Name ____________________ Class __________ Date __________

6 Explore the Seafloor

BIGIDEAS

- The ocean floor has varied and distinct surfaces much like those found on land.
- Satellites orbiting Earth, as well as sonar technology, are used to map the seafloor.
- The study of the seafloor and the features found underwater is called bathymetry.

Engage

Activate Prior Knowledge

In this Lesson, you will learn that the ocean floor is not flat but in fact has many features. Many of the seafloor features may seem new, but you are probably already familiar with them as features on land. Some features you see on land may have been under the sea when Earth was still forming millions of years ago.

The shape of Earth's land is called "topography". Topography also refers to the features on planets, moons, and asteroids. When surfaces under the water are described, the term used is "bathymetry".

Illustrate three landforms that you know. Then, list three or more adjectives that describe the landform. If possible name one or more examples of the landform (e.g., Mt. Everest, Grand Canyon).

Drawing of Landform 1	Drawing of Landform 2	Drawing of Landform 3
Answers will vary.		
Descriptions and Examples:	**Descriptions and Examples:**	**Descriptions and Examples:**

Name ______________________ Class ________ Date ________

Explore

Practice Process Skills: MAKE MODELS

The activity on Pages 102–104 of your textbook asks you to create a model of a seafloor. A model is a visual or physical representation of something. Models are important tools for scientists because they help scientists visualize things that are very complex, very small, or very large. They will also help you understand that the seafloor has many features, much like you might find on land.

There are many kinds of models. For the lab in your textbook, you will build a three-dimensional model. Three-dimensional models, or physical models, can show both how something looks and how something works.

Models are often used to show:

- An enlarged version of something tiny, such as a cell.
- A smaller version of something vast, such as the solar system.
- A version of something that cannot be directly observed, such as Earth's inner layers.

In preparation for the activity in the textbook, think about models and how they work. Then, record how you might model each of the features described below. Tell what materials you would use for your model.

1. A gently sloping land area *Answers will vary.* ______________________

2. An underwater mountain range *Answers will vary.* ______________________

3. A steep-sided canyon *Answers will vary.* ______________________

4. An underwater mountain with a flat top *Answers will vary.* ______________________

5. A flat, featureless plain *Answers will vary.* ______________________

Name ______________ Class ________ Date ________

Math Mini-Lesson

After building your seafloor model, you are asked to graph the distance vs. depth of another group's model. This line represents the distance from the coast. The model tells the depth of the ocean at each measured distance. Graphs show data in a visual way and help us to see and interpret relationships in data quickly. A line graph is a type of graph used to compare two pieces of related data, or variables.

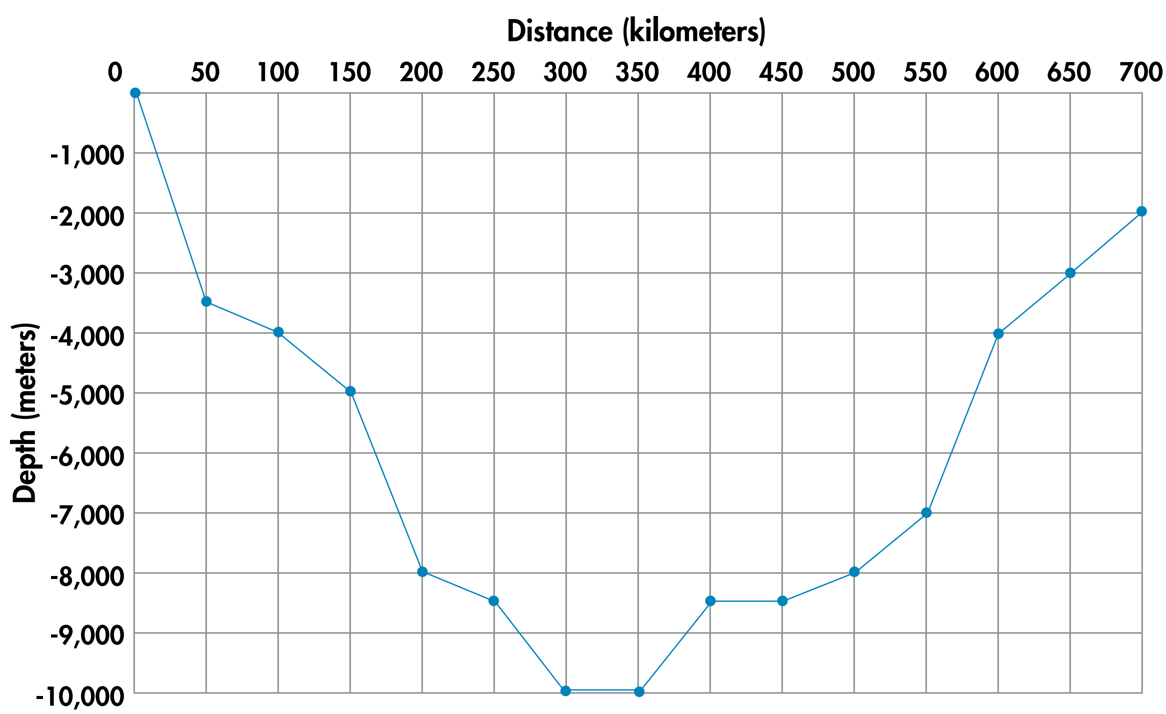
Distance (kilometers)	Depth (meters)
0	0
50	-3,500
100	-4,000
150	-5,000
200	-8,000
250	-8,500
300	-10,000
350	-10,000
400	-8,500
450	-8,500
500	-8,000
550	-7,000
600	-4,000
650	-3,000
700	-2,000

Line graphs include these key features:

- A title that tells what the graph is about.
- Two labeled axes that show the variables being compared.
- A scale that shows how each variable is measured.
- Data points that show the relationship between the variables.

Use the sample data (left) to practice making a line graph below. Notice that distance is shown along the x-axis (the horizontal axis). Depth is shown along the y-axis (the vertical axis). To start your graph, find 0 on the x-axis, and 0 on the y-axis. Draw a point or dot on this spot. Next find and put your finger where 50 kilometers is on the x-axis. Trace your finger straight down the graph until you come to 3,500 meters on the y-axis. Draw a point or dot on this spot. Continue plotting the remaining numbers from the table in this way. Then, draw a line to connect the points.

TITLE: *Profile of Ocean Depth over Distance*



Name ______________________ Class ________ Date ________

Use the graph you created on the previous page to answer the Questions below.

1. Why does the "zero" depth line start at the top of the scale? *Because I am measuring ocean depth – meters below the sea surface.*

2. The first point on the graph has a depth of 0 meters and a distance of 0 kilometers. What does this mean? *It means the graph starts at a shore or a coast and begins at sea level.*

3. How is depth measured on the graph? *Depth is measured in meters.*

4. How is distance measured on the graph? *Distance is measured in kilometers.*

5. What is the deepest depth shown on the graph? At what distance does this occur? *Ten thousand meters is the deepest depth. This occurs from 300-350 kilometers offshore.*

6. Describe the seafloor feature that you graphed. *Two opposite steep slopes come together and level off at the bottom.*

7. What seafloor feature might this graph represent? *It appears to be an underwater valley or possibly a trench.*

Hint: The average depth of the ocean is 4,000 meters. This feature would represent one of the deepest parts of the ocean.

Name ______________________ Class ________ Date ________

Explain

Reading Strategy: MAIN IDEA and DETAILS

When you read, it is important to understand the main ideas of the selection you are reading. Remember, the main idea tells what the selection is "mainly", or mostly about. Details often help to support the main idea by answering the questions who, what, where, when, why, how, or how many.

On Pages 105–112 of your textbook, you will learn about ways in which scientists map the ocean floor. As you read, complete the 5-4-3-2-1 graphic organizer below to record some main ideas and details of the text. ***Answers will vary. Sample responses are shown.***

Five Key Ideas
1. *Understanding the seafloor is important for many reasons, such as setting shipping routes.*
2. *Seafarers used to measure the depth of the ocean with plumb lines.*
3. *After World War I, scientists began using sonar to learn about the seafloor.*
4. *Today researchers use more sophisticated sonar technology to map the seafloor.*
5. *Satellites are also used to create images of the shape of the seafloor.*
Four Facts Related to the Main Idea
1. *Sonar relies on the reflective properties of sound to measure depth.*
2. *The average speed of sound in the ocean is 1,500 meters/second.*
3. *Satellites create images of the seafloor by looking at the shape of the water's surface.*
4. *The best bathymetry maps are made from a combination of satellite and sonar data.*
Three New Words and Their Meanings
1. *Sonar: Sound Navigation Ranging*
2. *Plumb lines: Lines attached to weights that seafarers used to measure ocean depths.*
3. *Bathymetry: The shape of the seafloor*
Two Facts You Already Knew
1. *Much of the ocean has yet to be explored.*
2. *The seafloor is not flat and is shaped much like Earth's landmasses.*
One Question You Still Have
1. *How did people develop sonar technologies?*

Name ______________________ Class ________ Date ________

Math Mini-Lesson

On Pages 105–108 of your textbook, you learned that scientists measure ocean depths using sound waves or sonar. Sonar instruments on ships transmit a sound pulse quickly into the water. When the pulse hits the ocean floor, the sound echoes back. Sound travels through seawater at a speed of 1,500 meters/second. By measuring the time it takes for the sound to travel through the water and be reflected back to the boat, scientists can do a simple calculation and determine sea depth.

Review the formula below. Then, answer the Questions that follow.

Formula for Calculating Sea Depth:

$$\text{Sea Depth (SD)} = \frac{1}{2} \times \text{Time (T)} \times \text{Velocity (V)} \quad \text{or} \quad D = \frac{1}{2}TV$$

Here's an example. Suppose it took 10 seconds for a sound pulse to travel through the water and return to the sonar instrument. You could calculate sea depth as follows:

Step 1: Insert the correct numbers into the formula.

$$D = \frac{1}{2}\text{(10 seconds) (1,500 meters/second)}$$

Step 2: Multiply the numbers in parentheses.

(10 seconds) (1,500 meters/second) = 15,000 meters

Step 3: Divide by 2 to solve.

15,000 meters ÷ 2 = 7,500 meters

Use the formula above to practice calculating sea depths from sonar data. Show all steps in your calculations and be sure to label your answer with the correct units.

1. Calculate sea depth if it takes 20 seconds for sound to be sent and returned by sonar.

15,000 meters

2. Calculate sea depth if it takes 25 seconds for sound to be sent and returned by sonar.

18,750 meters

3. Calculate sea depth if it takes 30 seconds for sound to be sent and returned by sonar.

22,500 meters

Name ______________________ Class ________ Date ________

Elaborate

Visual Literacy: Reading Diagrams

The diagram on Page 118 of your textbook shows approximate maximum depths to which some air breathing species dive in comparisson to seafloor features. Diagrams such as this are often used in science to show information in a visual way. Being able to read and understand information in diagrams is an important skill.

Complete the table below with information from the diagram. Add animal species, seafloor features, and depths, as needed. Then, answer the Questions that follow.

Animal Species and Seafloor Features	Depths (in meters)
Gray Seal	*70 meters*
Penguins and average depth of the continetal shelf	130 meters
Gray Whale	150 meters
Hawaiian Monk Seal	*200 meters*
Leatherback Sea Turtles	1,000 meters
Sperm Whales	2,000 meters
Average depth of the ocean	*4,000 meters*
Mariana Trench	11,000 meters

1. Why do you think penguins dive to the same depth of the continental shelf?

   Food sources are found along the continental shelf such as the penguin's prey, fish and squid.

2. Gray Whales are filter feeders that mainly eat small, shrimp-like animals called amphipods. Why do you think Gray Whales dive only to about 150 meters?

   These small organisms mostly drift in the water and are less likely to be found deep in the ocean.

3. Why don't the marine species shown in the diagram dive beyond 4,000 meters?

   These species all need to come to the surface of the water to breathe air and so can't dive too deep.

Name ______________________________ Class __________ Date __________

Lesson Summary

- The ocean floor has many features including continental shelfs, mid-ocean ridges, abyssal plains, trenches, continental slopes, seamounts, continental rises, and submarine canyons.
- The study of sea depths and their features is called bathymetry.
- Models are important scientific tools; they help scientists study things that are very complex, very large, or very tiny.
- Only 5% of the ocean has been explored, yet throughout history people have been interested in learning about the seafloor. Understanding the seafloor is important for creating shipping routes, maintaining national security, and studying marine animals.
- Early seafarers measured the depth of the seafloor with simple weights attached to lines called plumb lines.
- After World War I, the military began to use sonar technology to measure ocean depths. Sonar equipment set up on ships sent sound waves to the ocean floor. The time it took for the sound to return to the ship was recorded and used to calculate ocean depth.
- Today sophisticated sonar such as side scan sonar and multibeam sonar helps us map the ocean floor and locate things deep in the ocean, such as shipwrecks.
- Orbiting satellites are efficient instruments for mapping the seafloor today because they can scan large areas of the ocean. The best bathymetry maps are created by data collected from a combination of satellite and sonar data.
- Understanding bathymetry helps scientists explain the movements of marine animals.

Name ______________________ Class ________ Date ________

Lesson Review

Review seafloor features by recording the correct descriptions from those listed below into the blanks in the table. Some descriptions may go in more than one box.

gently sloping land area | bottom of steep slope | underwater mountain range
plunges deep below seafloor | underwater valley | flat, featureless plain
edge of continent down to seafloor | has peak or flat top | deepest feature of ocean
along or near the edges of continents | steep slope | underwater mountain
hill of sediment | steep-sided | makes up large part of seafloor

Seafloor Feature	Descriptions
Continental Slope	*steep slope* *edge of continent down to seafloor*
Mid-ocean Ridge	*underwater mountain range*
Seamount	*underwater mountain* *has peak*
Abyssal Plain	*flat, featureless plain* *makes up largest part of seafloor*
Submarine Canyon	*steep-sided* *underwater valley* *along or near the edges of continents*

Name ______________________ Class __________ Date __________

Seafloor Feature	Descriptions
Continental Rise	*hill of sediment* *bottom of steep slope*
Continental Shelf	*gently sloping land area* *along or near the edges of continents*
Trench	*steep-sided* *plunges deep below seafloor* *deepest feature of ocean*

Give two reasons why understanding sea depth or bathymetry is important when tracking marine animals.

1. *Answers will vary and include: specific animals will feed over areas of different depths for their food.*

2. ______________________