from the Topic using key terms as well as your own words.



Name Date

Topic 4.2 Summary

What are tectonic plates and how is their movement linked to geological processes?

Use with textbook pages 288–295.

Earth's Tectonic Plates

The lithosphere (Earth's crust and upper mantle) is broken into pieces called **tectonic plates**. They float on a part of the mantle called the asthenosphere, which can flow. Some tectonic plates are made up of oceanic crust. Most are made up of both oceanic crust and continental crust.

Reading Check

What are the differences between the lithosphere and asthenosphere?

Plate Movement

When magma rises from an ocean ridge, the magma produces new crust, which pushes the plates apart. As these plates are pushed apart, other plates are pushed together. Movement along any plate boundary results in changes at other boundaries.

Plate Movements

Plate Boundary	Motion of Plates	Activity and Features at Boundary
Convergent	• plates move toward each other	• subduction (denser crust moves below less dense crust) • deep ocean trenches • mountains • volcanoes • earthquakes
Divergent	• plates move apart	• formation of new oceanic crust • mid-ocean ridges • sea floor spreading • continental rifting
Transform	• plates slide past each other	• earthquakes

Technologies such as the Global Positioning System (GPS) measure the rate at which tectonic plates move. Different plates move at rates that vary from 1 to 15 cm per year.

Mantle Convection

When partially melted mantle material is heated by Earth's core, it rises toward Earth's surface. Cooler, denser mantle material sinks away from the surface. This sets up large **convection currents** within the mantle. This **mantle convection** is thought to move tectonic plates. Two processes that result from mantle convection and contribute to tectonic plate movement are **ridge push** and **slab pull**. Ridge push occurs as rising material pushes plates apart. Slab pull occurs when a subducting plate pulls the rest of a plate down.

The Lithosphere and Asthenosphere

Use with textbook page 290.

1. Describe how the following terms are related:

   a) lithosphere and crust

   _____

   b) lithosphere and mantle

   _____

   c) asthenosphere and mantle

   _____

2. What is the key role of the asthenosphere in the theory of plate tectonics?

   _____

   _____

3. What characteristics of the asthenosphere make it suitable for moving Earth's tectonic plates?

   _____

   _____

4. One analogy compares the asthenosphere to toothpaste or melted tar. Come up with your own analogy to describe the asthenosphere.

   _____

5. Use the Venn diagram to compare and contrast continental and oceanic crust.

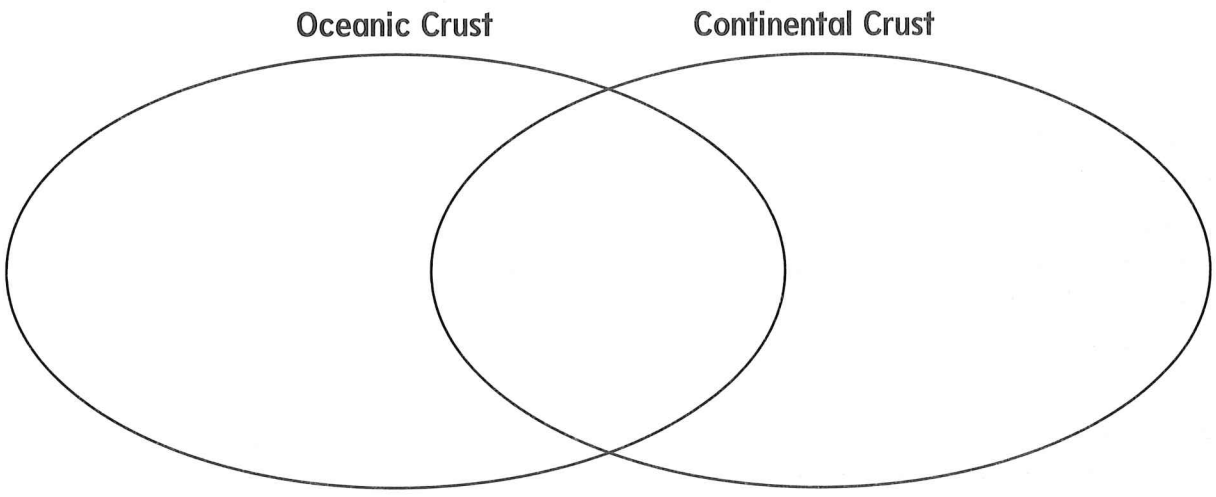
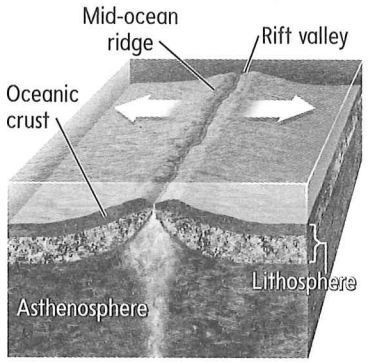
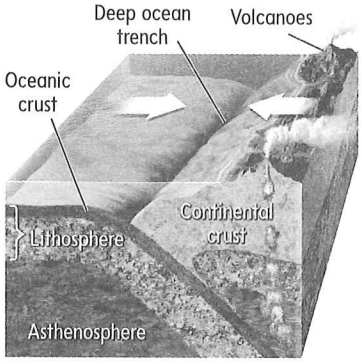
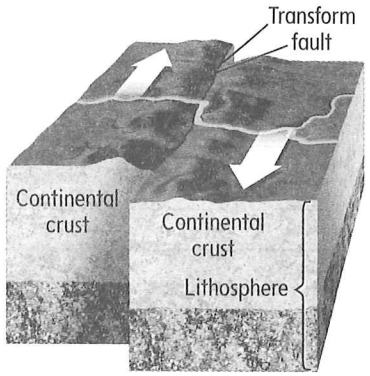


Plate Boundaries

Use with textbook pages 291–292.

1. Identify each type of plate boundary shown in the table, and describe the type of geological activity that occurs at that boundary.

Plate Boundary: _____	Plate Boundary: _____	Plate Boundary: _____
		
Geological Activity	Geological Activity	Geological Activity

2. Use your understanding of divergent and convergent plate boundaries to explain why the surface of Earth is not getting any larger or smaller.

_____

_____

Mantle Convection

Use with textbook page 294.

1. What two sources supply the heat energy that drives mantle convection?

2. How could you use a hot plate, a large beaker, water, and food colouring to model mantle convection? Draw a diagram to show what your model would look like, and explain how your model represents convection in Earth's mantle.

4.2 Assessment

Match each geological feature or process on the left with the plate boundary or boundaries it is associated with on the right. A geological feature or process can be present at more than one type of plate boundary.

Geological Feature or Process	Plate Boundary
1. ____ subduction	A. divergent plate boundary
2. ____ plate separation	B. convergent plate boundary
3. ____ mountain formation	C. transform plate boundary
4. ____ creation of new crust	
5. ____ plates sliding past one another	
6. ____ plate collision	
7. ____ deep sea trenches	
8. ____ volcanoes	
9. ____ mid-ocean ridge	
10. ____ earthquakes	
11. ____ continental rifting	
12. ____ sea floor spreading	

Circle the letter of the best answer for questions 13 to 24.

13. Which of the following best describes the lithosphere?

A. It comprises of only the crust.

B. It comprises of only mantle material.

C. It comprises of crust and part of the upper mantle.

D. It comprises of parts of all of Earth's layers.

14. Which of the following best describes the asthenosphere?

A. The material that makes up tectonic plates.

B. A material that flows.

C. Partially melted crust.

D. Liquid outer core.

15. Which statement best describes the relationship between the lithosphere and asthenosphere?

A. The lithosphere and asthenosphere are fused (joined) together.

B. The lithosphere and asthenosphere do not interact.

C. The asthenosphere floats on the lithosphere.

D. The lithosphere is broken into tectonic plates that float on the asthenosphere.

16. At a divergent plate boundary,

A. subduction occurs

B. sea floor spreading occurs

C. plates collide

D. deep sea trenches form

17. At a convergent plate boundary,

A. subduction occurs

B. rifts are present

C. plates move apart

D. new oceanic crust is made

18. At a transform plate boundary,

A. subduction occurs

B. there are volcanoes

C. plates slide past each other

D. mid-ocean ridges form

19. Deep sea trenches

A. form at subduction zones

B. form at convergent plate boundaries

C. are the deepest parts of the oceans

D. All of the statements are correct

20. Subduction occurs

A. when plates slide past each other

B. when tectonic plates are not moving

C. at mid-ocean ridges

D. when dense crust goes below less dense crust

21. The movement of tectonic plates

A. can be measured using satellites

B. is measured in cm/year

C. causes plates to interact

D. All of the statements are correct

22. Which statement best describes convection?

A. Cool fluid rises, while warm fluid sinks.

B. Warm fluid stays at the surface, while cool fluid stays at the bottom.

C. Warm fluid rises, while cool fluid sinks.

D. Cool fluid stays at the surface, while warm fluid stays at the bottom.

23. Which statement best describes slab pull?

A. Occurs at subduction zones.

B. Leading edge of plate pulls rest of plate down.

C. Gravity assists with plate movement.

D. All of the statements are correct.

24. Which statement best describes ridge push?

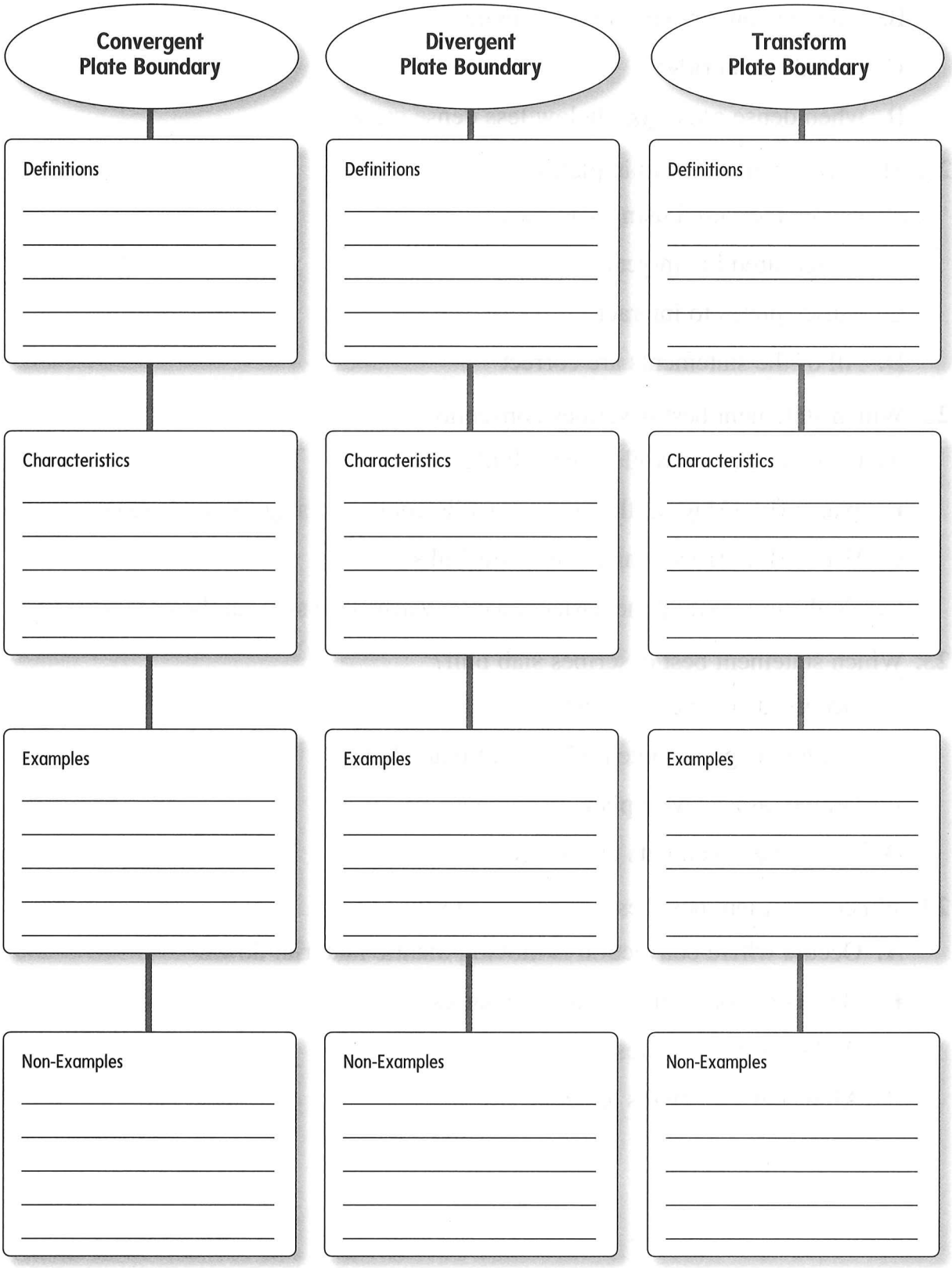
A. Occurs where convection is moving mantle material down.

B. Occurs at convergent plate boundaries.

C. Pushes tectonic plates apart.

D. All of the statements are correct.

25. Use a graphic organizer like the one below, or another of your choosing, to compare and contrast the three types of plate boundaries.



Name Date

Topic 4.3 Summary

How does the theory of plate tectonics explain Earth's geological processes?

Use with textbook pages 298–313.

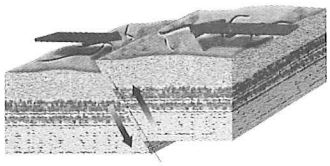
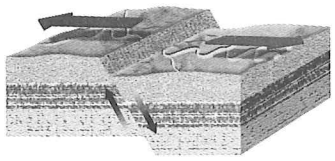
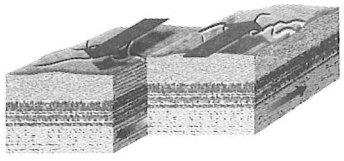
Earthquakes

Almost all **earthquakes** occur at tectonic plate boundaries. The movement of the plates applies pressure to rock. When the pressure is too great, the rock breaks and the energy is released in the form of an earthquake. A **fault** is the surface along which rocks break and move. The three types of faults are summarized in the table below.

The place deep in the crust where an earthquake starts is called the focus. The surface location directly above the focus is called the epicentre. As an earthquake occurs, vibrations called seismic waves are released.

Seismographs are used to measure and record ground movement. Data from seismographs can be used to determine strength and location of an earthquake. The Richter scale is used to represent the **magnitude** or strength of an earthquake. An increase of 1 on the scale represents a 10-fold increase in the strength of the earthquake.

Types of Faults

Reverse	• rock is squeezed together • one block rides up and over the other block • crust is shortened	
Normal	• rock is pulled apart • one block slips down relative to the other block • crust is lengthened	
Strike-slip	• blocks of rock move past each other horizontally	

Summarize

Write a short paragraph that summarizes the relationship among a fault, a focus, and an epicentre.

Topic
4.3
Summary

Reading Check

What is the difference between magma and lava?

Volcanoes

Magma moves from the mantle to Earth's surface at **volcanoes**. When magma reaches the surface of Earth it is referred to as lava.

Volcanoes can occur at oceanic-oceanic or oceanic-continental convergent plate boundaries. When an oceanic plate is subducted beneath another plate, magma can rise to form volcanoes. An oceanic trench forms where an oceanic plate is subducted. A curved group of volcanic islands forms when an oceanic plate subducts beneath another oceanic plate. High mountain ranges form when an oceanic plate subducts beneath a continental plate.

Mountain Ranges

Mountain ranges form at convergent plate boundaries. At oceanic-continental convergent boundaries volcanic mountains form as well as mountain ranges produced from pressure from colliding plates. At continental-continental plate boundaries, there is no subduction. This means one plate is pushed up on the other forming mountains. This is how the Himalayan mountain range is thought to have formed.

At the Surface: Before and After

Use with textbook pages 300–301.

1. Draw a cross-section or aerial view that shows what an area of land looks like before and after an earthquake occurs along a normal fault.

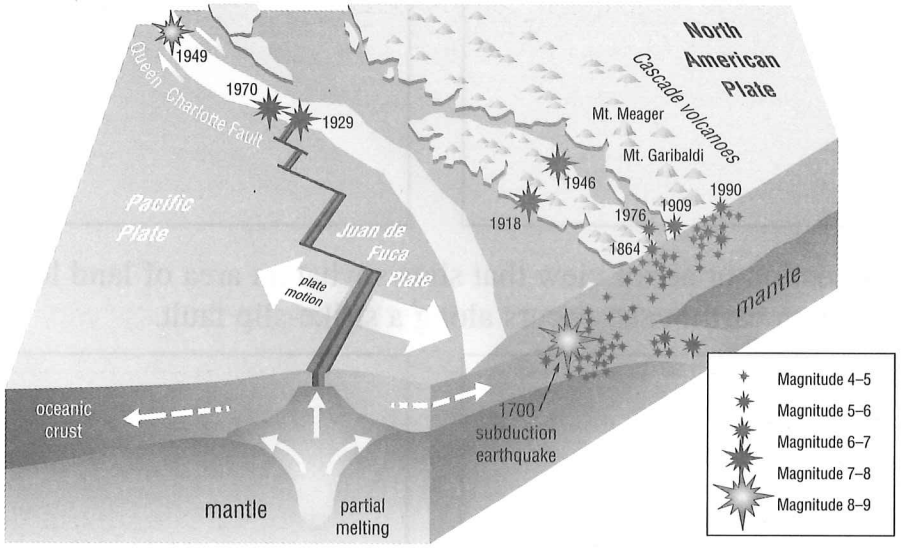
2. Draw a cross-section or aerial view that shows what an area of land looks like before and after an earthquake occurs along a strike-slip fault.

3. Draw a cross-section or aerial view that shows what an area of land looks like before and after an earthquake occurs along a reverse fault.

Interpreting Epicentres of the Juan de Fuca Plate

Use with textbook pages 300–301.

There is a usually an earthquake of very low magnitude (strength) every day in B.C. Most of these earthquakes originate beneath the ocean floor. Some have their focus in the crust at depths of 20 km or less. Major earthquakes occur within the Juan de Fuca plate and the subduction zone shown in the diagram below. Only earthquakes larger than magnitude 4 are shown. (Earthquakes of magnitude 4 will be felt by most people but are unlikely to cause much damage. Magnitude 5 and higher earthquakes have damaging effects.)



Write a paragraph to answer this question: Why do you think there are so many earthquakes in this area? Your answer should be based on evidence from the diagram and your understanding of plate tectonics.

Volcanoes at Convergent Boundaries

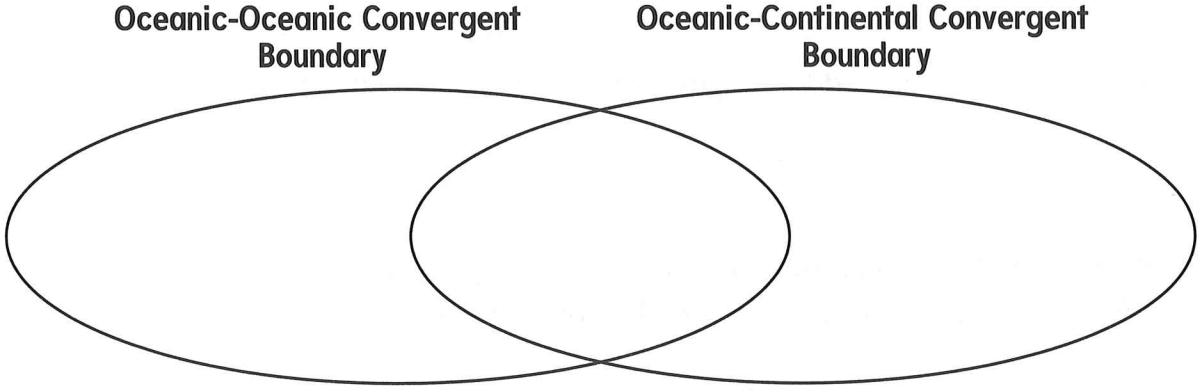
Use with textbook pages 306–307.

1. Explain how volcanoes form at convergent plate boundaries.

2. What characteristic of the converging plates determines which plate is subducted? You may wish to refer back to Topic 4.2 in your textbook, if necessary.

3. List the hazards that volcanoes can present.

4. Use the Venn diagram to compare the geologic features at the two types of oceanic convergent boundaries.

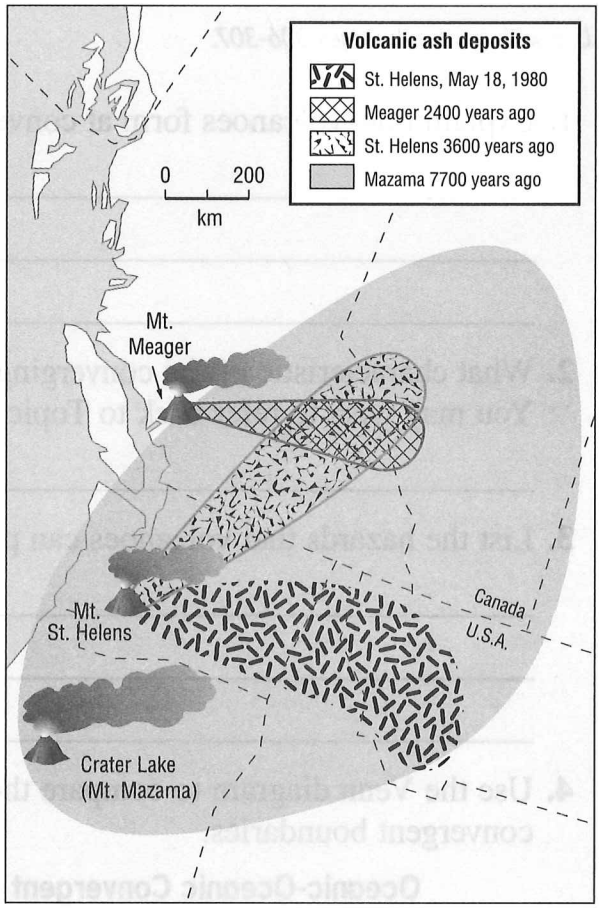


5. Why do islands form at an oceanic-oceanic convergent plate boundary?

6. Why do mountain ranges form at an oceanic-continental convergent plate boundary?

Volcanic Ash Analysis

An erupting volcano can produce huge clouds of ash that extend hundreds of kilometres. The ash can cause breathing problems as well as damage to crops, buildings, and machinery. The map at right shows deposits of volcanic ash in western North America over a long period of time. Use the map to answer the questions that follow.



1. Which volcano created the largest expanse of ash? When did it happen?

2. What direction do you think the wind was blowing when the volcanoes erupted? What evidence are you using to make your inference?

3. Why are cities in the interior of B.C. more likely than coastal cities to receive ash from the volcanoes shown?

Mountain Ranges

Use with textbook pages 307, 309, and 310.

1. Why do colliding continental plates behave differently than an oceanic plate colliding with a continental plate?

2. Why is there no volcanic activity at a continental-continental convergent boundary?

3. Explain the differences between the formation of the Coast Mountains in British Columbia and the Himalayan Mountains in southern Asia.

4. The Burgess Shale is famous for its fossils. It is located 2286 m above sea level in Yoho National Park near Golden, British Columbia. It contains 508-million-year-old fossils of sea organisms that lived on a reef. Use plate tectonics to explain how fossils of sea creatures can be found high in the mountains.

5. What plates collided (and are still colliding) and resulted in the formation of the Himalayan Mountains?

4.3 Assessment

Match each term on the left with the best descriptor on the right. Each descriptor may be used only once.

Term	Descriptor
1. ____ focus	A. earthquake vibrations
2. ____ seismograph	B. anywhere that molten rock from the mantle reaches Earth's surface
3. ____ reverse fault	C. occurs when blocks of rock are squeezed together
4. ____ earthquake	D. seismic waves that move the fastest
5. ____ hot spot volcano	E. occurs when blocks of rock slide past each other
6. ____ fault	F. seismic waves that only travel on the surface of Earth
7. ____ epicentre	G. point on Earth's surface directly above where earthquake starts
8. ____ seismic waves	H. natural movement of the ground when part of Earth's crust shifts
9. ____ subduction	I. occurs when blocks of rock are pulled apart
10. ____ strike-slip fault	J. seismic waves that can only travel through solids
11. ____ surface waves	K. location on Earth where earthquake starts
12. ____ normal fault	L. instrument that measures and records ground vibrations
13. ____ secondary waves	M. used to measure the magnitude of earthquakes
14. ____ volcano	N. the break in rock where movement happens during an earthquake
15. ____ primary waves	O. the movement of one tectonic plate under another
16. ____ Richter scale	P. occurs away from plate boundaries

Circle the letter of the best answer for questions 17 to 27.

17. Which of the following statements describe earthquakes?

A. Earthquakes can be predicted.

B. Most earthquakes occur at tectonic plate boundaries.

C. Earthquakes only occur under the oceans.

D. All of the statements are correct.

Use the table to answer questions 18 to 20.

I	strike-slip fault
II	reverse fault
III	normal fault

18. Which types of faults can form due to an earthquake?

A. I and II

B. I and III

C. II and III

D. I, II, and III

19. Which types of faults result in vertical (up or down) movement of blocks of rock?

A. I

B. I and II

C. II and III

D. I, II, and III

20. Which types of faults result in only horizontal movement of blocks of rock?

A. I

B. I and II

C. II and III

D. I, II, and III

21. Which statement best describes the epicentre of an earthquake?

A. The point where breakage of rock first happens.

B. The break where movement happens.

C. The point on Earth's surface directly above the focus.

D. All of the above statements are true.

22. Which statement best describes primary (P) waves?

A. Travel only through solids.

B. Cause rock particles to move forward and backward.

C. Slowest of the three types of waves.

D. All of the above statements are true.

23. Which statement best describes secondary (S) waves?

A. Travel only through solids.

B. Fastest of the three types of waves.

C. Cause rock particles to move up and down and side to side.

D. All of the above statements are true.

24. Which statement best describes surface (L) waves?

A. Travel only along the surface of Earth.

B. Slowest of the three types of waves.

C. Often cause the greatest damage.

D. All of the above statements are true.

25. When an oceanic plate collides with another tectonic plate,

A. subduction occurs.

B. an oceanic trench is formed.

C. magma can rise to the surface and cause an eruption.

D. All of the above statements are true.

26. Which statement best describes a hot spot volcano?

A. They form at tectonic plate boundaries.

B. They show evidence of tectonic plate movement.

C. They occur due to subduction.

D. All of the above statements are true.

27. When two continental plates collide,

A. subduction occurs.

B. mountain ranges form.

C. volcanoes are formed.

D. the plates stop moving.

28. Use the table to show how plate tectonics can be used to explain the occurrences of earthquakes, volcanoes, and mountain formation.

Geological Process	Explanation
Earthquakes	
Volcanoes	
Mountain Formation	

Name Date

Topic 4.4 Summary

How do geological features and processes affect where and how we live?

Use with textbook pages 318–325.

Summarize

What have you and your family done to prepare for a natural disaster?

British Columbia's Landscape

Geological processes have shaped B.C.'s landscape and given rise to features such as mineral deposits, river deltas, and hot springs. These features have influenced settlement patterns over the long history of the province.

Region	Geological Features
Northern Interior	• glacial lakes • nutrient rich soils • jade deposits in ancient oceanic rock
Northeast Peace River Region	• rich soils from ancient glacial lake • natural gas, oil and coal deposits • fossils
Southern Interior	• steep-walled canyons • lakes • mineral resources
Rocky Mountains	• some of Canada's highest mountains • North America's longest mountain valley • hot springs
Coastal Regions	• mountains and islands • earthquakes • dormant volcanoes

Geohazards

Geohazards are destructive events that result from geological processes. The province is vulnerable to many types of geohazards due to factors such as its location near active tectonic plate boundaries, the amount of rain and snow that falls, and the effects of ancient glaciers.

When and where earthquakes and other geohazards occur cannot be predicted accurately. Individuals, families, and governments can take steps to be more prepared for any type of geohazard.

Being Prepared

Use with textbook pages 323–324.

1. Even though we are unable to predict when a particular geohazard such as an earthquake will occur, it is important to be prepared for such an event. List all of the items you think should be kept in an emergency preparedness kit.

2. Visit the City of Vancouver website and review what is recommended for an evacuation kit and a home emergency preparedness kit. Write down any items you did not include on your list in question #1.

3. Tofino and Vancouver are both located near the Cascadia subduction zone. People in both places need to be prepared for the high likelihood of an earthquake occurring. However, the people of Tofino need to be prepared for different geohazards than the people of Vancouver.

   a) Find the District of Tofino and the City of Vancouver on a map. If an earthquake occurred off the west coast of British Columbia, what type of resulting geohazard would Tofino residents need to be prepared for that Vancouver residents would not?

   b) Why would this particular geohazard be a risk for Tofino, but not Vancouver?

4. Governments have a responsibility to ensure residents are aware of the risks of geohazards in their region and how to prepare for them.

   a) What does your local government do to inform residents of geohazard risks and how to prepare for them?

   b) What does the provincial government do?

Geohazards in British Columbia

Use with textbook pages 322–323.

British Columbia is vulnerable to different types of geohazards.

1. Briefly describe some of the geohazards to which British Columbia is vulnerable.

2. a) What factors make British Columbia vulnerable to geohazards?

b) Which of these factors might also make British Columbia an attractive place for people to live? Explain.

3. British Columbia is Canada's most tectonically active province.

a) Which tectonic plates contribute to British Columbia's geohazard risk?

b) What type of tectonic plate boundaries exist near British Columbia?

c) What geohazards do these tectonic plate interactions put British Columbia at risk of?

The Geology of Your Region

Use with textbook pages 320–323.

1. Identify on the map the region where you live.

_____

2. Think about the landforms and other geologic features of the place where you live.
   a) What geologic features makes your local area attractive to you?

_____

_____

   b) What geologic features make your local area attractive to tourists?

_____

_____

3. What geohazards could occur in your region?

_____

_____

4. Research the geological history of your local area.
   a) How has the geological history given rise to the geologic features you enjoy?

_____

_____

_____

   b) How has the geological history contributed to the risk of geohazards in your region?

_____

_____

_____

4.4 Assessment

Match the geohazards with their associated effects. Each effect may be associated with more than one geohazard.

Effect	Geohazard
1. movement of snow down a mountainside	A. volcano
2. can release large amounts of ash into atmosphere	B. earthquake
3. can cause damage to roads/bridges	C. avalanche
4. can give rise to tsunamis	D. mud/landslide
5. releases molten rock	
6. movement of mud down a mountainside	
7. violent shaking of ground	
8. can melt snow/glaciers causing lahars (mudslides)	

Circle the letter of the best answer for questions 9 to 14.

9. Which of the following statements is true of geohazards?

A. They can pose threats to people and property.

B. They are always human caused.

C. They only happen in the winter.

D. They can be predicted.

10. What region of Canada has the greatest amount of earthquake activity?

A. Saskatchewan

B. Western British Columbia

C. Central Ontario

D. Nunavut

11. Why does British Columbia have a history of volcanic activity?

A. It is located near the Pacific Ocean.

B. It has many deep valleys.

C. It is a mountainous region.

D. It is near tectonic plate boundaries.

12. Which of the following statements is not true of earthquakes?

A. They can give rise to tsunamis.

B. They usually occur at tectonic plate boundaries.

C. They can be accurately predicted.

D. British Columbia is at risk of earthquakes.

13. Which of the reasons could be used to explain why British Columbia is susceptible to geohazards?

A. It has substantial amounts of snow and rain.

B. It is a mountainous province.

C. It is located in a tectonically active region.

D. All of the reasons could be used.

14. The presence of tectonic plate boundaries near British Columbia

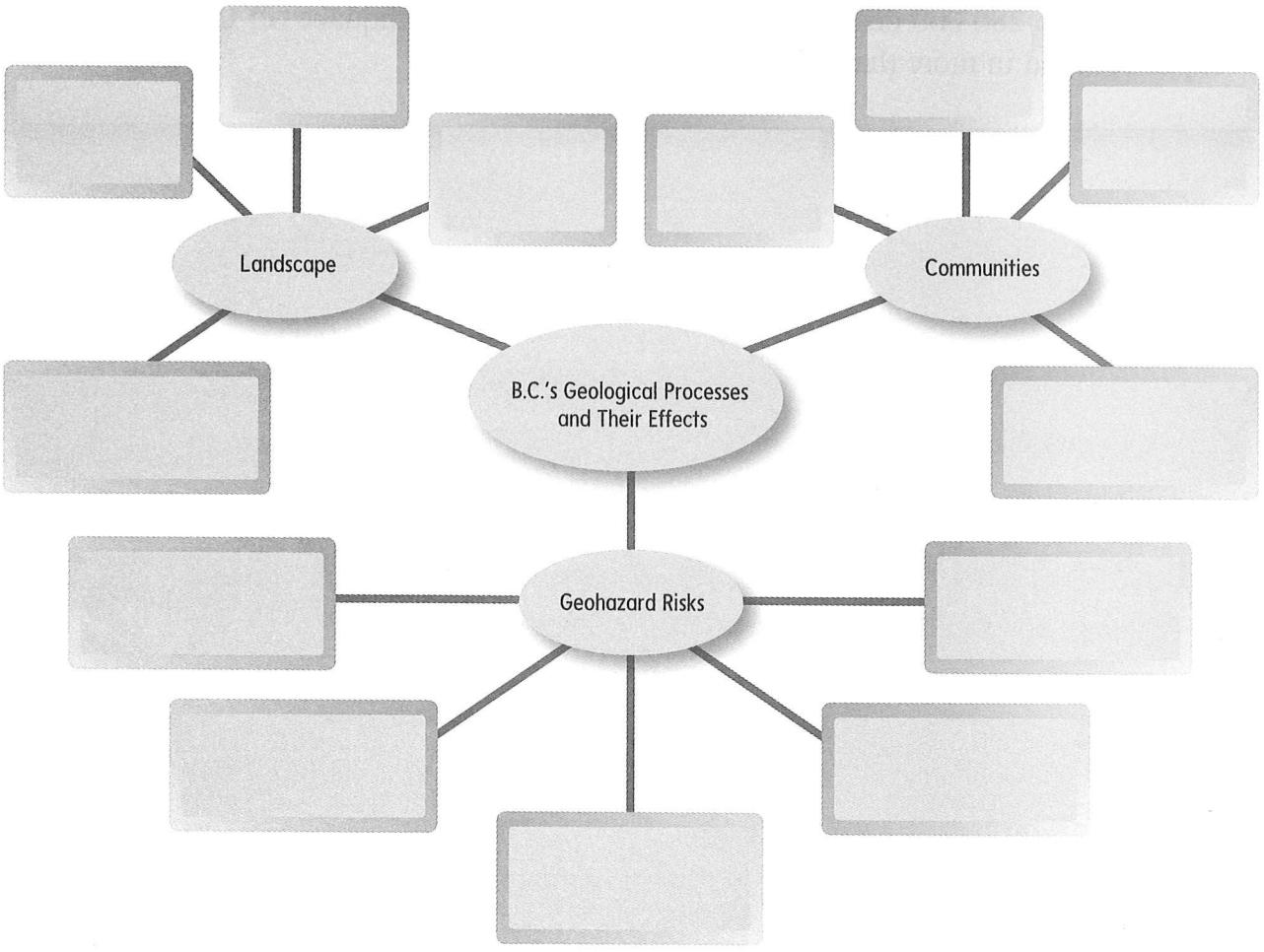
A. puts British Columbia at greater risk of geohazards.

B. explains the presence of volcanoes in British Columbia.

C. explains why British Columbia is at high risk of earthquakes.

D. All of the above statements are true.

15. Complete the mind map for British Columbia's geological processes and their effects on the landscape and communities.



Name Date

Unit 4 AT Issue

Should we worry about the Cascadia subduction zone?

What's the Issue?

The Cascadia subduction zone stretches from Vancouver Island to northern California. It is believed that the subduction zone is overdue for a megathrust earthquake. The west coast of North America, which parallels the subduction zone, is home to more than 10 million people who live in the "hazard zone." Large cities near the subduction zone include Vancouver, British Columbia; Seattle, Washington; and Portland, Oregon. Geologists have used scientific research as well as traditional oral narratives from coastal First Peoples to piece together the geologic history of the region. This history shows evidence of past megathrust earthquakes.

Other regions that have characteristics similar to the Cascadia subduction zone and have experienced megathrust earthquakes include northern Japan and Indonesia. In 2004 the Indian Ocean earthquake off the coast of Indonesia resulted in 230 000 to 280 000 deaths, and in 2011 the Tohoku earthquake off the coast of Japan resulted in more than 15 000 deaths.

Dig Deeper

Collaborate with your classmates to explore one or more of these questions—or generate your own questions to explore.

1. The Cascadia subduction zone is located at convergent plate boundaries.
   a) What tectonic plates form the Cascadia subduction zone?
   b) What geologic features typical of a convergent plate boundary can be found near the subduction zone?
2. The Cascade volcanic arc extends from north of Whistler, British Columbia, through the states of Washington and Oregon and into northern California.
   a) List the volcanoes that belong to this volcanic arc.
   b) What major eruptions have occurred along the arc?
   c) Use the theory of plate tectonics to explain the existence of these volcanoes.
3. It is believed that the last megathrust earthquake to occur on the subduction zone happened in 1700.
   a) What is the Neskowin Ghost Forest and how was it used to show evidence of the 1700 earthquake?
   b) What coastal First Peoples have traditional oral narratives that include the stories of the 1700 earthquake?
   c) What evidence for the 1700 earthquake has been found in British Columbia?
4. Earthquakes that occur at underwater subduction zones can cause devastating tsunamis.
   a) How and why does a tsunami form?
   b) What have coastal communities along the subduction zone done to prepare for a potential tsunami?
   c) What areas of British Columbia are especially at risk of a tsunami?
5. Geologists believe the Cascadia subduction zone is overdue for a high magnitude megathrust earthquake.
   a) What evidence has been collected to suggest the region is due for an earthquake?
   b) If a megathrust earthquake were to happen, what geohazards could occur?
   c) What have the various levels of government in British Columbia done to prepare for a future megathrust earthquake?