DATE: NAME: CLASS:

UNIT 4

Unit 4 Summary

BLM 4-1

Goal • Use this summary to review the concepts in Unit 4, Earth's Crust.

Chapter 10 Earth's crust is made up of rocks and minerals.

- A mineral is a pure, naturally occurring, inorganic solid substance, such as quartz, hematite, mica, and magnetite. (10.1)
- Minerals can be identified by their properties such as lustre, colour, streak, hardness, cleavage, and fracture. Lustre can be dull, glassy, or metallic. The Mohs Hardness Scale is used to rank the hardness of minerals. (10.1)
- A rock is a mixture of two or more minerals. Rocks are grouped into three families based on how they were formed: igneous, sedimentary, and metamorphic. (10.2)
- Igneous rocks result from the cooling of magma below Earth's surface (intrusive) or the cooling of lava at Earth's surface (extrusive). (10.2)
- Sedimentary rocks are formed through the processes of compaction and cementation and are composed of sediment from rocks, minerals, and decaying plants and animals. (10.2)
- Metamorphic rocks are made when heat, pressure, and/or hot fluids change one type of rock into another type. (10.2)
- Rocks change from one family to another as they are heated up, cooled down, worn away, and placed under pressure in the ongoing processes of the rock cycle. (10.3)
- Rocks and minerals have many uses. Many rock and mineral resources are found in Newfoundland and Labrador. (10.3)

Chapter 11 Earth's crust is constantly changing.

- Earth is made of four layers: crust, mantle, outer core, and inner core. (11.1)
- Evidence from the shape of continents, fossils, rocks, and climate change indicates that Earth's crust is broken into pieces. Evidence has also been gathered from the sea floor by sonar, magnetometers, and deep sea drilling. (11.1)
- The theory of plate tectonics replaced the continental drift theory and suggests that convection currents in the mantle may be the reason for the movement of the crust. (11.1)
- Earthquakes can occur where plates push together, pull apart, or move sideways past each other. (11.2)
- Where plates meet on convergent boundaries, mountains can form. When one plate subducts under another plate, melting occurs, forming volcanoes and mountain ranges. (11.3)
- The geologic time scale divides Earth's history into eras based on the appearance of life forms in the fossil record. (11.3)

Chapter 12 Soil is the living component of Earth's crust.

- Weathering, erosion, and deposition work together to break rock down and transport the sediments to other locations. (12.1)
- Eroded minerals, organic matter such as decaying plant and animal materials (humus), water, and air can combine to form soil that can support the life of plants. (12.2)
- Soils are considered to be sand/gravelly, clay, or loam depending on their particle size. Five factors that determine the type of soil formed are parent rock, climate, vegetation, landscape, and time. (12.2)
- Topsoil is a precious and valuable resource that can be easily lost due to misuse. There are ecological farming and forestry practices that can reduce erosion and help improve the quality of the soil. (12.3)

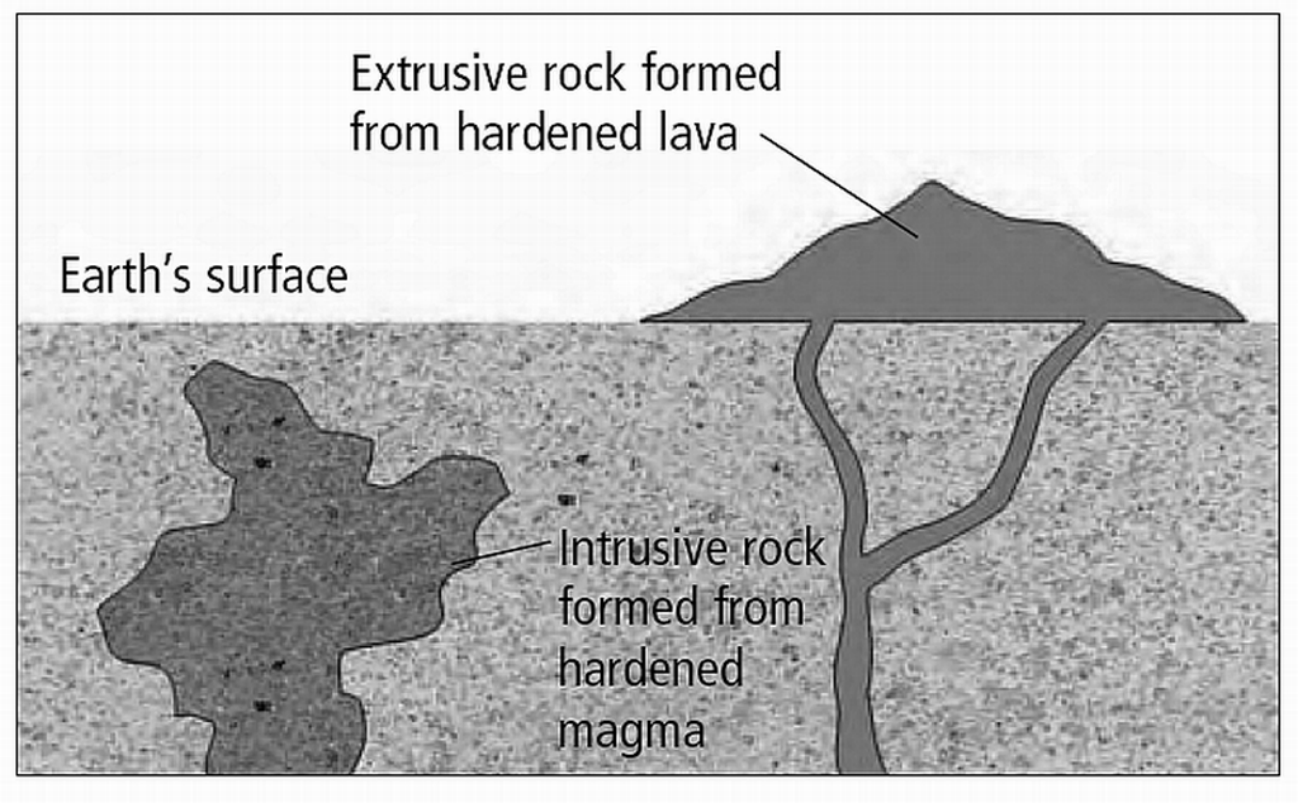
DATE: NAME: CLASS:

CHAPTER 10

Two Groups of Igneous Rocks

BLM 4-10

Goal • Learn about how the two types of igneous rocks form.



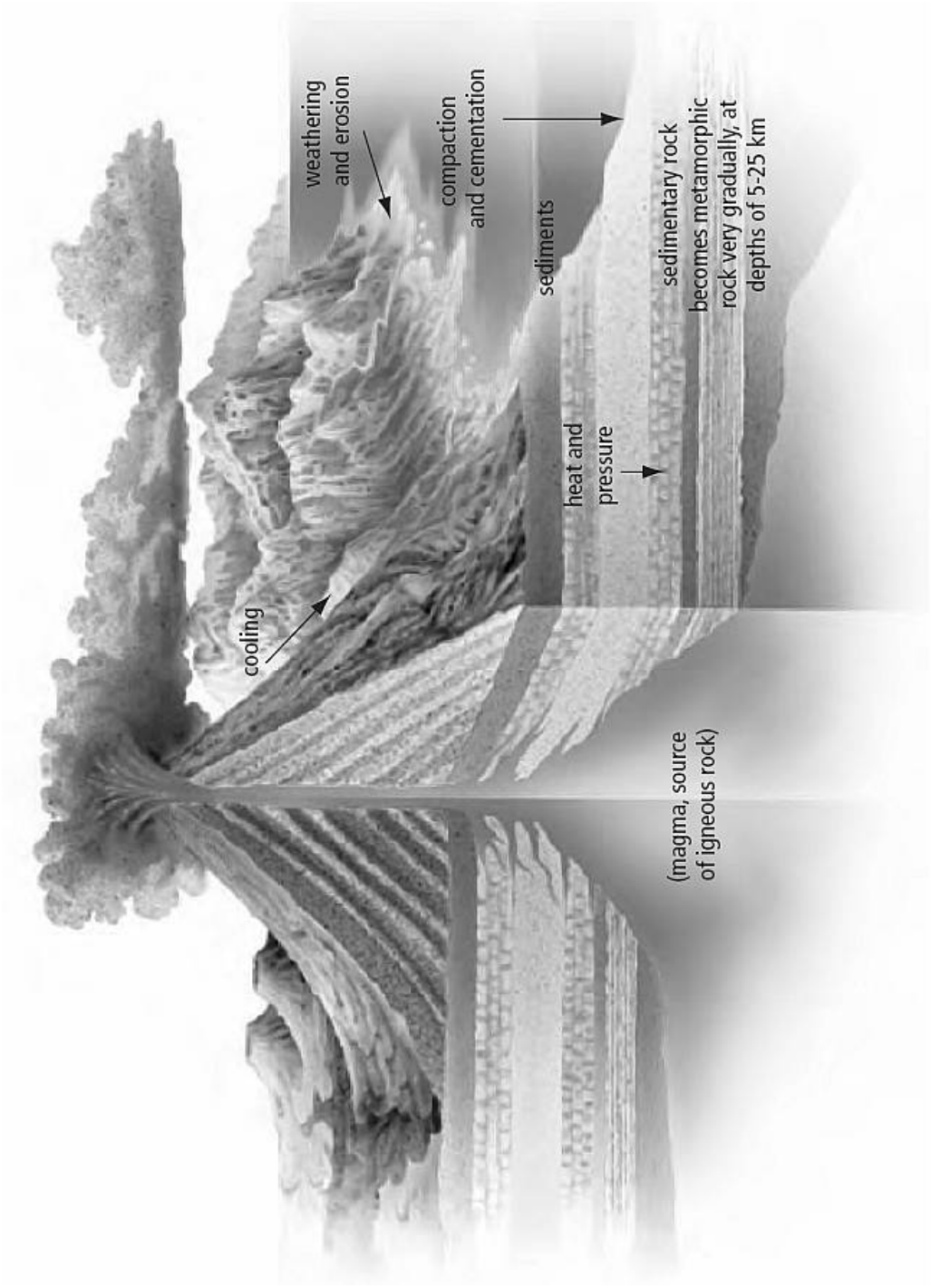
DATE: NAME: CLASS:

CHAPTER 10

Processes in the Rock Cycle

BLM 4-11

Goal • Learn about the processes in the rock cycle.



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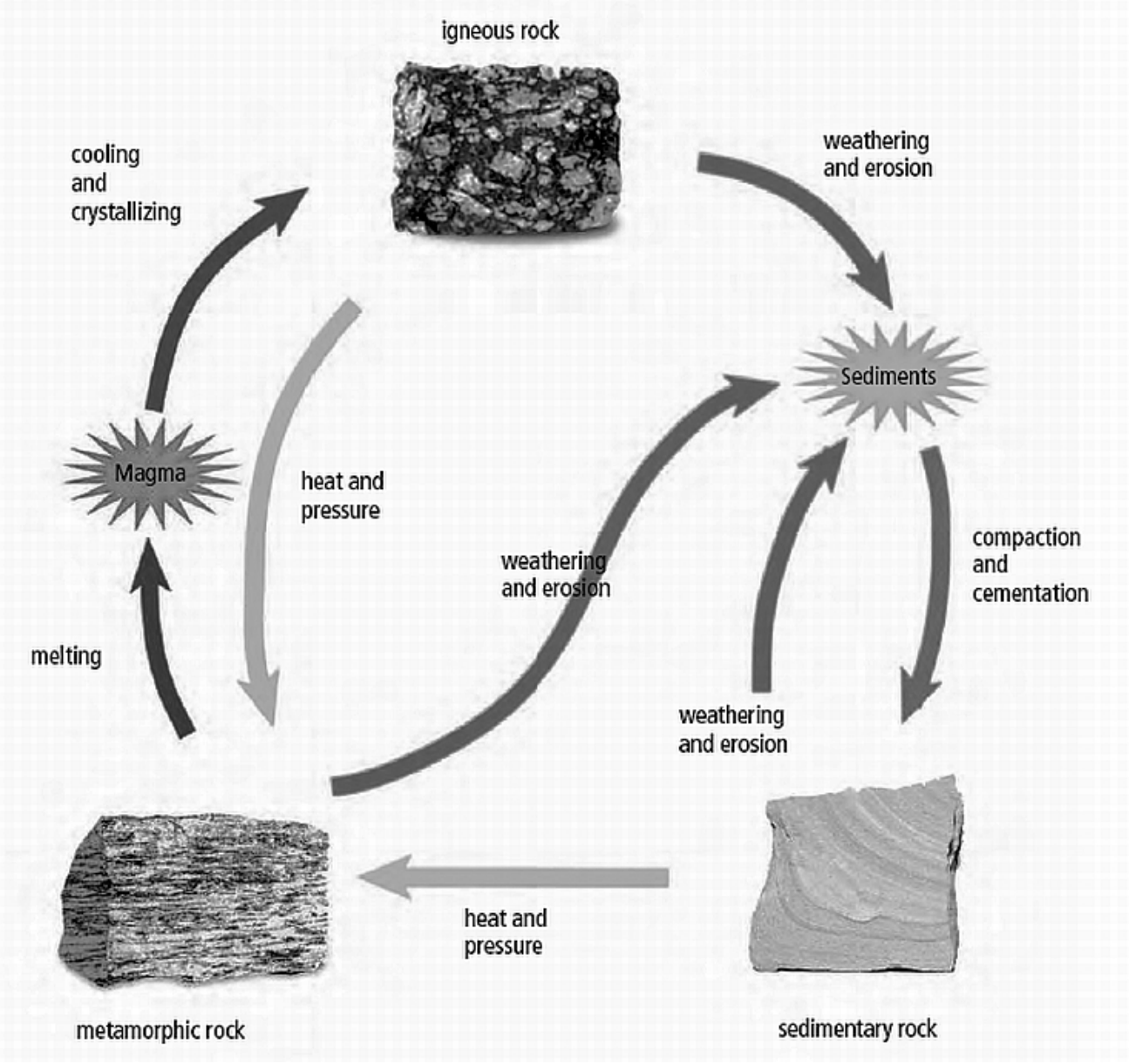
CHAPTER 10

A Rock Cycle Model

BLM 4-12

Goal • Learn about the parts of the rock cycle.



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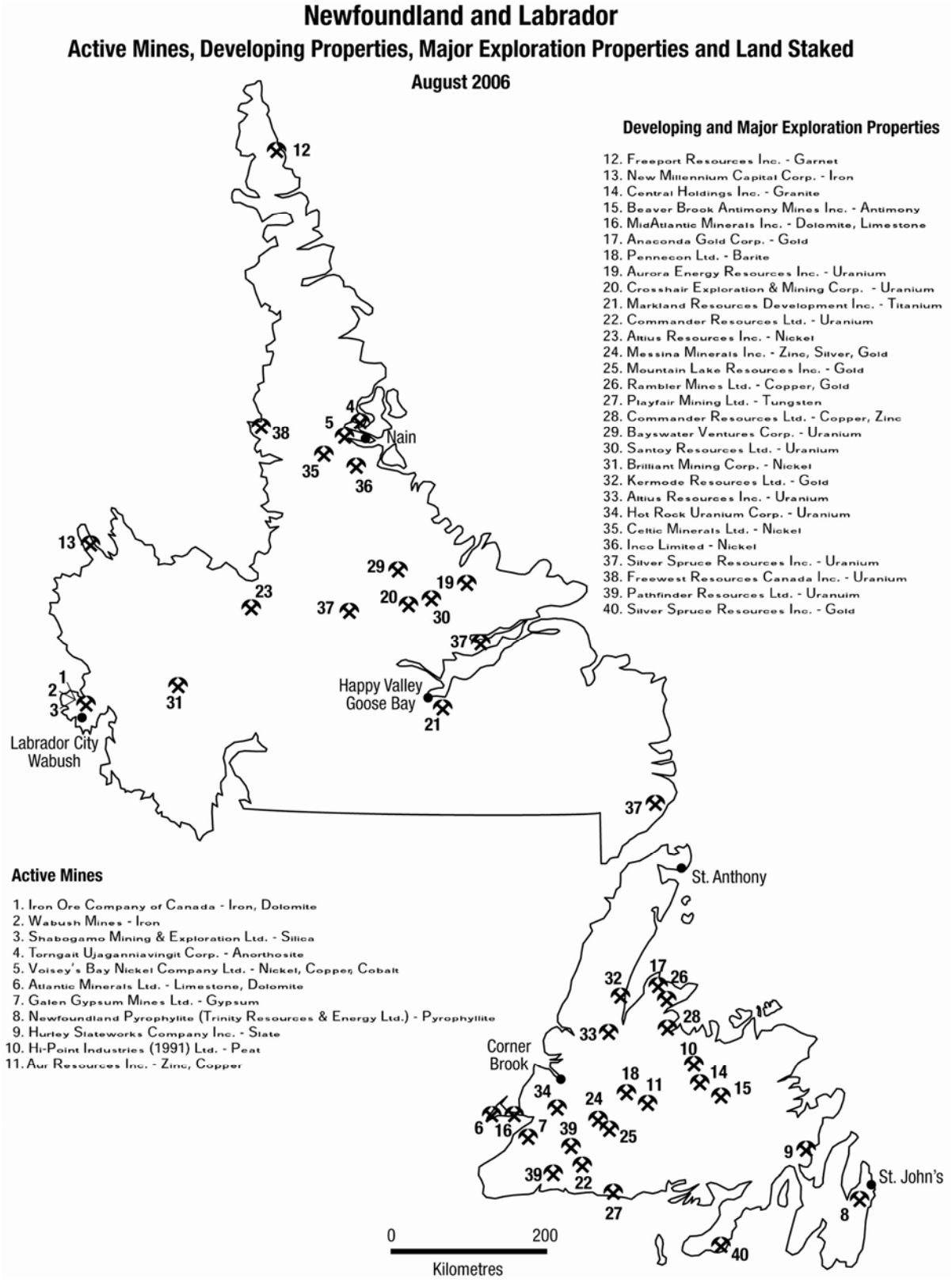
CHAPTER 10 # Research the Resource BLM 4-13

Goal • Use this map to help you complete Think About It 10-3B, Research the Resource.



DATE: NAME: CLASS:

BLM 4-13
continued

What Did You Find Out?

1. (a) Which mine is closest to where you live? _____

(b) What resource is mined there? _____

(c) What is one use for the resource?

_____

2. (a) What are five common mineral resources that are found in Newfoundland and Labrador?

_____

_____

_____

_____

_____

(b) Give one use for each resource.

_____

_____

_____

_____

_____

3. What effects does mining have on the surrounding environment?

_____

_____

_____

_____

_____

_____

_____

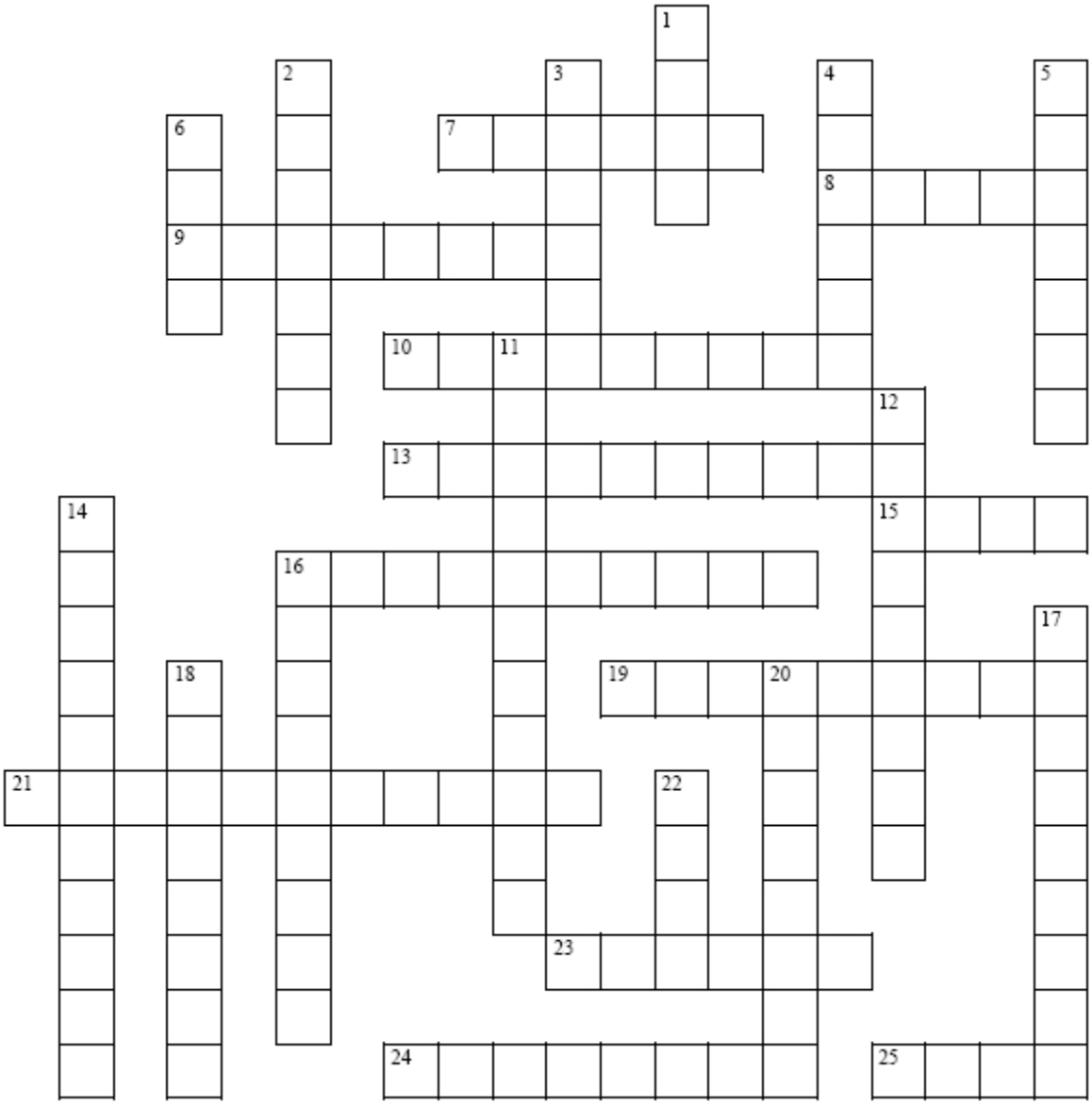
DATE: NAME: CLASS:

CHAPTER 10

Rocks and Minerals Crossword Puzzle

BLM 4-14

Goal	• Solve this crossword puzzle using terms from Chapter 10.



ACROSS

7 Examples are gold, silver, copper, iron, and zinc
8 Molten rock found below Earth's surface
9 Splits along smooth, flat planes
10 Processes by which rocks form and change (two words)
13 Process in which layers of sediment are squeezed together
15 Mineral with a value of 1 on the Mohs Hardness Scale
16 This type of rock has been changed into metamorphic rock (two words)
19 Rock that has cooled and hardened at Earth's surface
21 A rock family that includes gneiss, slate, and marble
23 The shininess of a mineral
24 Breaks along rough or jagged edges
25 Visible layers of rocks

DOWN

1 Valuable metallic mineral that is used in jewellery and has a yellow streak
2 Rock family that includes obsidian and granite
3 Powdered form of a mineral
4 The only rock that floats
5 Hardest known mineral
6 Mixture of two or more minerals
11 Process in which minerals dissolve and stick sediments together
12 Rock that has cooled and hardened below Earth's surface
14 Rock family that includes sandstone and shale
16 Sometimes called crude oil
17 Loose material, such as bits of rock, minerals, and plant and animal remains
18 Mineral used in pencils
20 Rock or mineral that can be mined and used for a specific purpose
22 Rare and beautiful minerals

DATE: NAME: CLASS:

CHAPTER 10

Igneous Rocks

BLM 4-15

Goal • Review your understanding of igneous rocks.

What to Do

Complete each statement with the correct term.

1. The word “igneous” comes from a Latin word meaning _____.

2. The type of igneous rock that forms when lava cools at or near Earth’s surface is called _____.

3. The type of rock that forms when magma cools slowly beneath Earth’s surface is called _____.

4. Molten material that is found below Earth’s surface is called _____.

5. Two conditions that are needed to melt minerals into magma are _____ and _____.

6. A common igneous rock that forms deep and very slowly in Earth’s crust is _____.

7. A common igneous rock that forms on Earth’s surface is _____.

8. The mineral crystals of an igneous rock that is formed below Earth’s crust are usually _____ than those formed at Earth’s crust.

9. Molten material that flows from volcanoes is called _____.

10. A rock that may form when molten material cools so quickly that no crystals can develop is _____.

DATE: NAME: CLASS:

CHAPTER 10 # The Rock Cycle BLM 4-16

Goal • Use these questions to review your understanding of the rock cycle.

Matching Questions

Match the term on the left with the best description on the right.
Each description may be used only once. You will not need to use every description.

Term	Description
_____ 1. gneiss _____ 2. granite _____ 3. obsidian _____ 4. limestone _____ 5. magma	A. source of igneous rock B. an intrusive rock C. a type of sedimentary rock D. parent rock of slate E. formed by heat and pressure F. an extrusive rock

Fill-in-the-Blanks Questions

6. If the minerals in a sedimentary rock melt and then cool, they can form a(n) _____ rock.

7. Sedimentary rocks and igneous rocks can be changed into metamorphic rocks by _____ and _____.

8. If an igneous rock weathers and erodes into fragments, the fragments can form a(n) _____ rock.

9. Weathering and erosion are two of the _____that change rocks.

Sorting Question

10. Write each word under the correct heading below: cementation, cooling, compaction, deposition, erosion, heating, igneous, melting, metamorphic, sedimentary, weathering

Processes in the Rock Cycle	Kinds of Rocks

DATE: NAME: CLASS:

CHAPTER 10

Rock Cycle Word Search Puzzle

BLM 4-17

Goal • Find and circle words about the rock cycle.

P H G C A U S E S G E N C C M E E M
U X E V U S E A N R M O B E I T T U
M Q A A I Y N I U E N I L A L I A E
I L B E T D R S T G K T G R S N L L
C V N T S E S A L F I A E W R A S O
E G Z T H E L O T N K T M S Y R L R
A L O T R S M B G N T N S I U G F T
F N A P G E D B F X E E N D R S L E
E E S H R C I H P R O M A T E M I P
W V Y A S Z Z F M I R E I J Y T M C
R S T N E M I D E S G C H D R L E O
E E C O M P A C T I O N H L E Z S O
F O B S I D I A N G M F E R Q S T L
N O I S O R E M A R B L E O H H O I
J B U Y L D X W A N J N C K U R N N
A Q W A M G A M R O C K I I B S E G

BASALT
CEMENTATION
COMPACTION
CONGLOMERATE
COOLING
EROSION
GEMS
GNEISS
GRANITE
HEAT
IGNEOUS
LAVA
LIMESTONE
MAGMA
MARBLE
MELTING
METALS
METAMORPHIC
OBSIDIAN
PETROLEUM
PRESSURE
PUMICE
ROCK
SANDSTONE
SEDIMENTARY
SEDIMENTS
SHALE
SLATE
WEATHERING

DATE: NAME: CLASS:

CHAPTER 10

Chapter 10 Review

BLM 4-18

Goal • Check your understanding of Chapter 10.

What to Do

Circle the letter of the best answer.

1. Which of the following is the best definition of a mineral?
   A. a mixture of coloured grains
   B. a mixture of solid substances
   C. a naturally occurring non-living solid substance
   D. a pure, organic solid substance

2. Which of the following minerals is harder than quartz?
   A. calcite
   B. diamond
   C. gypsum
   D. talc

3. Which of the following are igneous rocks?
   A. conglomerate, limestone
   B. gneiss, marble
   C. granite, basalt
   D. sandstone, shale

4. Which of the following are metamorphic rocks?
   A. conglomerate, limestone
   B. gneiss, marble
   C. granite, basalt
   D. sandstone, shale

5. Which of the following is true of the processes in the rock cycle?
   A. Only metamorphic rocks are changed by the processes.
   B. The processes occur in a set order.
   C. The processes occur only on the continents.
   D. The processes occur over thousands of years.

6. Which of the following rock and mineral resources is mined in Newfoundland and Labrador?
   A. diamonds
   B. gold
   C. silver
   D. tin

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

Term	Description
_____ 7. cementation _____ 8. compaction _____ 9. extrusive _____ 10. intrusive _____ 11. lava _____ 12. magma	A. rock formed from heat and pressure B. rock formed from lava C. rock formed from magma D. molten material at Earth's surface E. molten material below Earth's surface F. sediments are held together by another material G. weight and pressure on layers of sediments

Short Answer Questions

13. What are six properties you could use to identify a mineral?

_____

_____

_____

_____

_____

14. How is crystal size in igneous rocks related to the rate of cooling?

_____

_____

15. Why do sedimentary rocks have layers?

_____

_____

_____

16. Consider these three rocks: conglomerate, sandstone, shale.

(a) Which one has the smallest particles? _____

(b) Which one has the largest particles? _____

17. How is metamorphic rock formed from its parent rock? Include an example of a metamorphic rock and its parent rock in your answer.

_____

_____

_____

18. How are sediments created in the rock cycle?

_____

_____

_____

19. Imagine you have an unknown rock specimen. What steps would you take to identify whether it was igneous, sedimentary, or metamorphic?

_____

_____

_____

_____

_____

_____

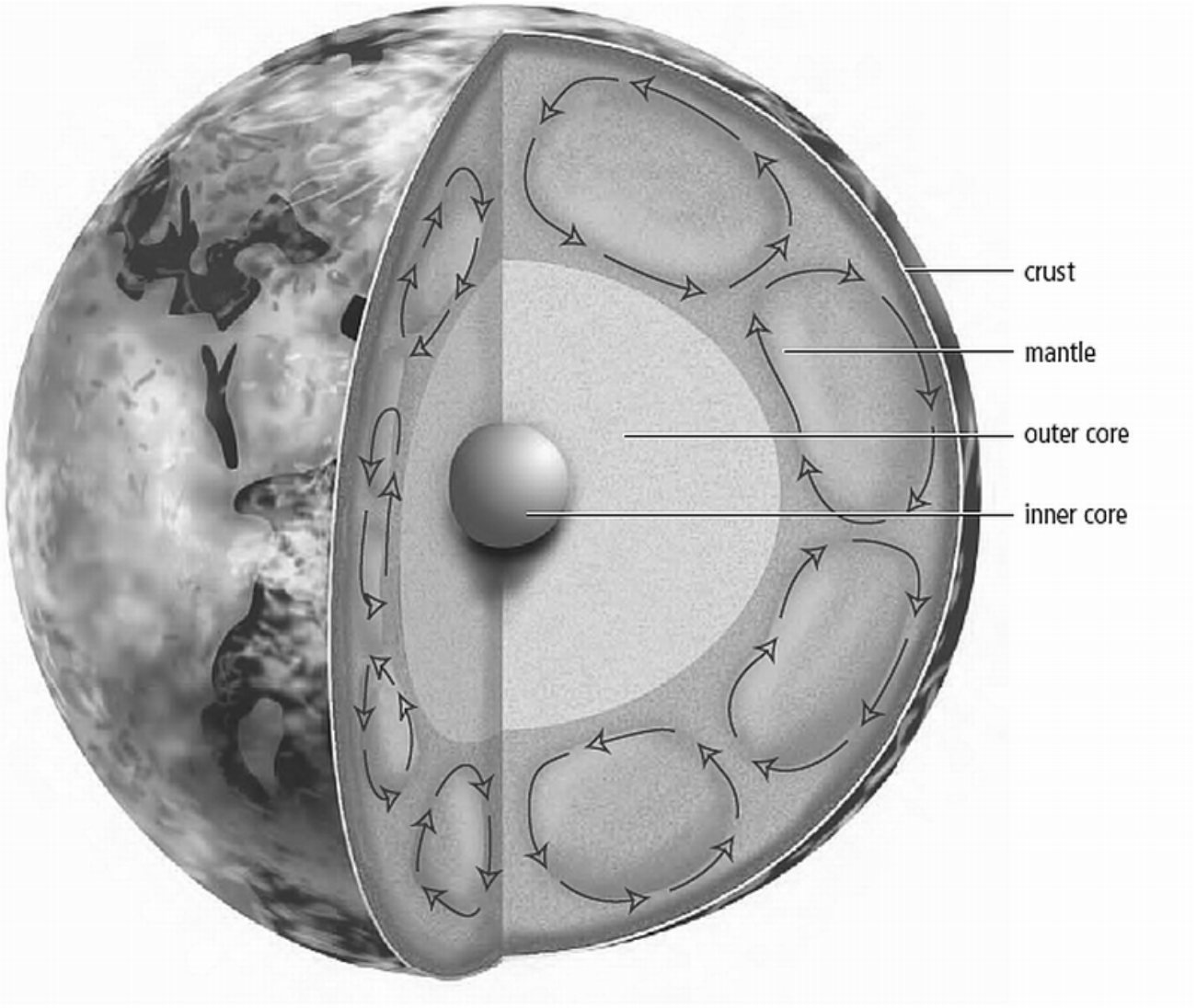
DATE: NAME: CLASS:

CHAPTER 11

A Model of Earth

BLM 4-19

Goal • Learn about Earth's layers.



DATE: NAME: CLASS:

UNIT 4

Unit 4 Key Terms

BLM 4-2

Goal • Use this list to help you review Key Terms from Unit 4, Earth's Crust.

Chapter 10 Key Terms	Chapter 11 Key Terms		Chapter 12 Key Terms
beds	bedrock	Richter scale	algal blooms
cementation	continental drift	Ring of Fire	chemical weathering
cleavage	convection currents	seismic waves	composting
compaction	convergent boundary	seismograph	deposition
extrusive rock	crust	sonar	desertification
fracture	divergent boundary	subduction zones	erosion
gems	earthquake	transform boundary	fertilizers
hardness	epicentre	volcano	humus
igneous	fault		leaching
intrusive rock	focus		mechanical weathering
lava	fold		no-till farming
lustre	fossil		permeability
magma	geologic time scale		porosity
metamorphic	inner core		soil
mineral	magnetometer		soil profile
parent rock	mantle		subsoil
resource	outer core		texture
rock	Pangaea		topsoil
rock cycle	plate tectonics		weathering
sedimentary			
streak			

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CHAPTER 11

Pangaea Map

BLM 4-20

Goal • Learn about how the continents might have looked when they were joined together in the supercontinent of Pangaea.

DATE: NAME: CLASS:

CHAPTER 11

Biological Evidence—Fossil Locations

BLM 4-21

Goal • Learn about the fossils that have been found on many different continents.

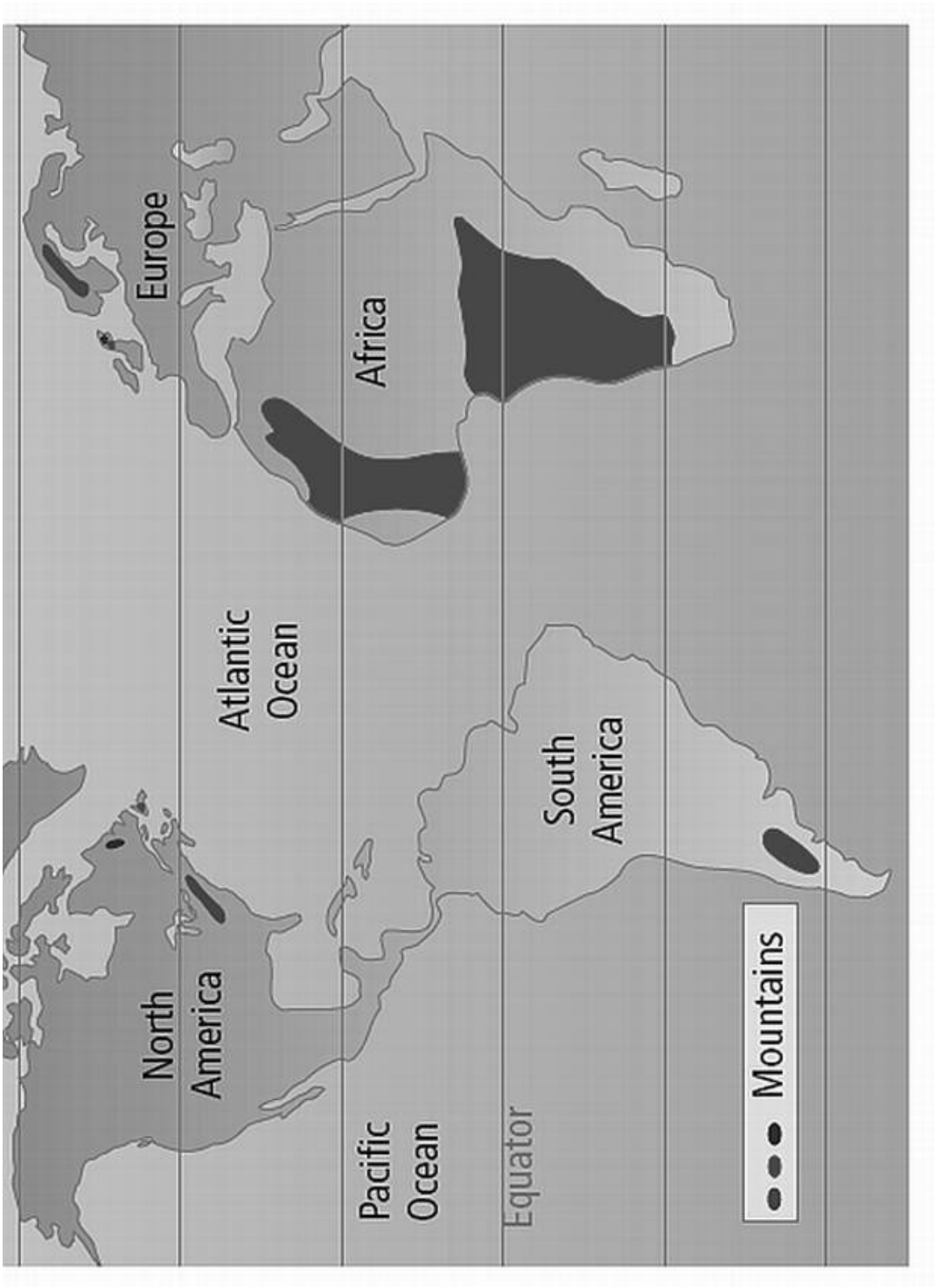
DATE: NAME: CLASS:

CHAPTER 11

Geological Evidence—Rocks and Rock Layers

BLM 4-22

Goal • Learn about the rock layers that have been found on different continents.



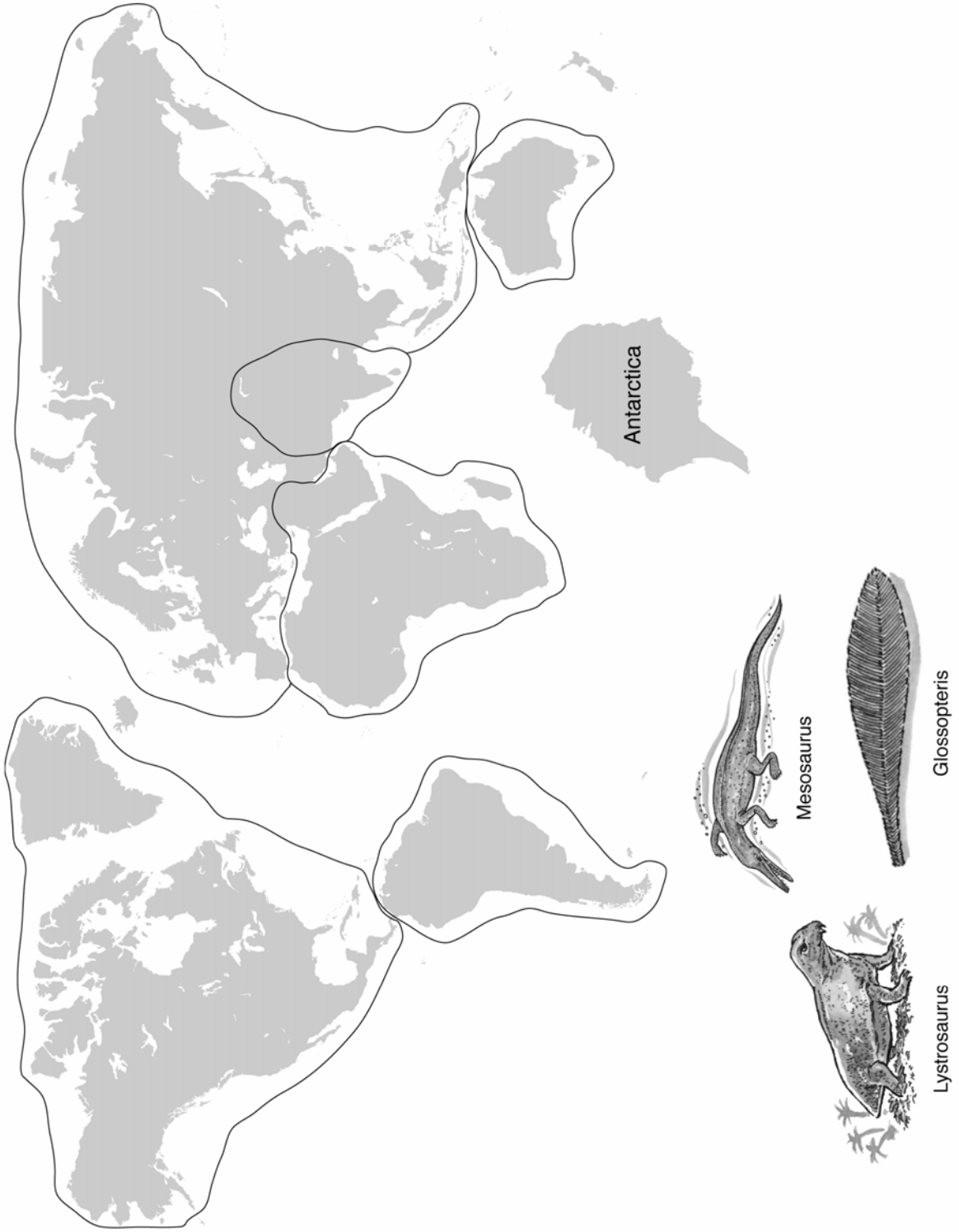
DATE: NAME: CLASS:

CHAPTER 11

Pangaea Puzzle

BLM 4-23

Goal • Use this world map with Think About It 11-1C, Pangaea Puzzle.



DATE: NAME:

BLM 4-23
continued

What Did You Find Out?

1. What difficulties, if any, did you experience in fitting the pieces of land together?

_____

_____

2. (a) Which pieces were hardest to fit together?

_____

(b) How might these pieces have looked 300 million years ago?

_____

_____

(c) How could you test your ideas?

_____

_____

3. (a) Why was Wegener's theory of continental drift a reasonable theory?

_____

_____

(b) Why did it make sense at the time?

_____

_____

4. (a) As a young child, what ideas did you have that you had to change as your knowledge increased?

_____

_____

(b) Was it easy or hard for you to give up your old ideas? _____

(c) How might your experience be compared to the experience of scientists?

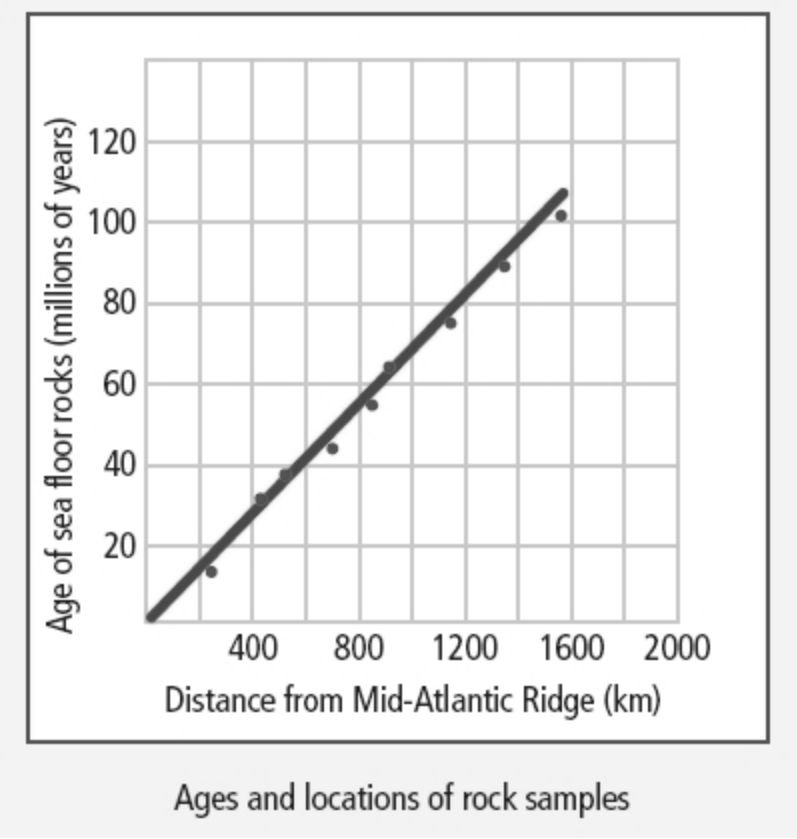
_____

_____

DATE: NAME: CLASS:

CHAPTER 11 **Evidence from the Sea Floor** BLM 4-24

Goal • Answer the questions from Think About It 11-1D, Evidence from the Sea Floor.



Ages and locations of rock samples

What Did You Find Out?

1. What is the age of the oldest rock and the youngest rock on the graph?

oldest: _____ youngest: _____

2. How far would you have to travel east or west from the Mid-Atlantic Ridge before you found rocks that were 60 million years old? _____

3. Write a sentence that states the relationship between the age of rocks in the Atlantic Ocean and the distance they are from the Mid-Atlantic Ridge.

_____

_____

4. What does this evidence suggest is happening to the sea floor? Explain your answer.

_____

_____

DATE: NAME: CLASS:

CHAPTER 11

A Mission on the *Alvin*

BLM 4-25

Goal • Develop a proposal for deep-sea research.

Introduction

The deep-sea research vessel, the *Alvin*, has been used for a variety of investigations that have helped us understand the world better. The *Alvin* has dived into deep ocean trenches and discovered new life. It has been used to study sea floor spreading and the mid-oceanic ridges. There are still many features of the ocean floor that remain to be studied, however.

Background Information

The *Alvin* is capable of
- operating at any depth from the surface to 4500 m at speeds of 0 to 3.4 km/h (0 to 2.0 knots), and remaining submerged for approximately 10 h (72 h under emergency conditions)
- carrying two or more observers and various internal and/or external instruments and tools
- travelling within areas of rugged landforms
- hovering in midwater and/or resting on the bottom to perform scientific and engineering tasks, including still and video photography
- using its manipulators and storage basket to distribute various scientific tools and to collect samples

The *Alvin* has proven most effective when used in a well-planned, co-ordinated program, where its abilities to observe, photograph, and collect samples are complemented by other research techniques. Due to its slow speed and limited power, the *Alvin* is not an effective vehicle for searching and surveying large areas.

What to Do

1. If you had the opportunity to conduct a research project using the *Alvin*, where would you go? What would you study?

_____

_____

_____

2. Think of a geologic problem related to the deep ocean. Work with a partner to develop a proposal for a research expedition that would use the Alvin. Use a sea floor map or similar resource to help you.

(a) Name of your project: _____

(b) Team members: _____

(c) Dates of project: _____ (d) Length of Mission: _____

(e) Purpose of mission (one paragraph):

_____

_____

_____

_____

(f) Expected mission results (one paragraph):

_____

_____

_____

_____

_____

(g) Detailed ocean floor map of study area:

(h) Using the back of this page, or a separate piece of paper, write two diary entries for your expedition. Each entry should be about one page long. Include details about your scientific finds.

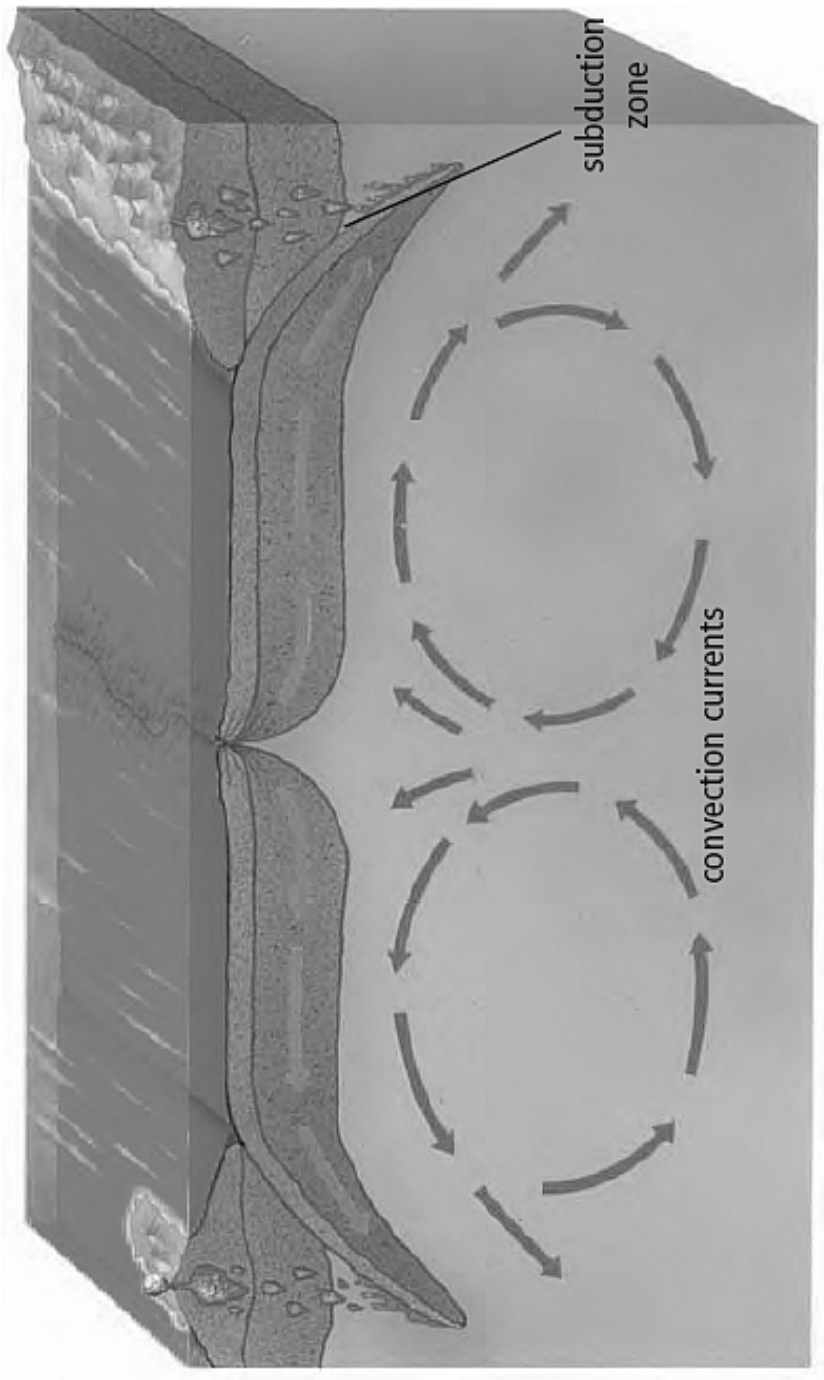
DATE: NAME: CLASS:

CHAPTER 11

Convection Currents

BLM 4-26

Goal • Learn about convection currents.



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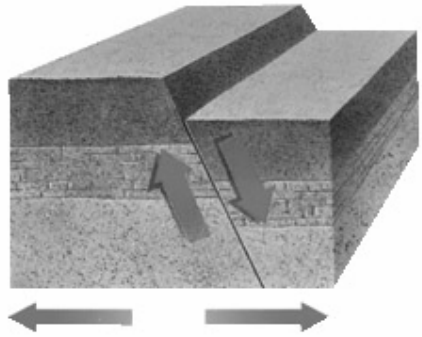
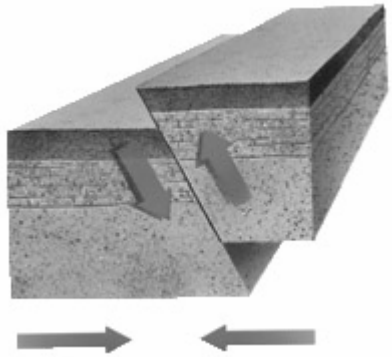
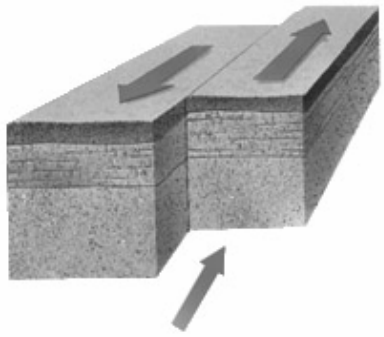
CHAPTER 11

Three Types of Faults

BLM 4-27

Goal • Learn about the three types of faults along which rock can move.

Three Types of Faults

Fault	Where it is produced	How it is produced	How the rock moves
 **Normal Fault**	• divergent boundaries	• plates move apart	• rock above the fault moves downward
 **Reverse fault**	• convergent boundaries	• plates push together	• rock above the fault moves up and over rock below the fault
 **Transform fault**	• transform boundaries	• plates move sideways past each other	• rock breaks as the plates try to slide past each other

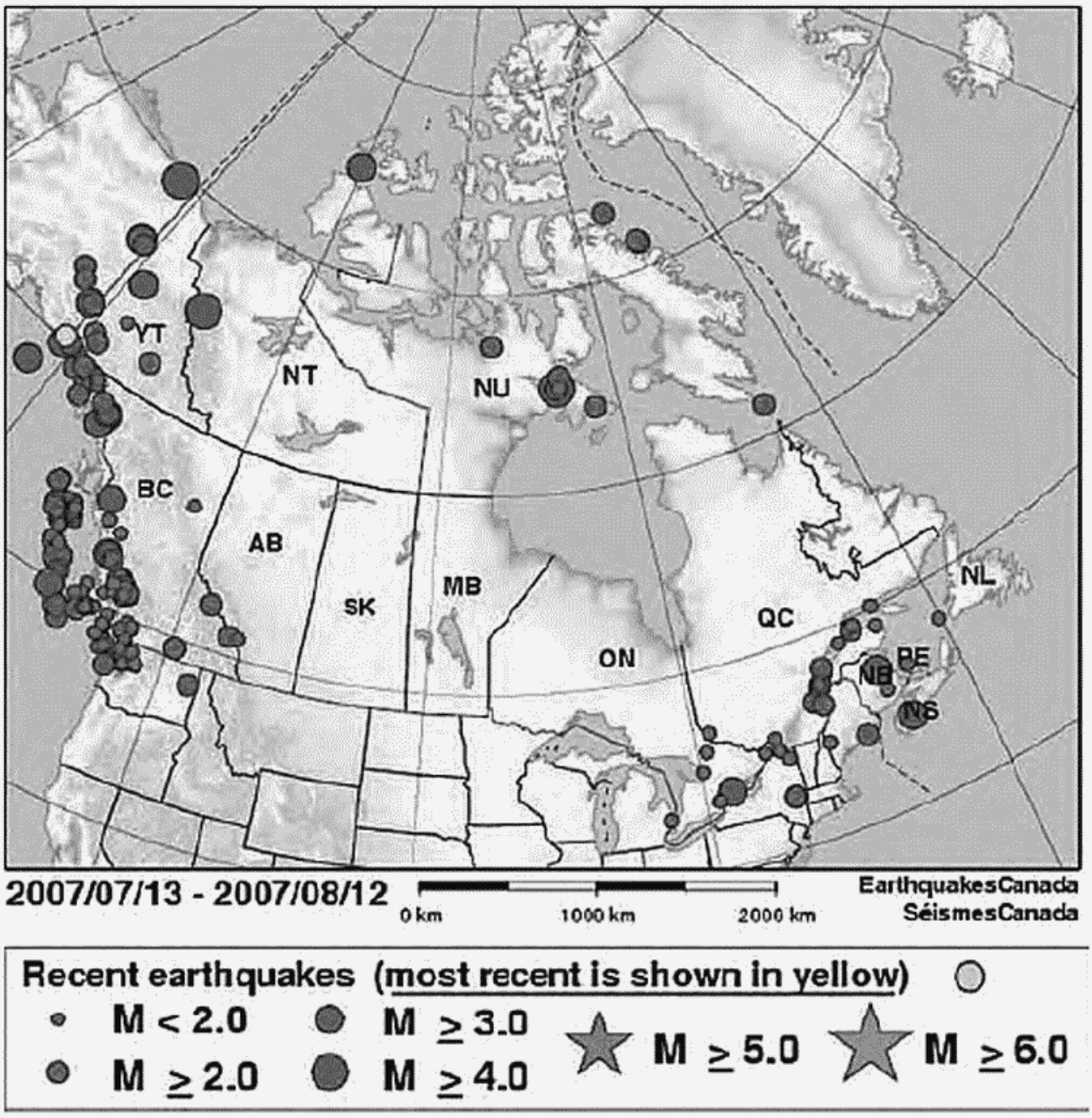
DATE: NAME: CLASS:

CHAPTER 11

Earthquakes in One Month in Canada

BLM 4-28

Goal • Learn about how many earthquakes occur in Canada in one month.



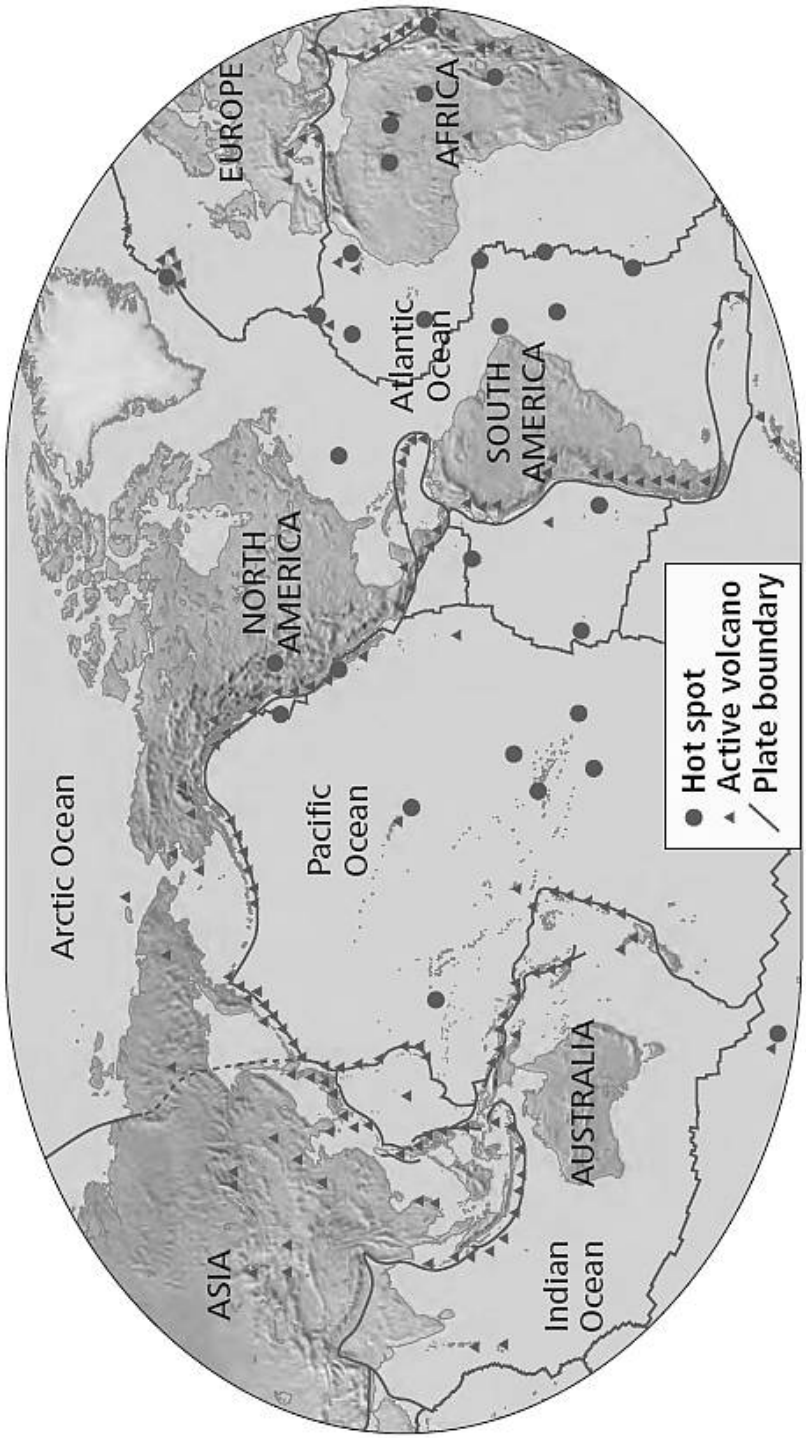
DATE: NAME: CLASS:

CHAPTER 11

The Ring of Fire

BLM 4-29

Goal • Learn about where volcanoes occur.



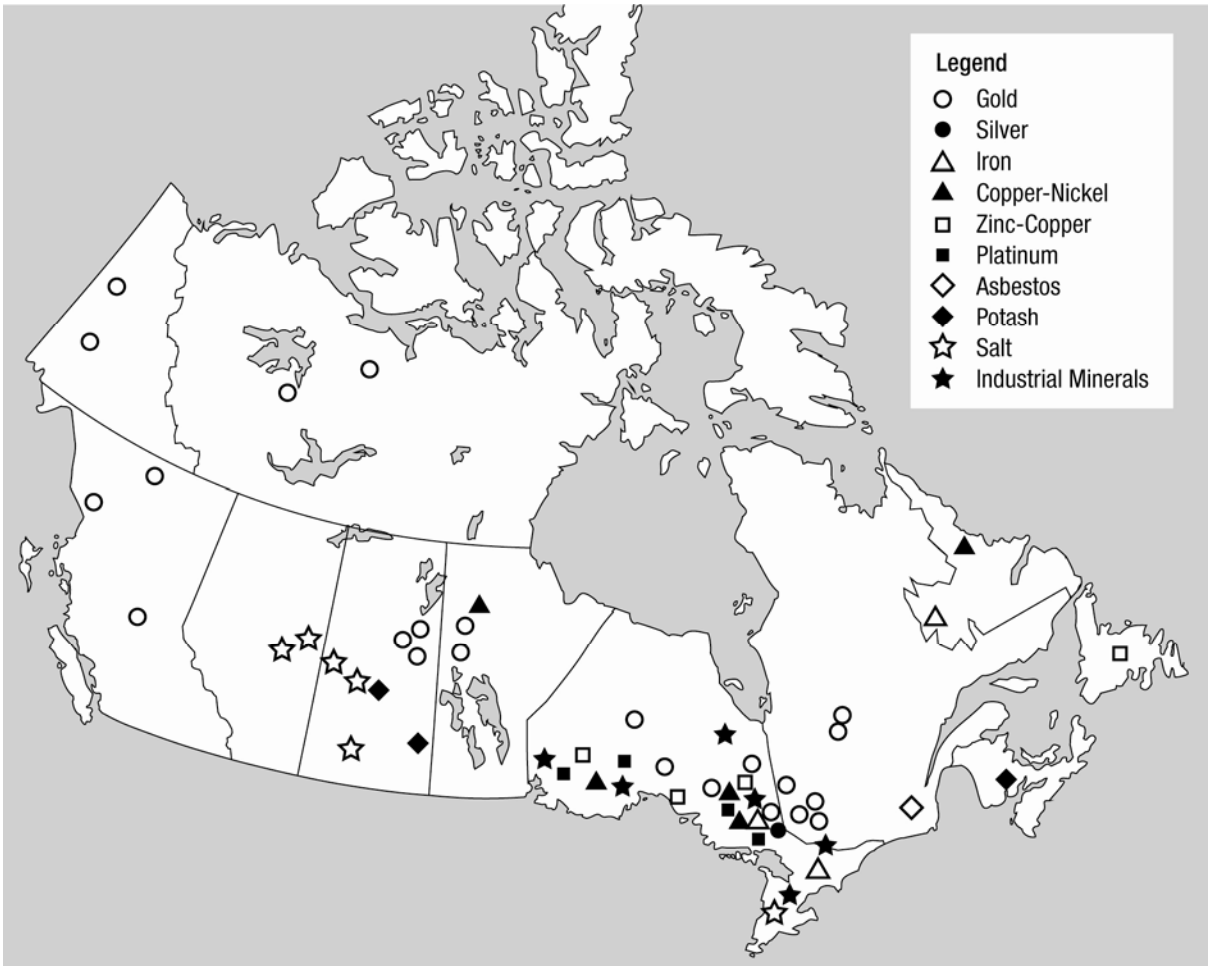
DATE: NAME: CLASS:

CHAPTER 10

Mapping Minerals and Their Uses

BLM 4-3

Goal • Use this map to help you complete Think About It 10-1B, Mapping Minerals and Their Uses.



Use the space below, or a separate page to record the information you research.

DATE: NAME: CLASS:

CHAPTER 11 **Seismic Stories** BLM 4-30

Goal • Learn how people have explained earthquakes and volcanoes in the past.

In India, people once thought that earth was supported by a tower of animals. At the bottom of the tower was a cobra. The cobra supported a turtle. On the back of the turtle were four elephants that carried Earth. When any of the animals moved, Earth moved, creating an earthquake.	In Hawaii, it was thought that Pele, the goddess of fire, lightning, and volcanoes dug fire pits (volcanoes). To this day, people sometimes report seeing her wandering near the volcanoes, protecting her home, and cursing anyone who takes away the volcanic rock.
In Central America, people once though Earth was square. A god supported the world at each of the four corners and watched the people. When there were too many people, the gods would tip Earth on its side to get rid of excess people.	In Mexico, people thought that the devil (El Diablo) made earthquakes. He created cracks in Earth so the he and others from his realm could come to Earth's surface and make mischief.
In Romania, ancient people thought that Earth sat on the three divine pillars: faith, hope, and charity. When one of the pillars was weakened by the bad deeds of humans, the world trembled.	The islands of Japan were once believed to rest on a large, curled up catfish. This fish was watched over by a god, who made sure that the catfish stayed still. Earthquakes happened when the god was distracted, and the catfish moved.
Anaxagoras was a Greek philosopher who lived in the 5th century B.C.E. He believed that air under Earth's surface is moving and that it sometimes gets caught up in the crevices of the Earth. When this air cannot make its way out, the force of the moving air shakes the surrounding ground and makes it tremble, resulting in earthquakes.	René Descartes was a French philosopher, mathematician, and scientist who lived in the late 1500s and early 1600s. He suggested that underground gas exploded, causing earthquakes. Other scientists of the past thought that since earthquakes and volcanoes sometimes occurred in the same areas that earthquakes resulted when liquid water changed to steam underground.

DATE: NAME: CLASS:

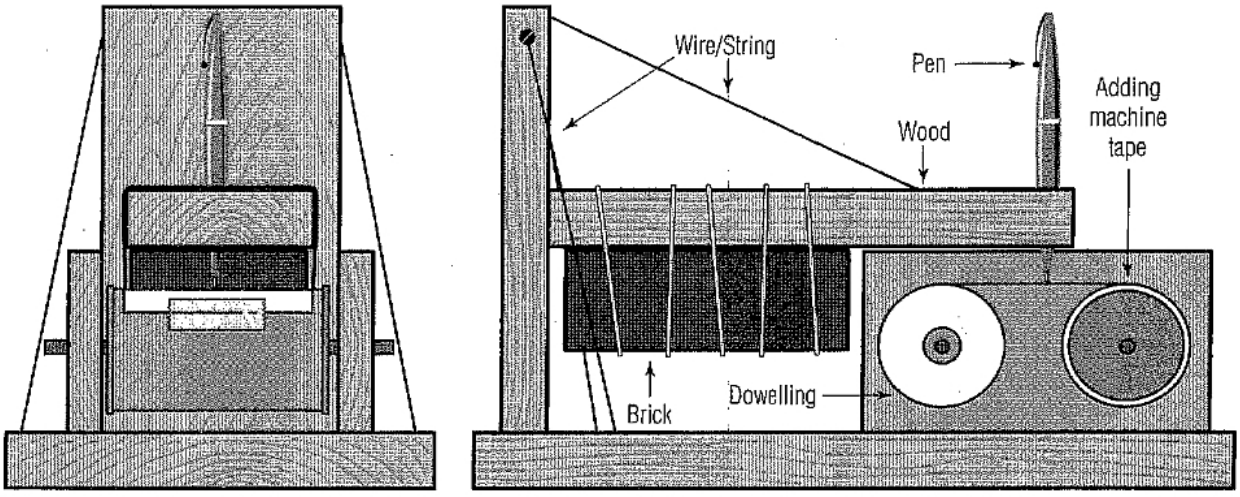
CHAPTER 11 **Shake It!** BLM 4-31

Goal • Use this handout to learn how earthquake waves are recorded.

Introduction

A seismograph is a scientific instrument that is used to record and measure vibrations of Earth. When there is an earthquake, the vibrations are detected by the seismograph and recorded, creating a seismogram.

Seismographs can be based on a pendulum or an electromagnetic system. The following model is based on the pendulum design. To help you make your seismograph, you might want to use some of the following materials. This is a simple design that you can elaborate and change if you wish.



Front view Side view

Note: the side view diagram is missing the second support for the adding machine roll so that the two rolls inside can be seen.

Materials for Building a Seismograph

- saw
- hammer
- screwdriver and screws
- ruler
- drill (optional)
- wooden pieces
- dowels (one must go through the adding machine tape centre roll)
- brick or other heavy, compact weight
- strong wire or sturdy twine (not elastic)
- roll of adding machine paper
- smooth-sided can with lid, about the same size as the paper roll
- pen or marker
- assorted nails
- masking tape
- cardboard

There may be other materials you want to use as well.

Tips for Building a Seismograph

- Your pen or marker should move easily over the adding machine paper roll.
- Both the adding machine roll and the second roll (about the same size) should be able to spin. The second roll should spin easily, using the dowel from the side of the machine.
- Tape down the end of the paper roll onto the second roll.
- Use screws to anchor the wire or twine onto the wooden supports.
- Simulate an earthquake and record your results.

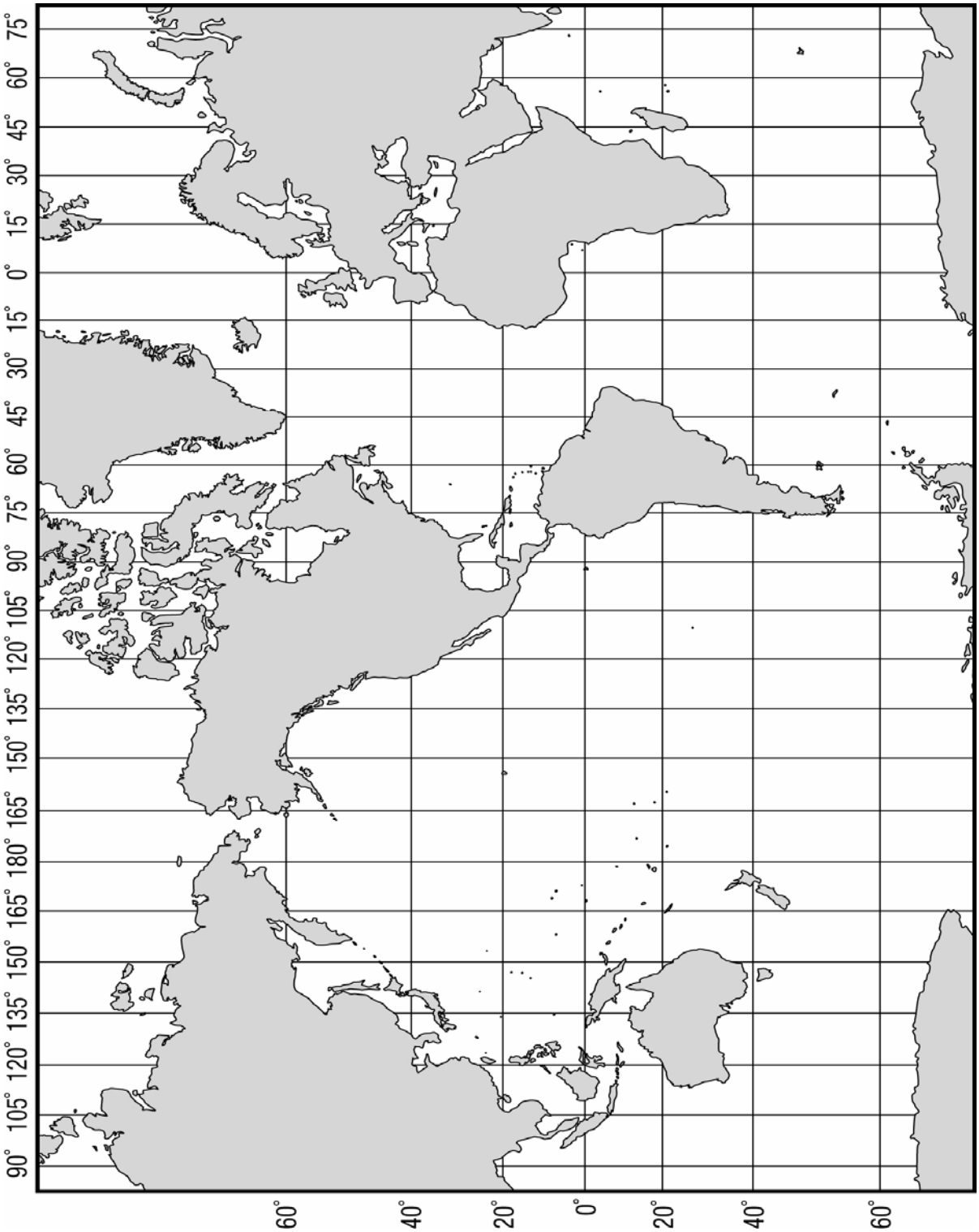
DATE: NAME: CLASS:

CHAPTER 11

Patterns in Earthquake and Volcano Locations

BLM 4-32

Goal • Use this map to plot earthquake, volcano, and plate boundary locations in Conduct an Investigation 11-2E, Patterns in Earthquake and Volcano Locations.



Analyze

1. Are most of the earthquakes located near volcanoes? Explain.

_____

_____

2. Describe the pattern of earthquakes, volcanoes, and plate boundaries in or around the Pacific Ocean.

_____

_____

3. Does the pattern around the Atlantic Ocean look similar to or different from the pattern around the Pacific Ocean? Explain.

_____

_____

4. Where do most earthquakes occur in North America?

_____

_____

5. Describe any places in the world that appear to have a large number of earthquakes.

_____

_____

Conclude and Apply

1. What conclusions can you make about earthquake and volcano locations, based on your observations?

_____

_____

2. If you were a scientist, what might you hypothesize about the areas of Earth's crust where volcanoes and earthquakes are found?

_____

_____

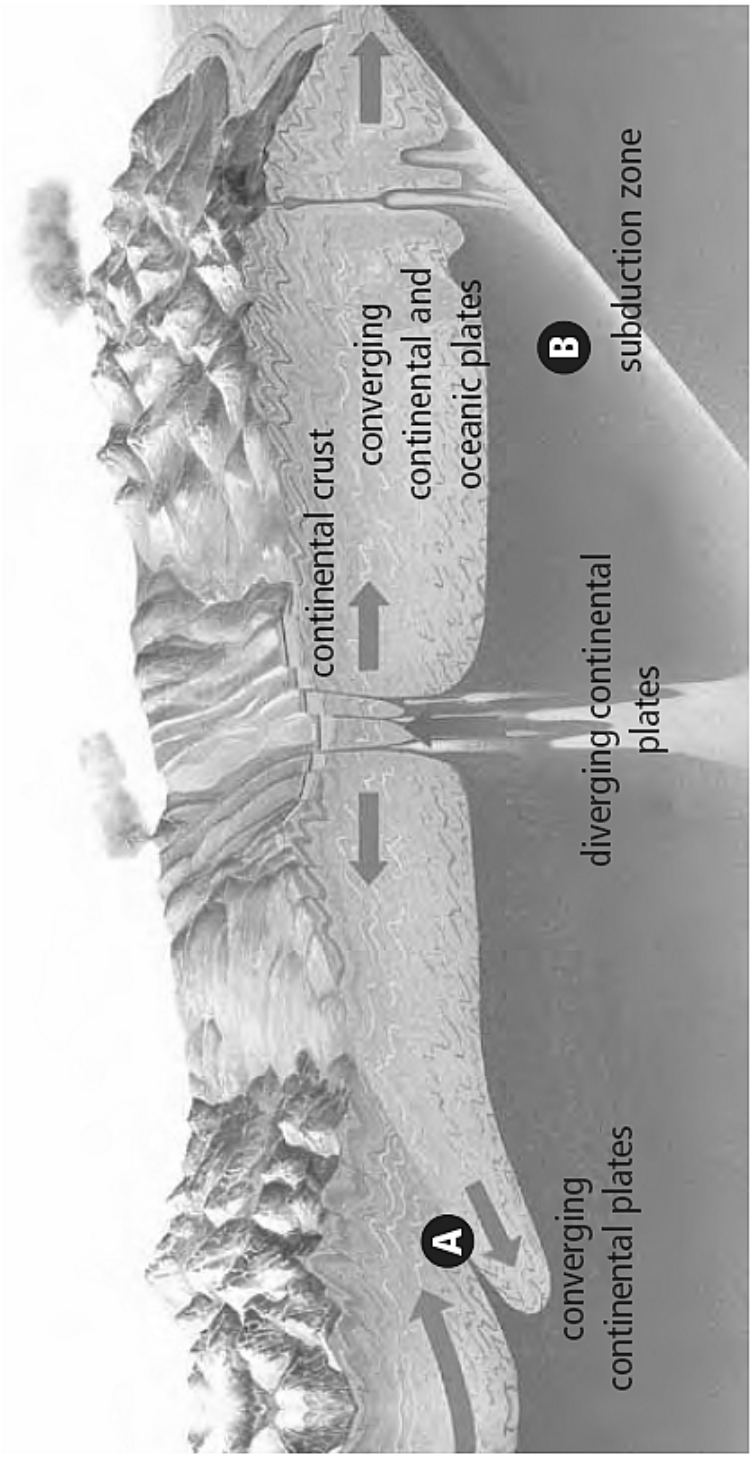
DATE: NAME: CLASS:

CHAPTER 11

Converging Plates

BLM 4-33

Goal • Learn about what happens when plates move together.



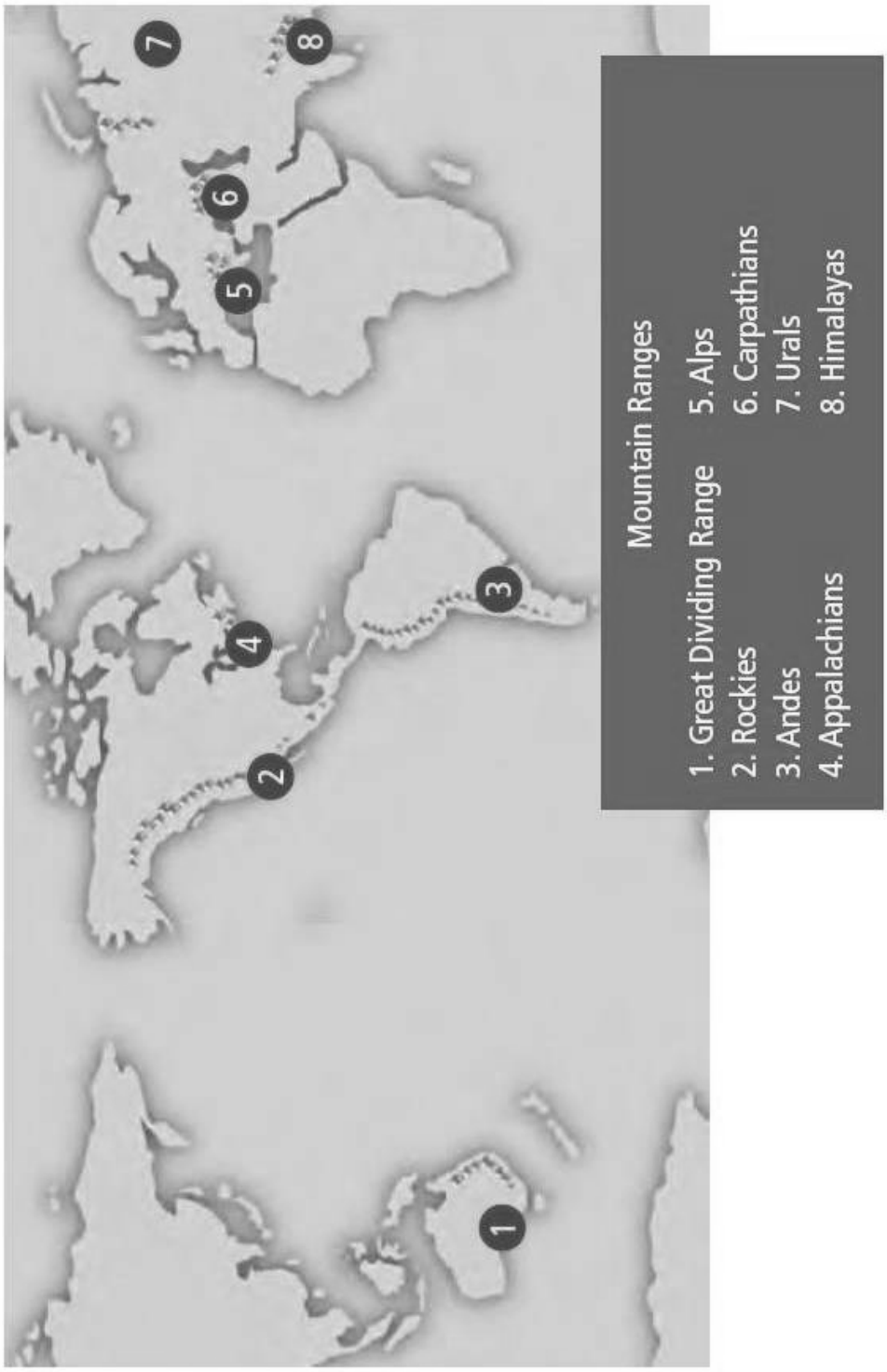
DATE: NAME: CLASS:

CHAPTER 11

Major Mountain Ranges

BLM 4-34

Goal • Learn about the location of major mountain ranges.



DATE: NAME: CLASS:

CHAPTER 11

Geologic Time Scale

BLM 4-35

Goal • Learn about the geologic time scale.

Geologic Time Scale

Era	Million years ago	Major life events	Representative organisms
Cenozoic	5	First human-like organisms	
	65	First placental mammals	
Mesozoic		Flowering plants dominant	
	144	First birds	
		First mammals	
		First flowering plants	
	213	First dinosaurs	
Paleozoic	248	Cone-bearing plants dominant	
	286	First reptiles	
		Great coal deposits form	
	320	First seed plants	
	360	First amphibians	
	408	First land plants	
		First jawed fish	
	438	Algae dominant	
		First animals with backbones	
	505	Simple animals without backbones	
Precambrian	590	Life diversifies	
		Bacteria-like organisms	
		First life forms	
	4600		

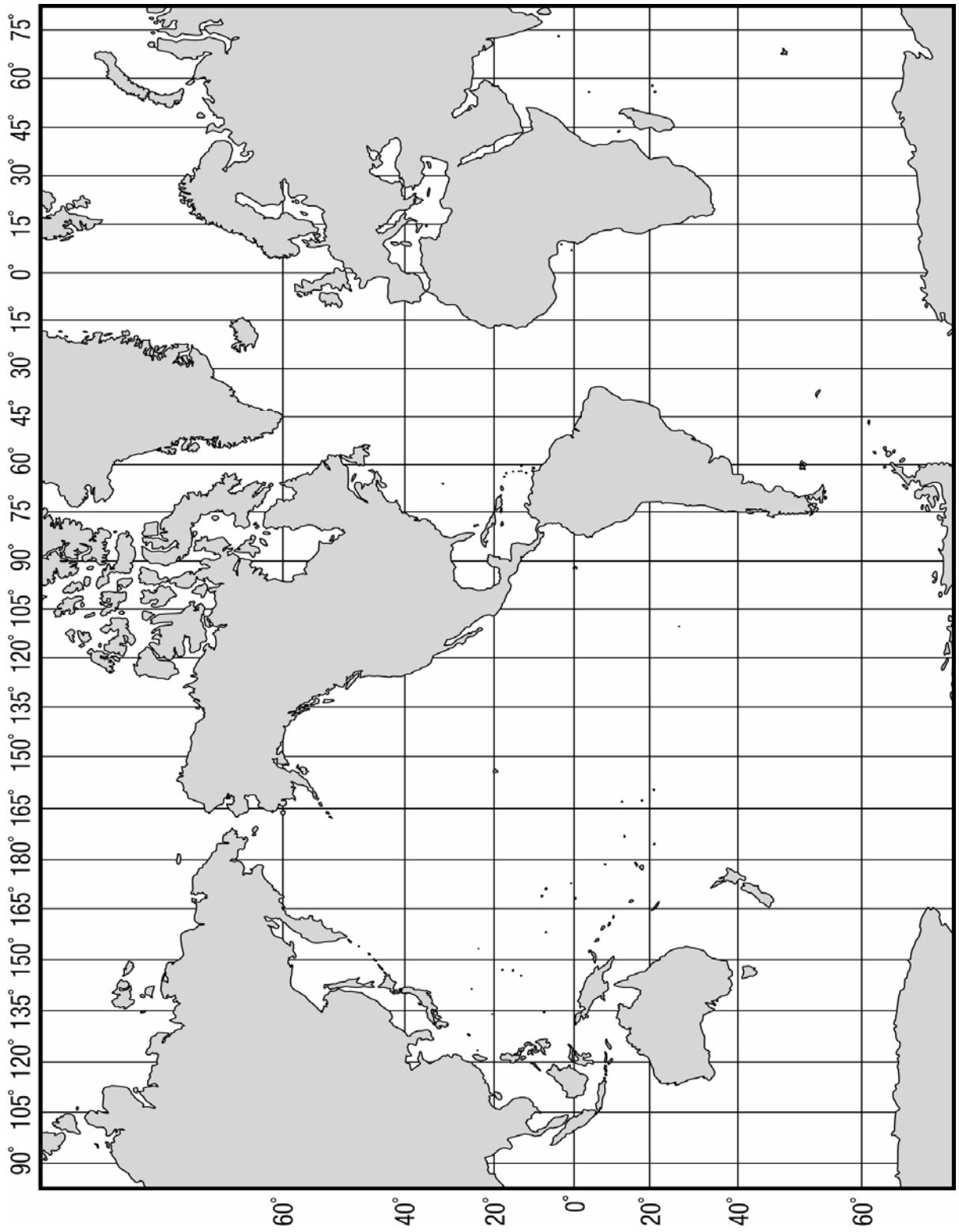
DATE: NAME: CLASS:

CHAPTER 11

Building a Mountain-Building Theory

BLM 4-36

Goal • Use this map to show the locations and types of mountain ranges in Conduct an Investigation 11-3F, Building a Mountain-Building Theory.



DATE: NAME:

Analyze

1. What categories did you create to classify your mountains? Why?

_____

_____

2. Where do most of the mountains on Earth's crust occur?

_____

3. (a) Compare your map with the map of volcano locations in Figure 11.27. What similarities can you observe between the locations of mountain ranges and that of volcanoes?

_____

(b) How does volcanic activity contribute to mountain building?

_____

Conclude and Apply

1. (a) How do the locations of mountain ranges compare with the locations of plate boundaries?

_____

(b) What are the exceptions?

_____

2. Describe at least three different ways in which mountains can be created.

_____

_____

3. (a) Predict where new mountain ranges might occur in the next 3 to 4 million years.

_____

(b) On which facts do you base your prediction?

_____

4. Write a definition of the word *mountain*.

_____

_____

DATE: NAME: CLASS:

CHAPTER 11

Chapter 11 Review

BLM 4-37

Goal • Check your understanding of Chapter 11.

What to Do

Circle the letter of the best answer.

1. Which of the following best describes Earth's mantle?
   A. deepest and hottest layer of Earth
   B. largest and most complex layer of Earth
   C. made of liquid iron and nickel
   D. where rock and mineral resources are found

2. Who hypothesized that some tectonic plates were sliding past each other?
   A. Alfred Wegener
   B. Charlotte E. Keen
   C. J. Tuzo Wilson
   D. Joseph Burr Tyrell

3. Which of the following describes the epicentre of an earthquake?
   A. a break in rock layers
   B. a place deep in the crust where the earthquake begins
   C. a surface location over the place where the earthquake begins
   D. measure on the Richter scale

4. Which of the following are part of the Ring of Fire?
   A. Krakatau, Mount St. Helens
   B. Table Mountain, Long Range Mountains
   C. the Alps, the Urals
   D. the Appalachians, the Himalayas

5. What are three different causes of mountain formation?
   A. colliding plates, separating plates, thin plates
   B. convergent, divergent, and transform boundaries
   C. folding, thrust faulting, volcanic eruptions
   D. normal, reverse, and transform faults

6. According to the geologic time scale, approximately how old is Earth?
   A. 4.6 billion years
   B. 4.6 million years
   C. 4.6 thousand years
   D. 4.6 trillion years

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

Term	Description
_____ 7. Cenozoic	A. appearance and extinction of dinosaurs
_____ 8. Ediacarans	B. appearance of fish and amphibians
_____ 9. Mesozoic	C. appearance of humans
_____ 10. Paleozoic	D. common fossil found worldwide
_____ 11. Precambrian	E. formation of Earth
_____ 12. trilobites	F. oldest fossil evidence of life on Earth found at Mistaken Point
	G. ones found in Western Newfoundland are different from ones found in Avalon Peninsula
	H. world's richest collection is found on the banks of the Red Deer River in Alberta

Short Answer Questions

13. What three types of evidence from the sea floor show that Earth's crust is moving?

_____

_____

_____

14. Are volcanoes distributed randomly or in a pattern? Explain your answer using examples.

_____

_____

15. Where do earthquakes usually occur in Canada?

_____

_____

16. What is the geologic time scale?

_____

_____

_____

17. What is an example of the evidence that shows that Newfoundland was not always in the location it is now?

_____

_____

_____

18. (a) What are four types of evidence that Wegener used to develop his theory?

_____

_____

_____

_____

(b) In your opinion, which type of evidence supported his ideas the best?

_____

(c) Why?

_____

_____

_____

DATE: NAME: CLASS:

CHAPTER 12 **Weathering and Erosion Quiz** BLM 4-38

Goal • Check your understanding of weathering and erosion.

Cause or Effect?

A cause is something that makes something else happen. An effect is what happens. For each pair of sentences, indicate whether each description is an example of a cause (C) or an effect (E)

1. (a) _____ A house builder removes trees from a lot.

   (b) _____ Topsoil is eroded during a heavy rain.

2. (a) _____ The shape of the land changes.

   (b) _____ Sediments constantly move from place to place.

3. (a) _____People who are building on a hill make the slope steeper.

   (b) ____ The erosion process becomes faster.

4. (a) _____Trees are planted in an area that was treeless.

   (b) _____ The erosion process in the area is slowed down.

Mechanical or Chemical?

In the space provided, indicate whether each description is an example of mechanical weathering (M) or chemical weathering (C).

5. _____ mosses growing on the surface of rocks produce pits in the rocks
6. _____ the wedging of tree roots along natural joints in granite outcrops
7. _____ limestone being dissolved by carbonic acid
8. _____ the oxidation of minerals that contain iron
9. _____ animal burrows dug in rock let in water and air
10. _____ repeated freezing and thawing of water that cracks rock
11. _____ the action of water, salt, and air on car fenders and panels
12. _____ acids from plant roots breaking up rocks
13. _____ a small rock falling from a cliff
14. _____ tree roots cracking the concrete foundation of a house

Problem-Solving Questions

Read each of the following situations, and write a recommendation based on your understanding of erosion and deposition.

15. Local politicians are thinking about selling one of your district's forest preserves. All the forest preserves are on sloped land. A land developer would like to buy the preserve and build a housing development there. What decision would you recommend to the board of the district? Explain.

16. The Warfords live in a low-lying area near a river. Almost every year, the river overflows and floods the Warfords' basement. What steps do you think the Warfords should take to prevent flood damage?

DATE: NAME: CLASS:

CHAPTER 12

Rocks that Fizz

BLM 4-39

Goal • Record your data for Conduct an Investigation 12-1B, Rocks that Fizz, and answer the questions that follow.

Table title: _____

Name	General Observations	Amount of Fizz
granite		
chalk		
sandstone		
shale		
marble		
limestone		
unknown rock A		
unknown rock B		

DATE: NAME:

Analyze

1. (a) What was the manipulated variable (the feature you changed)?

_____

(b) What was the responding variable (the feature you observed changing)?

_____

2. (a) Which rocks were affected by chemical weathering?

_____

(b) How could you tell?

_____

_____

3. Could you formulate a reasonable prediction about whether a rock would fizz or not just by looking at it? Explain why or why not.

_____

_____

Conclude and Apply

1. What is happening to the rock when the acid makes it fizz?

_____

_____

2. (a) Which unknown rock was affected by chemical weathering? _____

(b) Based on the information collected in your table, which other rock specimen does this unknown rock most closely resemble? _____

3. How could chemical weathering make it easier for a rock to undergo mechanical weathering?

_____

_____

DATE: NAME: CLASS:

CHAPTER 10

A Mineralogist's Mystery

BLM 4-4

Goal • Record your results for Conduct an Investigation 10-1C, A Mineralogist's Mystery (Core Lab). Then answer the questions that follow.

Table title: _____

Mineral Number	Colour	Lustre	Streak	Hard-ness	Other Properties	Mineral Name

DATE: NAME:

BLM 4-4
continued

Mineral Number	Colour	Lustre	Streak	Hard-ness	Other Properties	Mineral Name

Analyze

1. Before testing, which minerals looked the same?

_____

2. (a) Which mineral was the softest? _____

(b) Which mineral was the hardest? _____

3. (a) Which minerals were the same colour as their streak or powder?

_____

_____

(b) Which minerals had streaks with colours that surprised you?

_____

4. What other features or properties helped you identify the samples?

_____

_____

Conclude and Apply

1. (a) Were you able to identify all the mineral samples? _____

(b) If not, what other tests could you use to identify them?

_____

_____

2. (a) Which property was the most useful for identifying a mineral? Explain.

_____

_____

(b) Which properties were not very useful for identifying a mineral? Explain.

_____

_____

3. If your mineral was harder than your streak plate you would be unable to observe the colour of its streak. What would be another way to determine the streak of the mineral?

_____

_____

_____

DATE: NAME: CLASS:

CHAPTER 12

Weathered Lettering

BLM 4-40

Goal • Record your data for Find Out Activity 12-1D, Weathered Lettering, and answer the questions that follow.

Table title: _____

Headstone Name	Date on Headstone	Age of Headstone	Type of Rock	Amount of Weathering

Amount of Weathering		
1	No obvious weathering	Lettering is sharp and clear
2	Little weathering	Lettering easy to read but shows some signs of weathering
3	Some weathering	Most letters still legible but all clean edges removed
4	Quite a bit of weathering	Difficult to distinguish lettering
5	Very weathered	Unable to read any of lettering

DATE: NAME:

BLM 4-40
continued

What Did You Find Out?

1. (a) What evidence of mechanical weathering did you observe?

_____

_____

(b) What evidence of chemical weathering did you observe?

_____

_____

2. (a) Do all headstones of the same age have the same amount of weathering? _____

(b) Explain why or why not.

_____

_____

3. What type or types of rock were the headstones made of?

_____

_____

4. Have headstones that are the same type and approximately the same age weathered differently? _____ Explain.

_____

_____

5. What other factors besides age, type of rock, and position in the cemetery might play a role in how much a headstone has weathered?

_____

_____

6. Are headstones of the distant past made from the same materials as more recent headstones? _____ Why?

_____

_____

DATE: NAME: CLASS:

CHAPTER 12

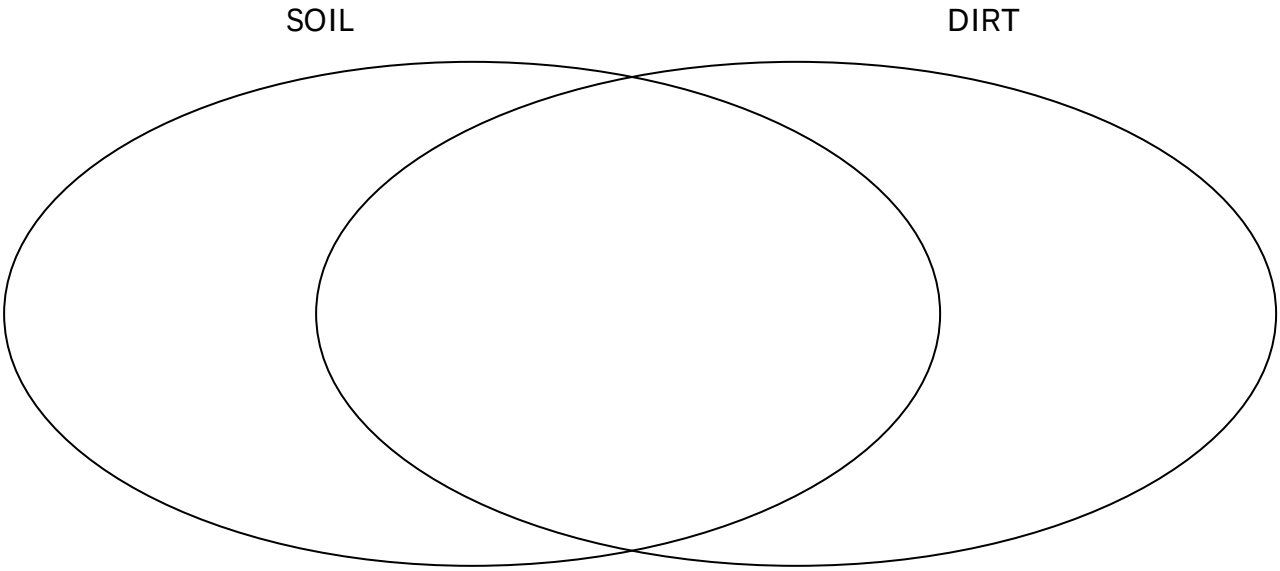
Comparing Dirt and Soil

BLM 4-41

Goal • Answer the questions from Find Out Activity 12-2A, Comparing Dirt and Soil.

What Did You Find Out?

1. Create a Venn diagram to compare and contrast dirt and soil.



2. What components (parts) of the soil could you identify?

_____

_____

3. What type of processes do you think the soil has undergone that dirt has not?

_____

_____

4. Why do you think soil is a better medium for growing most plants than dirt?

_____

_____

_____

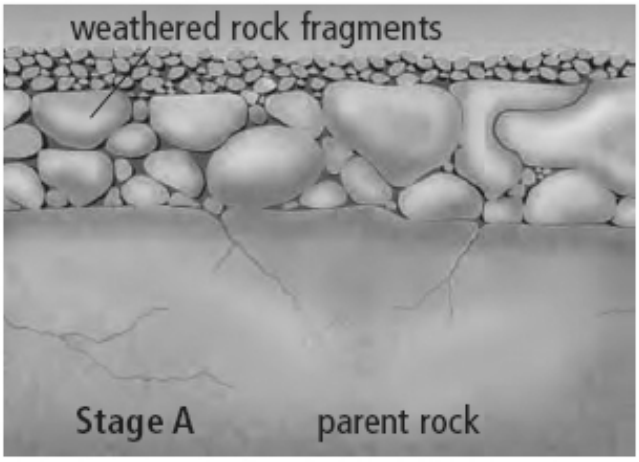
DATE: NAME: CLASS:

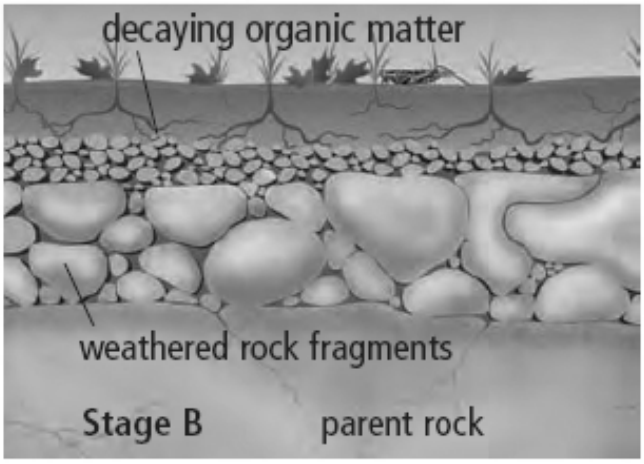
CHAPTER 12

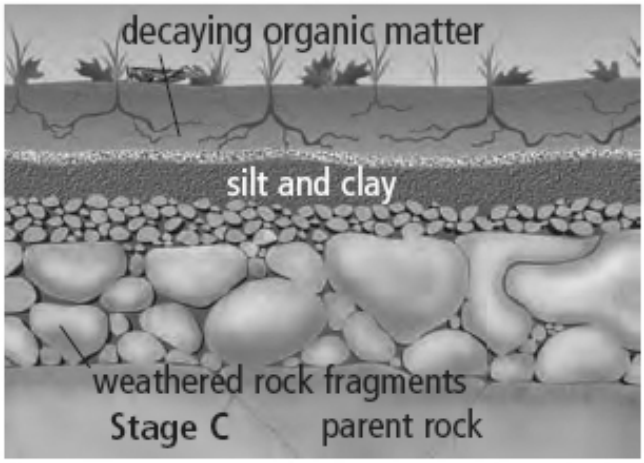
From Weathered Rock to Soil

BLM 4-42

Goal • Learn about how soil develops.



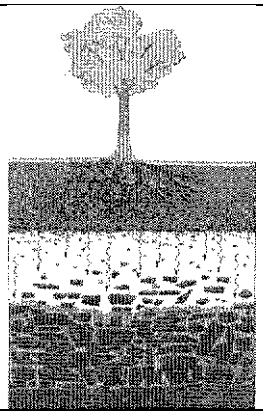




DATE: NAME: CLASS:

CHAPTER 12 **Layers of Soil** BLM 4-43

Goal • Use the soil profile to answer the following questions.

A horizon: organic matter, roots, worms, insects, and other living organisms	
B horizon: materials leached by water from the A horizon, some roots, and other living organisms	
C horizon: materials leached by water from the B horizon, partly weathered rock fragments, solid rock	

1. (a) Which soil layer contains the most humus? _____

(b) How far into the soil do plant roots extend? _____

(c) Where in this soil profile are worms and insects breaking down organic matter?

_____

(d) Where in this soil profile is solid rock being weathered into soil?

_____

(e) What is the name of the process by which water carries materials from the upper horizons down to the lower levels?

_____

2. What factors in an area help to determine the type of soil and thickness and composition of the layers?

_____

_____

3. Choose a factor from question 2, and explain how it can affect the soil in an area.

_____

_____

DATE: NAME: CLASS:

CHAPTER 12

Major Factors that Determine how Soil Develops

BLM 4-44

Goal • Learn about the major factors that determine how soil develops.

Major Factors that Determine how Soil Develops

Factor	What It Does	Examples
Parent material	- determines physical and chemical properties of soil	- red soils indicate parent rock is rich in iron - limestone bedrock helps make soil less acid
Climate	- determines what kinds of plants will grow, and how fast they decompose - affects weathering and cause erosion, carry nutrients from the soil - determines severity of erosion, the rate and amount of water entering the soil, and the rate of chemical reactions and biological activity	- moisture is required for soil organisms to change organic matter into humus - high rainfall leaches mineral nutrients from topsoil - spring run-off helps create rich river-bottom land - wind can blow away sediment before soil has a chance to form - coastal sand dunes contain wind-blown sand
Vegetation	- determines the amount and type of organic matter in and on the soil - protects the soil from erosion	- decaying plants add nutrients and organic matter to the soil - leaf litter in pine forests increases soil acidity - plant roots help hold the soil in place
Landscape	- affects drainage, warmth, and protection from weather - movement of glaciers exposes bedrock, moves parent materials, and deposits sediments	- soil may be eroded from slopes and deposited in lowlands. - glaciers deposit sand and gravel; unusually rocky fields; sediment with a wide variety of particle size, from fine clay to coarse gravel
Time	- influences the availability of minerals and the extent of humus development	- young soils do not yet have much humus

DATE: NAME: CLASS:

CHAPTER 12

Be a Soil Sleuth

BLM 4-45

Goal • Record your data for Conduct an Investigation 12-2B, Be a Soil Sleuth (Core Lab) and answer the questions that follow.

	Soil Sample			
	Your Soil Sample	**Clay**	**Sand**	**Gravel**
Colour				
Average particle size				
Texture when wet				
Texture when dry				
Time to drain 25 mL				

Analyze

1. Compare the feel and stickiness (texture) of the sand, gravel, and clay samples.

(a) Which one is the grittiest? _____

(b) Which one is the stickiest? _____

2. (a) Compare the drainage of the sand, clay, and gravel mixture.

Which drained the most quickly? _____

Which drained the least quickly? _____

(b) How did the drainage rate of the gravel mixture compare with the drainage rate of the other samples? _____

(c) Which one did your soil sample resemble the most in drainage? _____

Conclude and Apply

1. How does the addition of gravel and sand affect the speed at which water drains through the clay?

_____

_____

2. (a) What would you do to increase the speed at which water drains through the soil?

_____

_____

(b) Which characteristics do you think most affect how quickly the water drains through the soil?

_____

_____

4. Rank the size of the soil particles from largest to smallest in clay, sand, and gravel.

_____

5. Which types of soil would be the best to grow vegetables in your garden? Why?

_____

_____

DATE: NAME: CLASS:

CHAPTER 12 **Land Use and Soil Loss** BLM 4-46

Goal • Use these questions to solve problems about land use and soil loss issues.

Matching

Match the term on the left with the best description on the right.
Each description may be used only once. You will not need to use every description.

Term	Description
_____ 1. algal blooms _____ 2. composting _____ 3. ploughing _____ 4. no-till farming _____ 5. enhanced plant growth	A. practice of leaving plant stalks in the field B. mechanical turning and loosening of the soil C. breaking down of plant material D. planting a different crop in each field each year E. a negative effect of fertilization F. a positive effect of fertilization

True / False

In the space provided before each statement, state whether the statement is true or false. If it is false, rewrite it correctly in the lines that follow.

6. _____ A newly developing soil does not yet have a subsoil layer.

_____

_____

7. _____ Desertification is currently happening in a few parts of the world.

_____

_____

8. _____ In dry areas, farmers minimize soil erosion by ploughing under the natural vegetation.

_____

_____

9. _____ To prevent erosion, trees and shrubs should be cleared from areas around streams.

_____

_____

DATE: NAME: CLASS:

CHAPTER 12

Chapter 12 Review

BLM 4-47

Goal • Check your understanding of Chapter 12.

What to Do

Circle the letter of the best answer.

1. What is the most common type of mechanical weathering?
   A. animals moving through the soil
   B. chemical reactions caused by acid rain
   C. frost action
   D. machines breaking down rock

2. What is the most powerful agent of erosion?
   A. glaciers
   B. gravity
   C. water in motion
   D. wind

3. How does weathered rock material change as you go deeper into a soil profile?
   A. First it decreases, and then it increases.
   B. It decreases.
   C. It does not change.
   D. It increases.

4. Which of the following is the best definition of desertification?
   A. process in which nutrient depleted soils are formed through the erosion of fertile soils
   B. process in which nutrient rich soils are eroded
   C. process of planting desert plants in soil
   D. process of turning desert soil into fertile soil through addition of organic matter

5. Which of the following is a positive effect of using fertilizers?
   A. decreased erosion through enhanced plant growth
   B. decreased pollution in run-off
   C. increased algae in water
   D. increased phosphates in lakes

6. Which of the following is a negative effect of using fertilizers?
   A. decreased algae in water
   B. decreased dissolved oxygen in water
   C. decreased phosphates in lakes
   D. increased erosion through enhanced plant growth

Match the term on the left with the best description on the right.
Each description may be used only once. You will not need to use every description.

Term	Description
_____ 7. dirt _____ 8. humus _____ 9. leaching _____ 10. permeability _____ 11. porosity _____ 12. texture	A. amount of empty space in soil or rock B. combination of eroded rocks, water, air, and organic matter C. how a soil feels when it is rubbed between fingers D. how easily liquids and gases pass through soil or rock E. produced by breaking down plant and animal remains F. removal of soil materials dissolved in water G. weathered minerals with little organic matter

Short Answer Questions

13. What is the difference between weathering and erosion?

_____

_____

_____

14. What are five factors that influence the formation of soils?

_____

_____

_____

_____

_____

15. (a) How many soil layers are usually present in a soil profile? _____

(b) Briefly describe the general characteristics of each layer.

_____

_____

_____

_____

_____

16. (a) What are three types of soil?

_____

(b) How are the three types different from each other?

_____

_____

_____

17. Name four farming practices that reduce soil loss.

_____

_____

_____

_____

18. Why is the loss of organic matter in soil such a serious problem?

_____

_____

_____

_____

DATE: NAME: CLASS:

CHAPTER 12

Unit 4 Review

BLM 4-48

Goal • Check your understanding of Unit 4.

What to Do

Circle the letter of the best answer.

1. Which of the following rock and mineral resources is made from the remains of once living organisms?
   A. basalt
   B. coal
   C. gems
   D. gypsum

2. Which of the following is true of convection currents?
   A. Hot magma in the lower mantle moves upward.
   B. Hot magma moves downward after it is heated on Earth's crust.
   C. The heated rock rises out of the deep ocean trench.
   D. When the rock cools, it rises higher in the mantle.

3. Where do most earthquakes occur?
   A. along active plate boundaries
   B. wherever there are mountains
   C. wherever there are openings in Earth's crust
   D. wherever there are volcanoes

4. What happens at a mid-ocean ridge?
   A. a deep ocean trench is formed
   B. new crust is created
   C. oceanic plates converge
   D. one plate is forced below another plate

5. Which is the best definition of soil?
   A. a combination of minerals, water, air, and organic matter
   B. a substance that provides nutrients for plants
   C. material produced by breaking down plant and animal remains
   D. weathered minerals formed from the bedrock

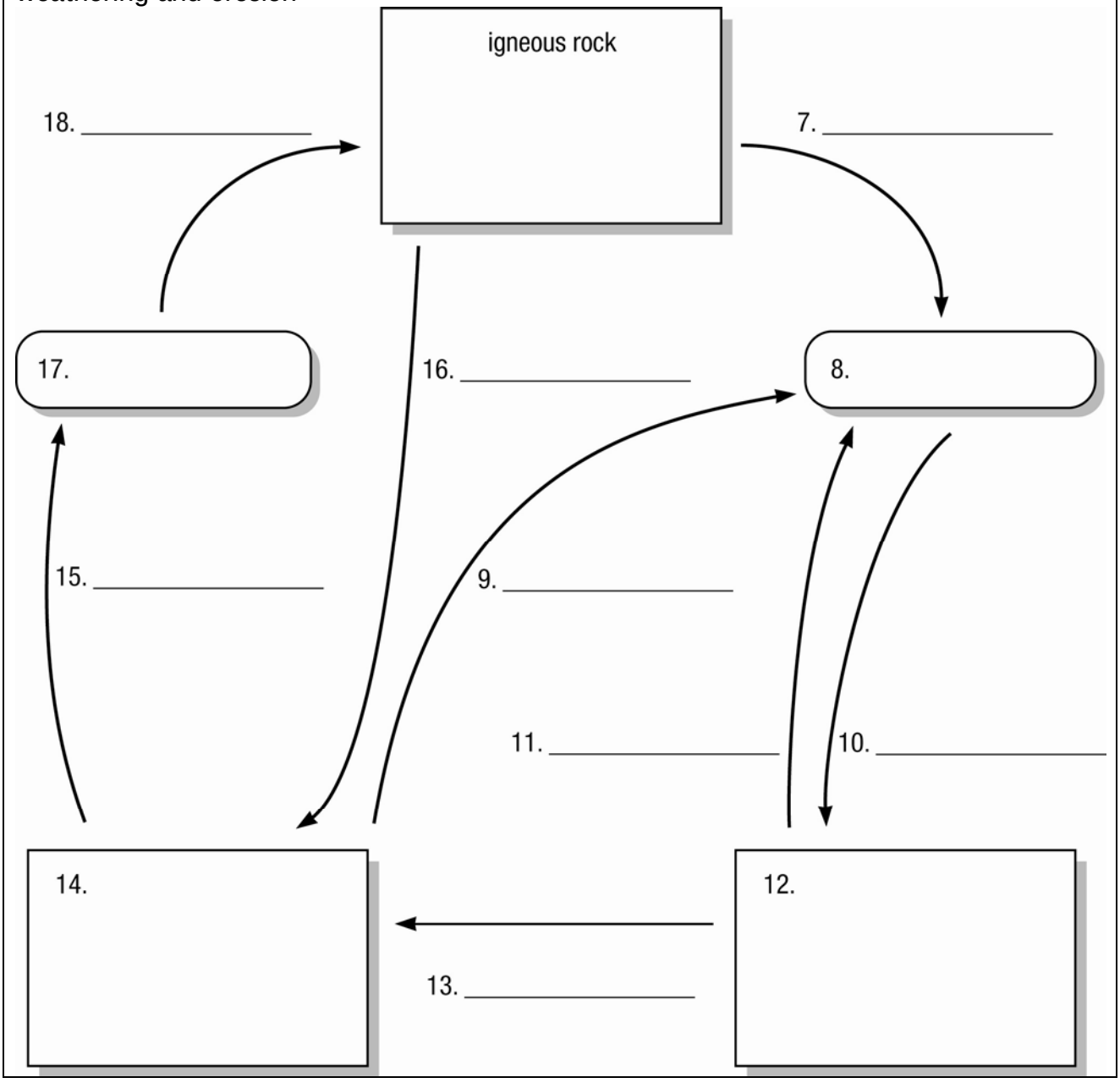
6. Which of the following is an example of compost?
   A. crushed minerals
   B. dry leaves
   C. rock dust
   D. volcanic ash

DATE: NAME: CLASS:

BLM 4-48
continued

Use the following labels to show the parts of the rock cycle. Each label may be used more than once.

compaction and cementation
cooling and crystallizing
heat and pressure
magma
melting
metamorphic rock
sedimentary rock
sediments
weathering and erosion



Short Answer Questions

19. (a) What are two rock or mineral resources mined in Newfoundland and Labrador?

_____

_____

(b) What is a use for each resource?

_____

_____

20. (a) Is Earth's crust getting thicker? _____

(b) Why or why not?

_____

_____

_____

_____

21. How can desertification be prevented?

_____

_____

_____

_____

22. Throughout this unit, you learned about different technologies that have helped people understand more about the geology of the world. What technology do you think has been the most important? Explain your opinion.

_____

_____

_____

_____

_____

BLM 4-5, Mineral Identification Quiz
1. G
2. D
3. B
4. A
5. H
6. E
7. C
8. F
9. magnetite
10. coal
11. graphite

BLM 4-6, Birthstone Research
See BLM 4-7 for sample research results.

BLM 4-8, A Mineral Identification Story
1. pyrophyllite, hematite, magnetite, quartz, feldspar, mica, fluorite, calcite, pyrite, coal
2. magnifying glass: examining the three minerals in granite—quartz, feldspar, and mica
compass: showing the magnetic properties of magnetite
penny: scratching the calcite
iron nail: scratching the calcite and fluorite
acid: reacting with the fluorite

BLM 4-14, Rocks and Minerals Crossword Puzzle
Across
7. metals
8. magma
9. cleavage
10. rock cycle
13. compaction
15. talc
16. parent rock
19. extrusive
21. metamorphic
23. lustre
24. fracture
25. beds

Down
1. gold
2. igneous
3. streak
4. pumice
5. diamond

6. rock
11. cementation
12. intrusive
14. sedimentary
16. petroleum
17. sediments
18. graphite
20. resource
22. gems

BLM 4-17, Rock Cycle Word Search Puzzle

P H + + A + S + S G E N C + M E E M
U + E V + S + A N R M O B E + T T U
M + A A I Y N I U E N I L A + I A E
I L + E T D R S T G K T G + S N L L
C + N + S E S A L + I A E + + A S O
E G + T H E L O T N + T M + + R L R
+ L O T R S M + G N + N S + + G F T
+ N A P G E + + + + E E + + + + L E
E E + H R C I H P R O M A T E M I P
W + + A S + + + + I + E I + + + M C
+ S T N E M I D E S G C + D + + E O
+ E C O M P A C T I O N + + E + S O
+ O B S I D I A N + + + E + + S T L
N O I S O R E M A R B L E O + + O I
+ + + + + + + + + + + + + + U + N N
+ + + A M G A M R O C K + + + S E G

BLM 4-18, Chapter 10 Review
1. C
2. B
3. C
4. B
5. B

6. B
7. F
8. G
9. B
10. C
11. D
12. E
13. Any order: colour, streak, hardness, lustre, cleavage, fracture. Other answers may also be acceptable.
14. The faster the cooling rate, the smaller the crystals. (The slower the cooling rate, the larger the crystals.)
15. Sedimentary rocks are formed through the compaction and cementation of sediments that settle on top of each other in layers.
16. (a) shale
(b) conglomerate
17. A parent rock, such as limestone (granite, shale), is put under heat and pressure in the presence of hot fluids to become marble (gneiss, slate).
18. Sediments are created when rocks are weathered and eroded.
19. Students' answers might include first determining whether the rock was made of compacted and cemented sediments (sedimentary), whether it shows evidence of having been heated and cooled 9igneous), or whether it has thin, wavy layers (metamorphic).

BLM 4-37, Chapter 11 Review
1. B
2. C
3. D
4. A
5. C
6. C
7. C
8. F
9. A
10. B
11. E
12. G
13. Sonar evidence shows there are mountains on the sea floor. Magnetometers show that there are strips of magnetic rock on the sea floor that were formed when there were magnetic reversals. Deep sea drilling shows that rock near mid-ocean ridges is younger than rock farther away.
14. There is a pattern. Most volcanoes occur along plate boundaries. Some volcanoes occur where plates are thin.
15. Earthquakes in Canada usually occur along active plate boundaries, such as off the British Columbia coast, in the Ottawa and St. Lawrence valleys, in New Brunswick, and off the southern shore of Newfoundland.

16. The geologic time scale is a way of dividing Earth's history into smaller units, based on the appearances of different kinds of life forms in the fossil record.
17. Evidence that shows that Newfoundland was not always in the location it is now includes that different types of trilobites are found on different parts of the island, and that rock in eastern Newfoundland is similar to rock found in Europe and Africa.
18. (a)palaeographical evidence—shape of continents
biological evidence—fossils
geological evidence—rocks and rock layers
meteorological evidence—climate change
(b) and (c) Answers will vary, but should be supported with reasonable ideas.

BLM 4-38, Weathering and Erosion Quiz
1. (a) C
(b) E
2. (a) E
(b) C
3. (a) C
(b) E
4. (a) C
(b) E
5. C
6. M
7. C
8. C
9. M
10. M
11. C
12. C
13. M
14. M
15. Students' answers may vary, but should be supported by an understanding of the increase in erosion that may result from the development and the importance of preserving topsoil.
16. Students' answers may vary, but should include reasonable suggestions, such as to limit run-off and plant trees along the riverbank to help hold the soil in place.

BLM 4-43, Layers of Soil
1. (a) A
(b) B
(c) A
(d) C
(e) leaching
2. parent material, climate, vegetation, landscape, time
3. Any of the following:

Factor	How It Affects Soil
Parent material	- determines physical and chemical

	properties of soil
Climate	- determines what kinds of plants will grow, and how fast they decompose - affects weathering and cause erosion, carry nutrients from the soil - determines severity of erosion, the rate and amount of water entering the soil, and the rate of chemical reactions and biological activity
Vegetation	- determines the amount and type of organic matter in and on the soil - protects the soil from erosion
Landscape	- affects drainage, warmth, and protection from weather - movement of glaciers exposes bedrock, moves parent materials, and deposits sediments
Time	- influences the availability of minerals and the extent of humus development

BLM 4-46, Land Use and Soil Loss

1. E
2. C
3. B
4. A
5. F
6. True
7. False. Desertification is currently happening in *many* parts of the world.
8. False. In dry areas, farmers minimize soil erosion by *not* ploughing under the natural vegetation.
9. False. To prevent erosion, trees and shrubs should be *left in* areas around streams.

BLM 4-47, Chapter 12 Review

1. C
2. C
3. B
4. A
5. A
6. B
7. G
8. E
9. F
10. D
11. A
12. C
13. Weathering is the breaking down of rock, whereas erosion is the loosening and transporting of sediments.
14. Five factors that influence the formation of soils are parent material, climate, vegetation, landscape, and time.

15. (a) 3
(b) Students' answers may vary, but could include the following points. The topsoil is the most fertile layer of soil and home to insects, earthworms, rodents, and microorganisms. the subsoil contains minerals that have leached from the topsoil and contains fewer nutrients and less water than the topsoil. the weathered bedrock is at the beginning of the long, slow process of rock changing into soil.
16. (a) Any order: sandy (gravelly), clay, loam
(b) Students' answers may vary, but could include the following points. Sandy/ gravelly soil has large particles and feels gritty. Clay soil has small particles feels sticky or greasy. Loamy soil has medium size particles and feels gritty and stocky at the same time.
17. Any order: no-till farming, planting windbreaks, reducing reliance on fertilizers, limiting run-off. Other answers may also be acceptable.
18. Students' answers may vary. Sample answer: The health of the soil influences the health of the plants, which in turn influences our own health. With the loss of organic matter, the soil may no longer be able to support the growth of plants and there may be a total environmental change in a region.

BLM 4-48, Unit 4 Review
1. B
2. A
3. A
4. B
5. A
6. B
7. weathering and erosion
8. sediments
9. weathering and erosion
10. compaction and cementation
11. weathering and erosion
12. sedimentary rock
13. heat and pressure
14. metamorphic rock
15. melting
16. heat and pressure
17. magma
18. cooling and crystallizing
19. Accept all reasonable answer. Students may have used resources and uses from the Table 10.3 on page 346 of the student book.
20. (a) No
(b) Even as new crust is being made at mid-ocean ridges, old crust is moving into the mantle in subduction zones. The forces of weathering and erosion are constantly wearing down and carrying away rock.
21. Accept all reasonable answers, such as planting windbreaks, limiting run-off, reducing reliance on fertilizers, and practising no-till farming

22. Students' answers may vary, but should show an appreciation of how our lives have been improved by advances in technology and increased understanding of the geology of our planet.

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CHAPTER 10

Mineral Identification Quiz

BLM 4-5

Goal • Check your understanding of the mineral properties.

What to Do

Match the term on the left with the best description on the right.
Each description may be used only once. You will not need to use every description.

Term	Description
_____ 1. cleavage _____ 2. diamond _____ 3. fracture _____ 4. hardness _____ 5. mica _____ 6. lustre _____ 7. talc _____ 8. streak	A. measure of how easily a mineral can be scratched B. tendency of a mineral to break with rough, jagged edges C. one of the softest minerals D. hardest known mineral E. reflection of light from a mineral's surface F. colour left by mineral on unglazed porcelain tile G. tendency to split along smooth, flat surfaces H. common mineral that breaks along smooth, flat surfaces I. how heavy a mineral is

Short Answer Questions

11. This mineral has a black colour, a dull lustre, and a black streak. Check your Mineral Identification Guide on page 323 of your student book to identify the mineral.

_____

12. Magnetite also has a dull lustre. How could you tell it apart from the mineral you identified in question 11?

_____

_____

13. The mineral in your pencil that you use to write with is often confused with lead. What is the name of this mineral? Check on page 319 of your student book for the answer.

_____

DATE: NAME: CLASS:

CHAPTER 10

Birthstone Research

BLM 4-6

Goal • Record your research about birthstones.

Month	Birth-stone	Colours	Symbolism or history
January	garnet		
February	amethyst		
March	aqua-marine		
April	diamond		
May	emerald		
June	pearl		
July	ruby		
August	peridot		
September	sapphire		
October	opal		
November	topaz		
December	turquoise		

DATE: NAME: CLASS:

CHAPTER 10

Birthstone Chart

BLM 4-7

Goal • Learn more about birthstones.

Month	Birthstone	Colours	Symbolism or history
January	garnet	- found in every colour but blue	- believed to give the wearer guidance in the night and protect the wearer from nightmares - Ancient Egyptians thought garnet was an antidote for snake bites and food poisoning
February	amethyst	- best when deep medium purple with rose-coloured flashes	- symbolizes peace, protection, and tranquillity - type of quartz
March	aquamarine	- best when pastel sea blue	- in ancient times, it was thought to aid seafarers - universal symbol of youth, hope, and health - type of beryl
April	diamond	- usually colourless, but sometimes a strong, bright colour - green, red, pink, blue, canary yellow, and amber	- "diamond" comes from the Greek word *adamas* meaning "unconquerable," suggesting the eternity of love - it was once believed that diamonds were splinters of stars, crystallized lightning, or hardened dew drops - diamond is the hardest mineral with a rating of 10 on the Mohs Hardness Scale.
May	emerald	- best when pure grass green	- legends say that wearing an emerald cures a wide range of ailments, including low IQ, poor eyesight, and infertility, and enables the wearer to predict the future - type of beryl
June	pearl	- range of colours	- a pearl symbolizes something rare, fine, or admirable - a pearl is made by an oyster when it surrounds any foreign irritants with layers of a substance called nacre

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BLM 4-7
continued

July	ruby	- red	- "ruby" comes from the Latin word *ruber*, meaning "red" - rubies are said to protect their owners from misfortune when set in jewellery and worn on the owner's left side - a ruby is a variety of corundum
August	peridot	- yellow to yellow-green	- favoured by pirates, and considered to be a powerful protection against problems - volcanic origin; sometimes found in the black sands of Hawaii
September	sapphire	- all colours except red, but popular in deep blue	- ancient priests and sorcerers thought this stone helped them to foretell the future - a sapphire is a variety of corundum
October	opal	- white opal: white or light body colour with flashes of many colours - black opal: black, dark blue, dark green, or gray with vivid flashes of red, pink, or bright green	- symbolizes hope, innocence, and purity - in the past, opal was thought to give invisibility to its owner, improve eyesight, banish evil spirits, and favour children, the theatre, friendships, and feelings - sometimes tourmaline (red to violet) is used as a birthstone for October
November	topaz	- colourless, orange-yellow, red, honey-brown, light green, blue, and pink - rare and most valuable are orange-red and pink colours	- "topaz" comes from the Greek word meaning "to shine" and "fire" - in the past, topaz was thought to increase strength, cool tempers, restore sanity, cure asthma, relieve insomnia, and give invisibility, and to change colour when in an area near poison
December	turquoise	- range from sky blue (the most desirable colour) to blue green and apple green	- "turquoise" comes from a word meaning "Turkish stone" (transported through trade route from Turkey to parts of Europe) - some First Nations people believed that turquoise can bring happiness and good fortune to all

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CHAPTER 10

A Mineral Identification Story

BLM 4-8

Goal • Read this story and answer the questions that follow. Then try to identify the minerals in your mineral kit.

Alexander Murray and James P. Howley were geological pioneers in Newfoundland in the late 1800s and early 1900s. This story is a fictional story.

Alexander Murray and his assistant James P. Howley were two very prominent geologists who lived and worked in Newfoundland and Labrador. On July 15, 1875, Murray and Howley were invited to dine at the home of Mr. Bennett, a very important St. John's business owner. Murray and Howley were going to give Bennett ten mineral specimens to take back to England. If they could convince Bennett of the value of their mineral specimens, they would certainly make enough money to continue their work.

Murray instructed Howley to select ten of his finest mineral specimens and with these in hand, they arrived at Mr. Bennett's house. Mr. Bennett greeted them and immediately asked to inspect the specimens. Howley spread a cloth over the table and placed the first specimen on it. Murray took a leather case from his jacket. He opened the case and removed a magnifying glass, a compass, a penny, an iron nail, and a small glass jar of acid.

Bennett selected a dull yellow mineral and commented on how smooth it felt. He scratched it with his fingernail. "What is the good of this?" he asked. Murray assured him of its value. The mineral was pyrophyllite. It was used for making ceramic tiles and was very plentiful in Long Pond, a community just west of St. John's.

Next, Bennett picked up the hematite. It slipped from his hands and landed in his lap. A reddish brown stain from the rock was left on his pants. Mr. Bennett was not amused. Howley informed Bennett that hematite was found in large quantities on Bell Island and could be smelted to make iron.

The third specimen had been placed on the cloth close to Murray's compass. Bennett noticed that something unusual had happened to the compass. Instead of pointing toward magnetic north, the needle was now pointing directly at the third specimen. This heavy, dark gray mineral had a shiny metallic lustre. It was from Labrador and contained a very high percentage of iron. The mineral was called magnetite.

Murray apologized to Mr. Bennett for bringing along the next specimen. It was not a mineral at all. It was a rock. The rock was called granite and it contained three minerals, quartz, feldspar, and mica. Bennett examined it with the magnifying glass. The feldspar was shiny and orange. The quartz was very hard and easily scratched the glass of the magnifying glass. The mica was black and soft and peeled off into very thin sheets. Murray assured Mr. Bennett that the granite was very useful as a building material and in making long-lasting headstones.

The next two specimens looked so much alike that Bennett could not easily tell them apart. They were almost the same colour, they had flat sides, and they were both shiny. Bennett decided to test their hardness. He found that one of them could be scratched with both the penny and the nail, but the other could only be scratched by the nail. Howley informed him that the harder one was a mineral called fluorite from St. Lawrence, the only fluorite mine in Canada. The softer one was called calcite. At this point, Howley accidentally bumped Bennett's elbow and the calcite specimen dropped from his hand and smashed to the floor. To Bennett's surprise, the calcite had broken into several pieces that were identical in shape to the original specimen. Howley explained that some minerals tend to split along flat planes of weakness, a property called cleavage. This specimen also made a fizzing sound when Murray carefully placed a drop of acid on it.

When Mr. Bennett saw the next specimen, his eyes widened with excitement. This gold-coloured mineral had a shiny lustre and he was convinced that is was gold. Howley scratched the specimen with the nail and asked Mr. Bennett to smell the powdered form of the mineral. Bennett coughed as he smelled the foul rotten egg odour from his specimen. It was pyrite, locally known as fool's gold.

The last specimen was as black as tar and very light. Bennett recognized it immediately for he had used it for years to burn in his stove to heat his house. The specimen was coal and it was found on the west coast of Newfoundland.

Delighted with these specimens, Bennett assure Murray and Howley that they would be working for many years to come if they continued to find such valuable specimens as these in Newfoundland and Labrador.

Questions

1. What were the ten minerals that Howley and Murray showed to Bennett?

_____

_____

_____

2. Explain how the characters used each of the following to identify the minerals.

magnifying glass _____

compass _____

penny _____

iron nail _____

acid _____

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CHAPTER 10

Write about Rocks

BLM 4-9

Goal • Record your results for Find Out Activity 10-2A, Write about Rocks

Table title: _____

Rock ID Number	Colour	Rounded Particles: Yes/No	Layers: Yes/ No	Crystals: Yes/ No	Other properties

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What Did You Find Out?

1. Do you think all rocks have a similar history? Explain your answer based on your observations.

_____

_____

_____

_____

_____

2. How could you turn a cup of sand into a rock? Share your ideas with others and your teacher before trying it.

_____

_____

_____

_____