Read and Learn

VOCABULARY
salinity p. 436
water pressure p. 437
continental shelf p. 438
continental slope p. 438
abyssal plain p. 438

SCIENCE CONCEPTS
- what water is like in different parts of the ocean
- what the ocean floor looks like

Focus Skill **MAIN IDEA AND DETAILS**

Look for examples of features on the ocean floor.

Main Idea
- detail
- detail
- detail

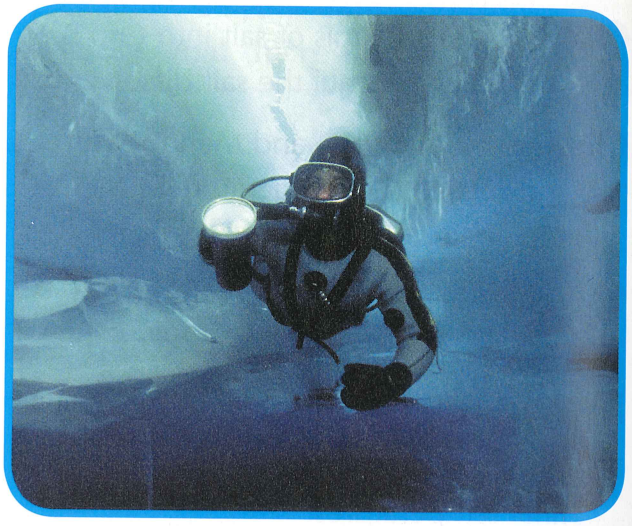
Ocean Water

If you've ever been swimming in the ocean, you know an important fact about it. Ocean water is salty.

The salt in the ocean comes from minerals that are washed out from the land. Water evaporates from the surface of the ocean, but the salt is left behind. Most of the salt is sodium chloride, table salt, but ocean water also has other salts.

The amount of salt in water is called **salinity** (suh•LIN•uh•tee). Oceans don't have the saltiest water on Earth. The salinity of the Dead Sea, a lake between Israel and Jordan, is ten times that of the oceans. Much less water flows into the Dead Sea than evaporates from it. This increases its salinity.

This diver wears a wet suit to keep warm when diving in deep, cold water. ▼



The area around the Dead Sea gets very little rain, so every year, the sea gets smaller and the water and shore get saltier. ▼

The submersible diving vehicle *Alvin* has thick walls so that it can dive about 4,000 m (13,000 ft) below the ocean surface. ▶

The pressure underwater can be very great. Water pressure crushed this foam cup.

The salinity of the ocean doesn't change much from place to place. But other conditions of the ocean depend on the water's depth. One of these conditions is temperature. At the surface, the water is warmed by the sun and by warm air above the surface. But most of the ocean is deep, and deep water is cold. About 90 percent of the ocean has a temperature between 0°C and 3°C (32°F and 37°F). That's cold!

The ocean also gets darker with depth. The water absorbs and scatters light, so the water gradually gets darker until there's no light at all. In some parts of the ocean, light reaches down as far as about 200 m (656 ft). In other places, light reaches down only about 30 m (100 ft).

Something else that depends on the ocean's depth is pressure. Imagine that you could dive 10 m (33 ft) into the ocean. There would be 10 m of water above you, pushing down. The downward push of water on a given area is called **water pressure**. Water pressure increases as you go deeper into the ocean, because more water pushes down. Water pressure at great depths can crush most objects.

To study the oceans, scientists use small submarines called *submersibles* (suhb•MER•suh•buhlz). The thick walls of a submersible don't collapse in water that would be deep enough to crush the hull of a regular submarine.

Focus Skill **MAIN IDEA AND DETAILS**

What are three details that describe conditions deep in the ocean?

Insta-Lab

Under Pressure

Use a pencil to carefully poke three small holes of exactly the same size in the side of a foam cup. One should be near the top, one near the middle, and one at the bottom. Hold the cup over a sink or a bucket. Quickly pour water into the cup, and observe what happens. How does the depth of the water affect pressure?

The Ocean Floor

In many ways, the ocean floor is like the land. Some parts of the ocean floor are flat. Some parts are sloped. The ocean floor has mountains, deep valleys, and even volcanoes.

As the ocean floor extends away from the land, it first drops gently and then slopes downward more steeply. The part of the ocean floor that slopes gently near the land is called the **continental shelf**.

The part of the ocean floor that slopes steeply is called the **continental slope**. Deep canyons can be found in some parts of the continental shelf and continental slope. These canyons were formed by large rivers flowing into the ocean.

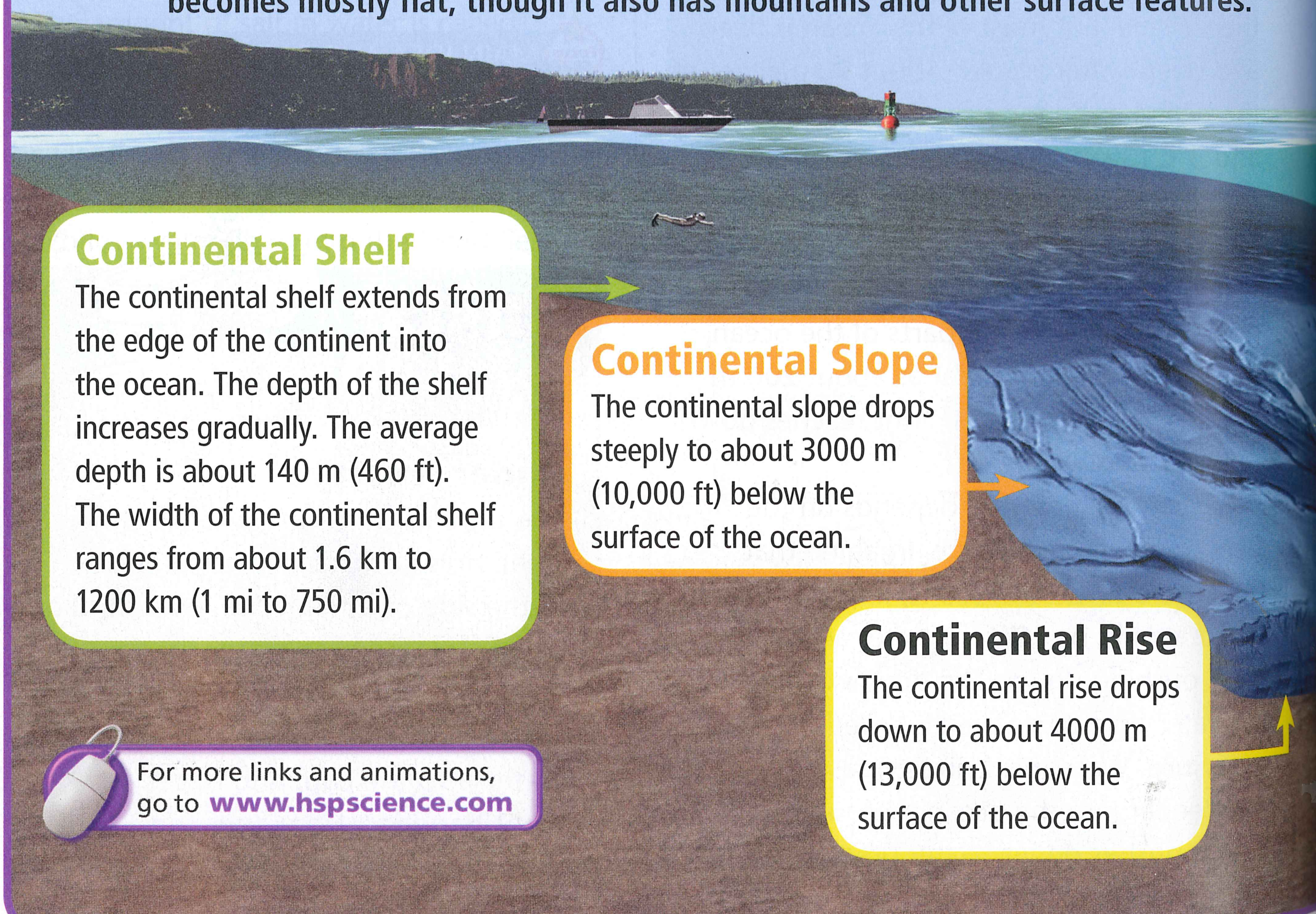
Remember that rivers carry eroded rock called sediment. Sediment is carried out to sea and falls along the continental slope. It piles up at the base of the continental slope, forming the continental rise.

The largest, flattest areas in the ocean are the **abyssal plains** (uh•BIS•uhl PLAYNZ).

Science Up Close

Features of the Ocean Floor

The ocean floor slopes down from the edges of the continents. Then it becomes mostly flat, though it also has mountains and other surface features.

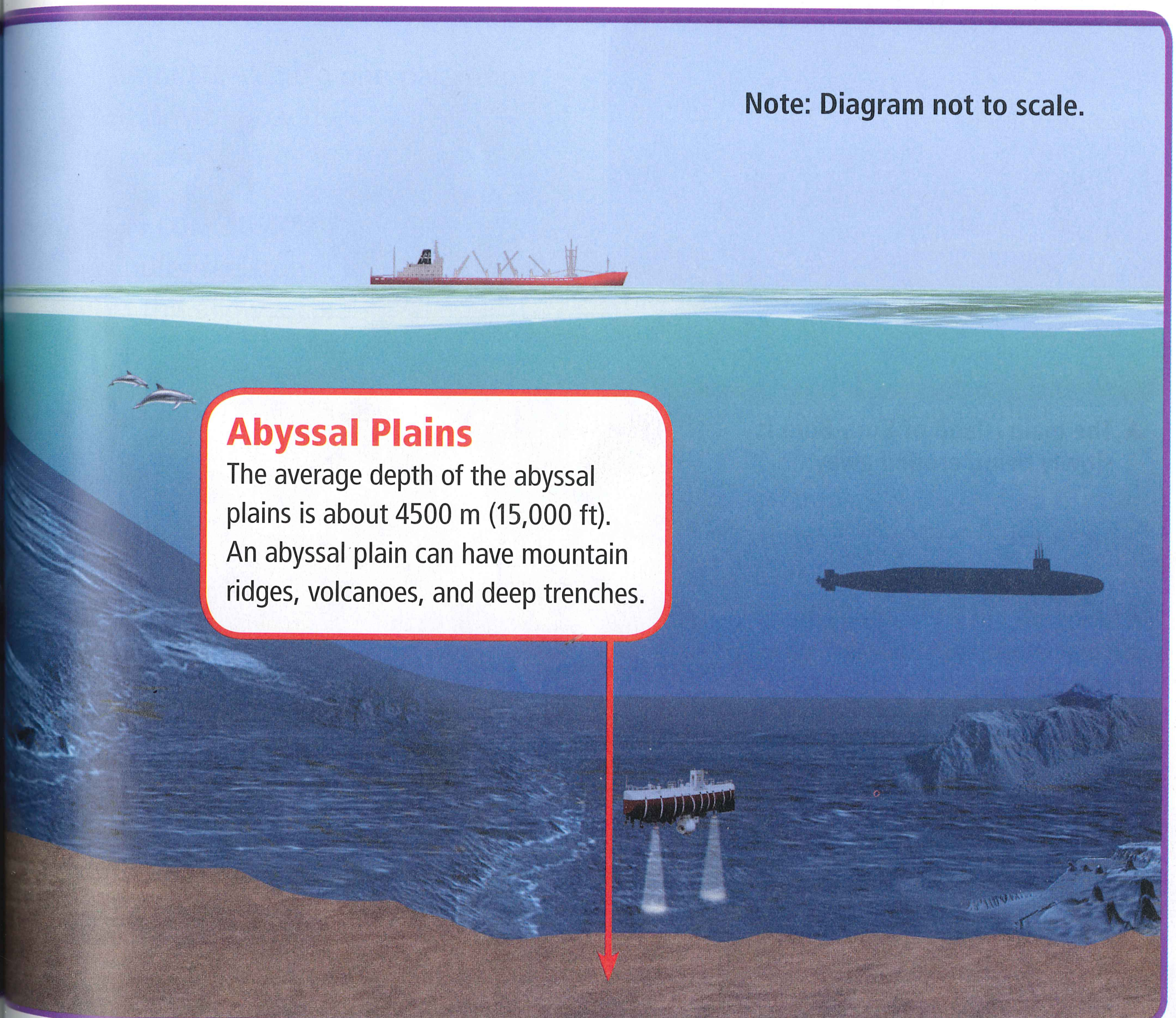


These deep, mostly flat areas are covered by a thick layer of sediment. However, abyssal plains aren't completely flat. In some places, they are cut by deep trenches. The Mariana Trench, in the Pacific Ocean, is the deepest trench. At its greatest depth, it is about 11,000 m (36,000 ft) below the surface of the ocean.

Abyssal plains also have mountains rising from their underwater surface. Some underwater mountains were formed by volcanic eruptions. Underwater mountains sometimes build up enough rock to extend above the water. Some islands in the ocean are the tops of mountains. The Hawaiian Islands formed from volcanic eruptions that took place over millions of years.

In the middle of the ocean, the sea floor rises to form ridges of underwater mountains. Mid-ocean ridges, as they are known, extend about 60,000 km (37,500 mi) through the Pacific, Atlantic, Arctic, and Indian Oceans.

Focus Skill **MAIN IDEA AND DETAILS** **What are three features found on abyssal plains?**



Changes to the Ocean Floor

The ocean floor is always changing. Almost every day, somewhere under the ocean, a volcano is erupting. Over time, an island may form.

In 1963, an underwater volcano near Iceland began to erupt, building up layers of lava. Six months later, the volcano reached the surface of the water, forming the island of Surtsey. The volcano continued to erupt for four more years and then finally stopped. Now Surtsey is getting smaller. The island has sunk slightly, and ocean waves are wearing away the rock.

Islands in the ocean can disappear completely. Bora-Bora, an island in the Pacific Ocean, formed from a volcano. Coral reefs then grew in a ring around the island. Over time, the main island has been sinking and the ocean has worn away much of the rock. In the future, Bora-Bora will be gone. The ring of coral will still be there, forming an island called an *atoll* (A•tawl).

Focus Skill MAIN IDEA AND DETAILS

What are three main ways islands in the ocean can change?

▲ The main island of Bora-Bora is slowly being eroded away.

The island of Surtsey formed from a volcanic eruption. The steam and ash from the eruption shot up as high as 305 m (1000 ft) in the air. ▶

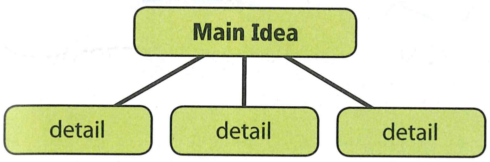
Lesson Review

Essential Question

What Are the Oceans Like?

In this lesson, you learned that the ocean has many properties that other bodies of water don't have. You also learned about the features of the ocean floor and how they are constantly changing.

1. **Focus Skill MAIN IDEA AND DETAILS** Draw and complete a graphic organizer with details for this main idea: The ocean floor has several features.



2. **SUMMARIZE** Write a one-paragraph summary of how the characteristics of the ocean change with depth.

3. **DRAW CONCLUSIONS** Coral is made of the outer skeletons of animals. How does this allow a coral reef to last longer than the island around which it grew?

4. **VOCABULARY** Make a crossword puzzle that uses the terms from this lesson.

Test Prep

5. **CRITICAL THINKING** What might happen to a hollow rubber ball if a submersible took it 300 m (1000 ft) below the ocean surface? Explain.

6. What could cause the salinity of a sea to increase?
   - **A.** an increase in rainfall
   - **B.** an increase in fresh water flowing into it
   - **C.** an increase in salt water flowing out of it
   - **D.** an increase in evaporation

Make Connections

Writing

Narrative Writing

Suppose you are an explorer making an underwater voyage across the floor of the Atlantic Ocean. Write a **story** about your voyage.

9÷3 Math

Make a Bar Graph

Make a bar graph to compare the deepest points in the oceans. Use these numbers:

Atlantic Ocean—8648 m
Arctic Ocean—5450 m
Indian Ocean—7725 m
Pacific Ocean—11,033 m

Health

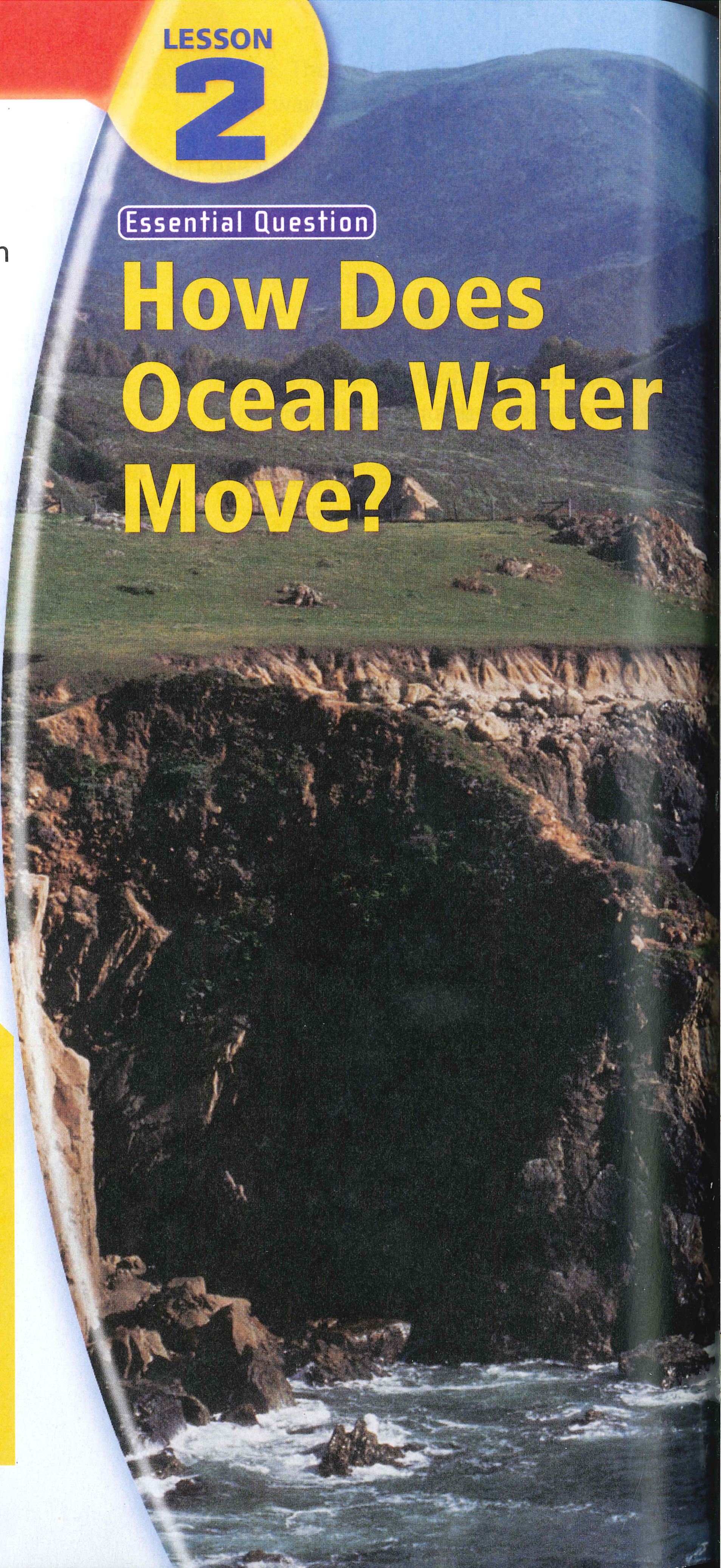
Don't Drink the Water

Research the reason for not drinking ocean water. Then write a paragraph that tells what you learned.

LESSON 2

Essential Question

How Does Ocean Water Move?



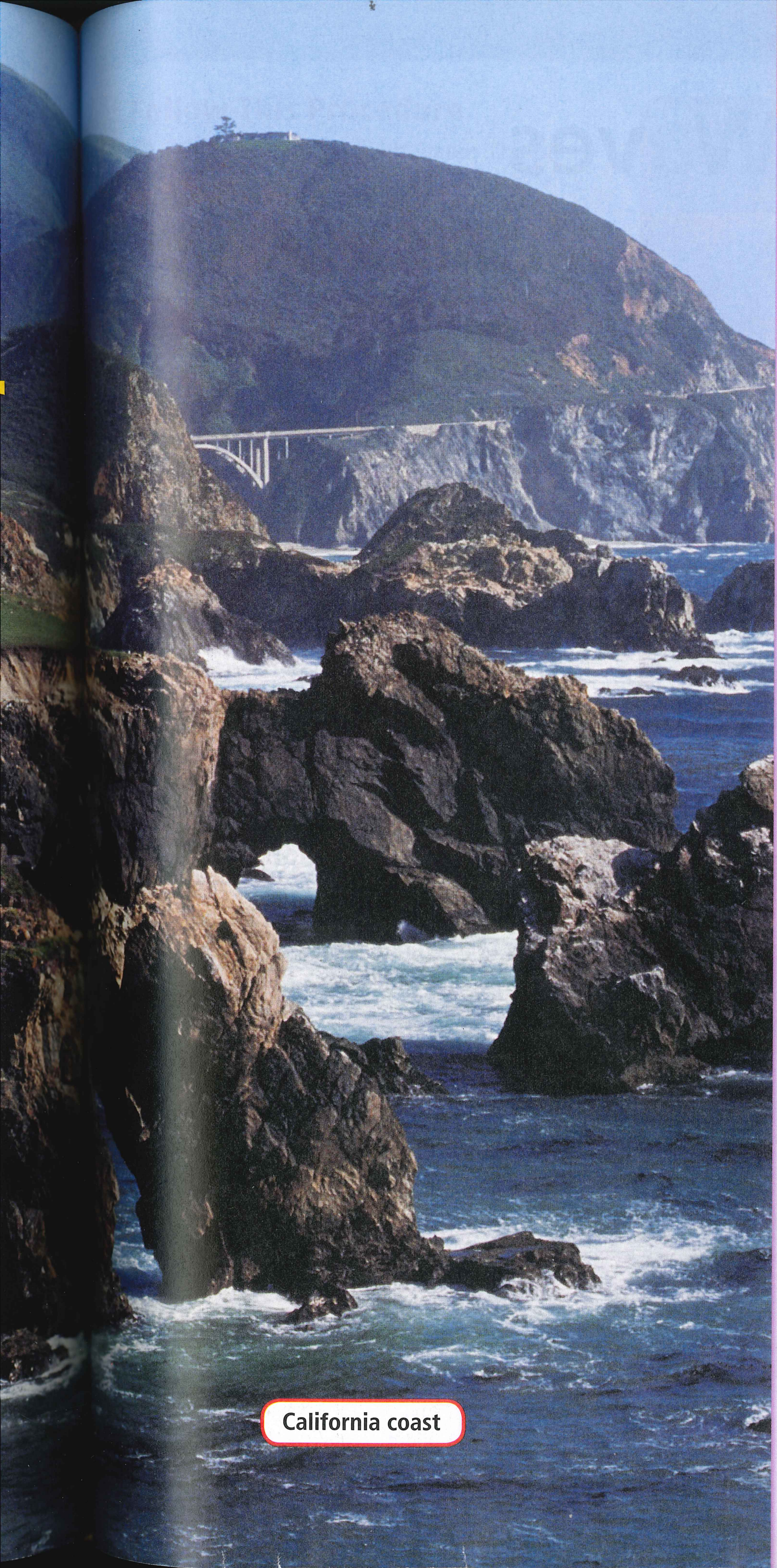
Investigate one way in which waves form.

Read and learn the different ways that waves form and how the sun and moon cause ocean water to move.

Fast Fact

Wave Sets

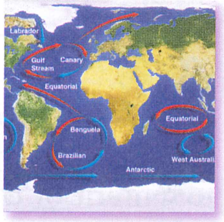
When waves approach the shore, they seem to move in sets. In each set, the waves get bigger and bigger and then smaller again. Then another set begins. In the Investigate, you will make and observe your own waves.



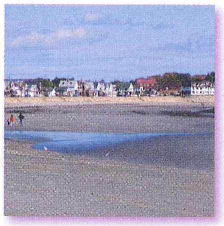
California coast

Vocabulary Preview

wave [WAYV] A disturbance that carries energy through matter or space (p. 446)



current [KER•uhnt] A stream of water that flows like a river through the ocean (p. 448)



tide [TYD] The repeated rise and fall of the water level of the ocean (p. 450)

Read and Learn

VOCABULARY
wave p. 446
current p. 448
tide p. 450

SCIENCE CONCEPTS
- how waves form
- what causes currents and tides

Focus Skill — COMPARE AND CONTRAST
Look for ways waves and currents are alike and different

alike — different

Waves

Have you ever stood on a beach and watched the waves? From a distance, waves look like traveling ridges of water. But the water in waves doesn't move across the ocean. The water actually moves up and down. A **wave** is the up-and-down movement of surface water.

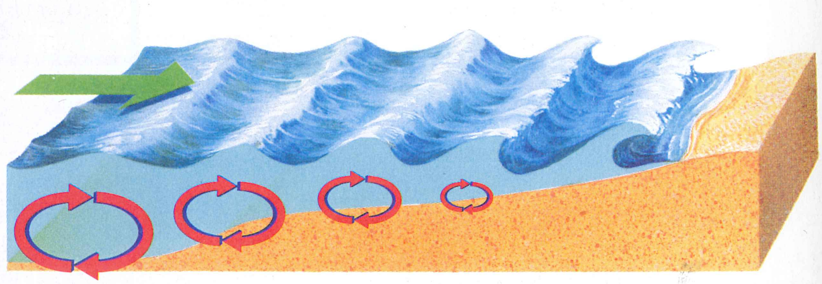
In the Investigate, you saw that air blowing across water makes waves. Energy from the moving air moves the water. When wind blows across the ocean, it pushes the water up, forming ripples. When wind blows on the ripples, more water moves up. Soon, the ripples form waves.

A wave carries energy, not water, across the ocean. Inside the wave, water turns in small ovals. After the water moves around the ovals, it returns to about the place where it started. The energy, however, travels forward.

Water moves up and down and energy moves forward until it approachs the shore.

Modern surfing began in Hawai`i in the 1800s. ▼

Wave Movement



As a wave approaches the shore, the bottom of the wave slows down and the top falls forward.

A tsunami, like the one that caused this damage in Sri Lanka in 2004, is the most destructive of all ocean waves. ▶

As the water becomes shallow, the waves slow down. They also become higher and closer together.

The bottom of the wave slows the most, so the top moves ahead of the bottom. When the top gets far enough ahead, the wave falls over, or *breaks*. It's like tripping over something. Your foot stops moving, but the rest of you keeps going, causing you to fall forward. Breaking waves are what people see crashing onto the shore at the beach.

Some waves are caused by more than ordinary winds. A hurricane or other strong storm moving over the ocean pushes water forward. This adds to the usual height of the waves. The mound of water that pushes onto shore in a hurricane is called a *storm surge*. Storm surges are highest in places where the continental shelf is nearly flat.

The biggest waves are not caused by winds. The great energy of an earthquake or a volcanic eruption can produce a wave called a *tsunami* (tsoo•NAH•mee). In the open ocean, a tsunami isn't a high wave, but it is long and moves very fast. When a tsunami approaches the shore, it slows down. This makes it become much higher. In 1958, an earthquake near Alaska produced a tsunami that was 524 m (1719 ft) high!

Focus Skill **COMPARE AND CONTRAST** **How is a tsunami different from other waves?**

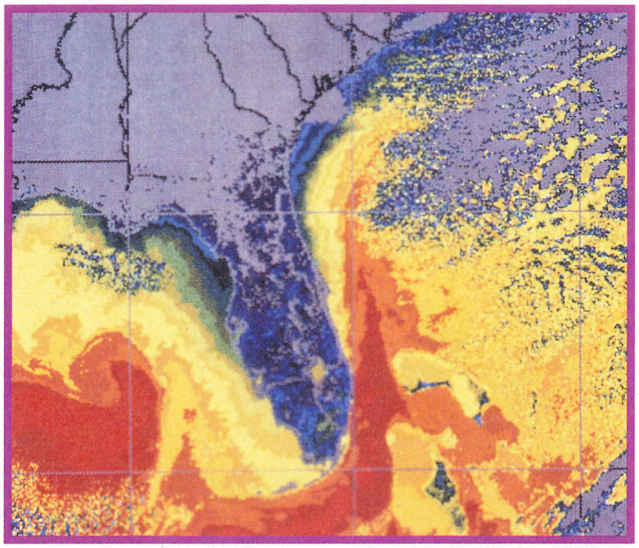
Math in Science
Interpret Data

Waves Around the World

Scientists use the movement of buoys offshore to calculate how high waves will be and how fast the wind is moving. These are the predictions for one week. Why do you think the waves were predicted to be higher near Australia than near Florida?

Waves Around the World

Location	Open-Ocean Wave Heights (m)	Wind Speeds (km/hr)
Capetown, South Africa	2–7	11–45
Long Beach, California	1–2	3–21
Port Orange, Florida	0–1	3–11
Hilo, Hawai`i	2–4	6–27
Gold Coast, Australia	1–8	5–39



▲ **On this satellite image, the warm water of the Gulf Stream is shown in orange. Cooler water is yellow, green, and blue.**

Currents

Would you be surprised to learn that the sun causes ocean water to move? Air around the equator is heated by the sun. This air moves north, toward the poles. As it moves, the air pushes ocean water forward. The result is a **current**, a stream of water that flows like a river through the ocean.

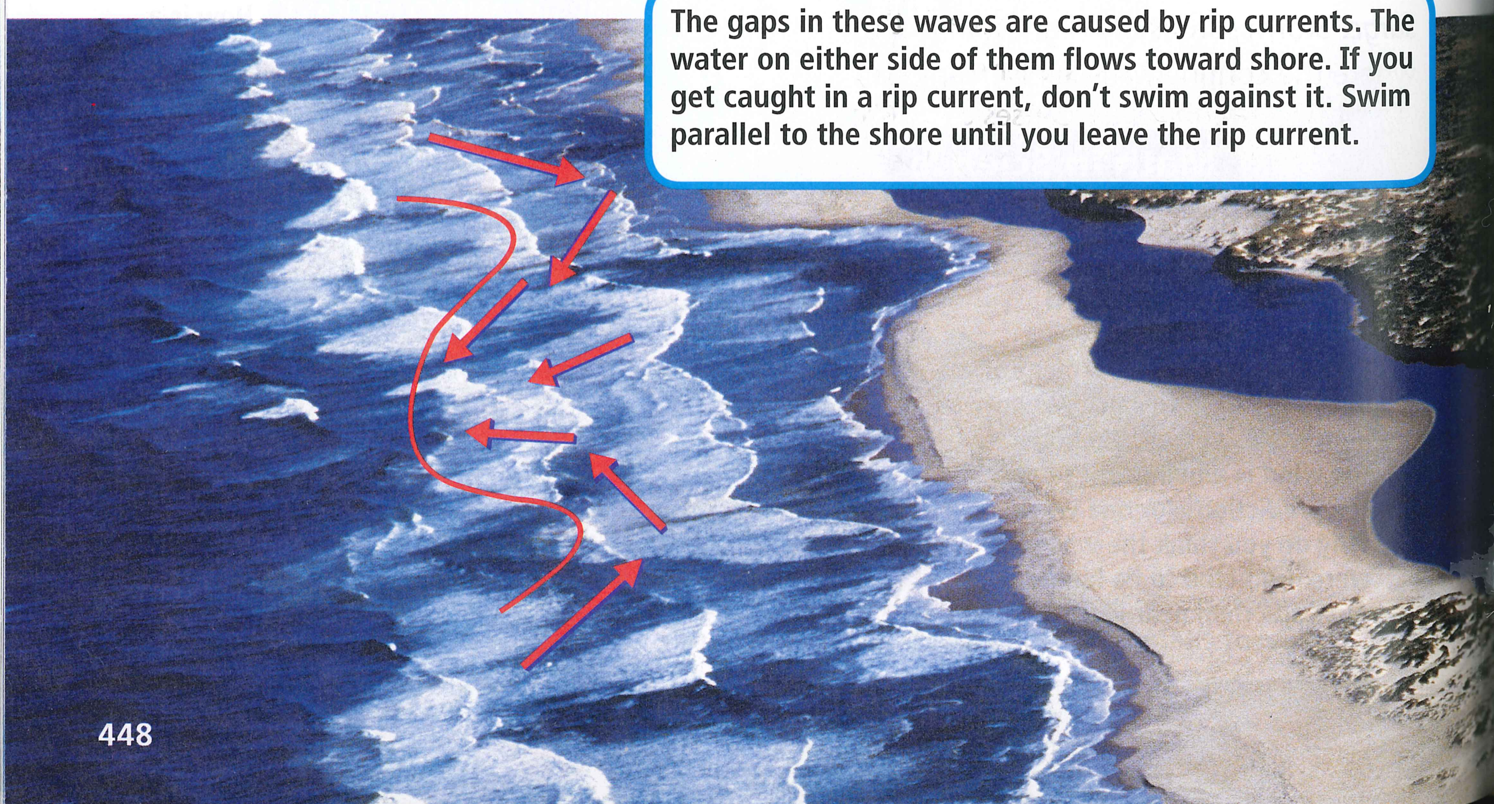
Large currents in the open ocean are known as surface currents. These carry water great distances across the surface.

The Gulf Stream is a surface current that flows all the way across the Atlantic Ocean. The current begins in the Gulf of Mexico and flows north along the eastern coast of the United States. Then it turns east and flows across the Atlantic Ocean to Europe.

Oceans also have smaller currents that stay near coasts. These currents erode and deposit sand, helping shape beaches.

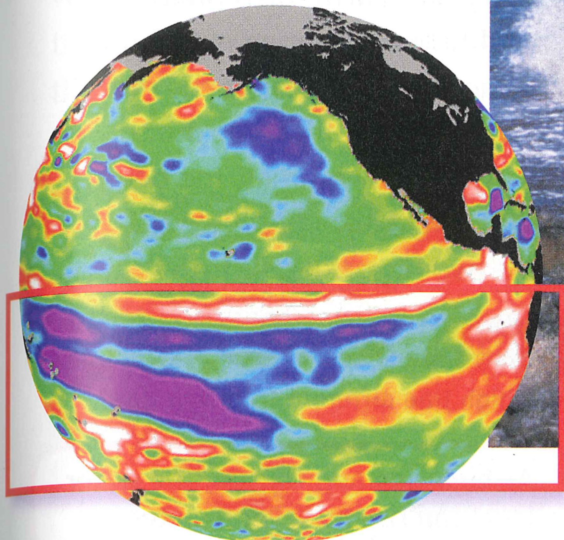
Sometimes people coming out of the ocean after a swim have trouble finding their beach towels. A current, called a longshore current, sometimes flows along the shore. It carries swimmers away from the place where they entered the water.

Another kind of current along some shores is a rip current. Rip currents carry water away from the beach. This makes them dangerous for swimmers. A rip current can flow faster than 2.4 m/sec (7.9 ft/sec). That's faster than even an Olympic swimmer can swim back to shore.



The gaps in these waves are caused by rip currents. The water on either side of them flows toward shore. If you get caught in a rip current, don't swim against it. Swim parallel to the shore until you leave the rip current.

The huge red-and-white areas in the Pacific show warmer waters caused by an El Niño. The purple area shows water kept cool by the El Niño. ▼



▲ Rain from an El Niño has caused many landslides along the California coast.

Some currents flow deep in the ocean. Off the west coast of South America, for example, winds blow warm surface water away from the land. Deep-ocean currents then carry cooler water up toward the surface near the coast.

Changing winds can affect these currents. If the winds don't blow toward the west, the warm surface water stays near the coast. The deep, cold currents don't reach the surface, and the coastal water stays very warm. This warm water causes an *El Niño* (EL NEEN•yoh), a change in the weather patterns over the Pacific Ocean.

How does the warm water affect the weather? Warm water evaporates faster than cool water does. Where the ocean is warm, clouds form and bring rain. In most years, the wind pattern pushes the warm water to the west. As a result, Australia gets rain, and South America and the west coast of North America have dry weather.

During an El Niño, however, the weather pattern reverses. Australia has very dry weather, and the west coasts of South America and North America get storms and huge amounts of rain. This can cause flooding in some areas that aren't used to such heavy rains.

Focus Skill COMPARE AND CONTRAST

How is a surface current different from a current near a coast?

Insta-Lab

A Kitchen El Niño

Fill a large container with very warm water. Fill a small cup with very cold water, and add a few drops of food coloring. Use tongs to gently lower the cup straight down into the warm water, below the surface. Observe what happens. How is this similar to what happens during an El Niño?

Tides

Imagine walking along the shore and seeing a boat resting in the mud. You might wonder why someone would leave a boat in such a place. But if you walked by later, you might see the boat floating in water, even though it's in the same place.

Each day, the water level at an ocean shore rises and falls. This rise and fall in the water level of the ocean is called a **tide**. At certain times, the water is high enough to float a boat at the shore. At other times, there isn't enough water to float the boat.

Tides are caused by the "pull" of the sun and moon on Earth's oceans. Although the sun is larger, the moon affects tides more because it is closer to Earth.

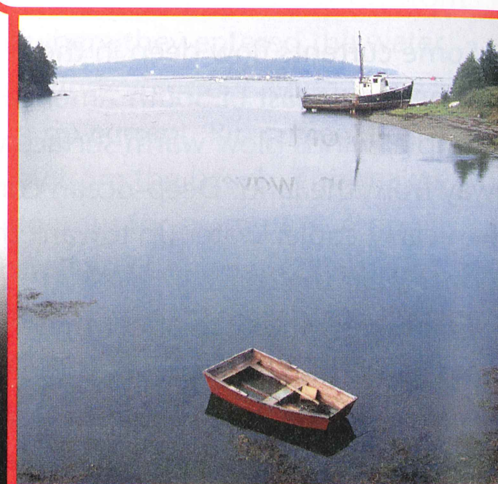
The moon pulls on all of Earth. The land doesn't move much, but the water does. As a result, two bulges of water form. One bulge is on the side of Earth facing the moon. The second bulge is on the opposite side of Earth, where the pull of the moon is slightly less. The level of the ocean is higher in the bulges, producing a *high tide.* In the parts of the ocean between the bulges, the water level is lower. At those places, a *low tide* occurs.

There are usually two high tides and two low tides every day. Earth turns on its axis once every 24 hours. This means that the beach with the boat is closest to the moon once a day and farthest from the moon once a day. At these two times, the beach has high tides. The beach has low tides between the two high tides.

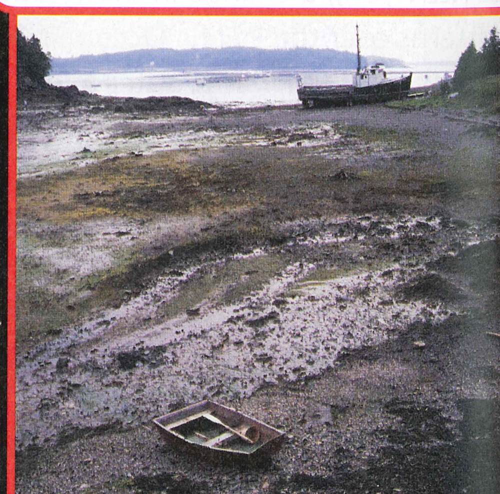
Focus Skill **COMPARE AND CONTRAST**

How is high tide different from low tide?

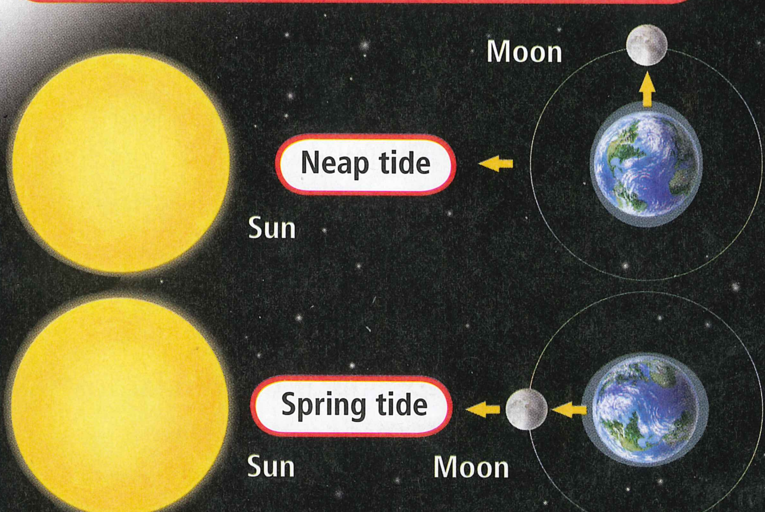
As high tide approaches, the water level can rise by several meters.



At low tide, the water level is low and more of the land can be seen.



When the moon and the sun align, their effects combine to produce large tidal changes, called *spring tides*. Smaller changes occur during neap tides.



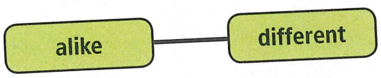
Lesson Review

ssential Question

ow Does Ocean Water Move?

 this lesson, you learned that a wave carries energy, not vater, across the ocean. You also learned about the influences ne sun has on ocean currents, as well as the influence of both ne sun and the moon on ocean tides.

1. **COMPARE AND CONTRAST** Draw and complete a graphic organizer that compares and contrasts these things: waves, currents, storm surges, tsunami.



2. **SUMMARIZE** Write a one-sentence summary, using a real-life example, for each of the vocabulary terms in this lesson: *wave, current, tide.*

3. **DRAW CONCLUSIONS** Why is it helpful for ships going from North America to Europe to travel in the Gulf Stream?

4. **VOCABULARY** Write a sentence for each vocabulary term to show that you understand it.

Test Prep

5. **CRITICAL THINKING** Scientists study satellite images that show the temperatures of different areas of the Pacific Ocean. Why is this information important?

6. Which can cause tsunamis?
   - **A.** currents
   - **B.** earthquakes
   - **C.** tides
   - **D.** winds

Make Connections

Writing

Narrative Writing

What would it be like to ride a wave that was traveling across the ocean? Write a **story** that tells what would happen on such a journey.

9÷3 Math

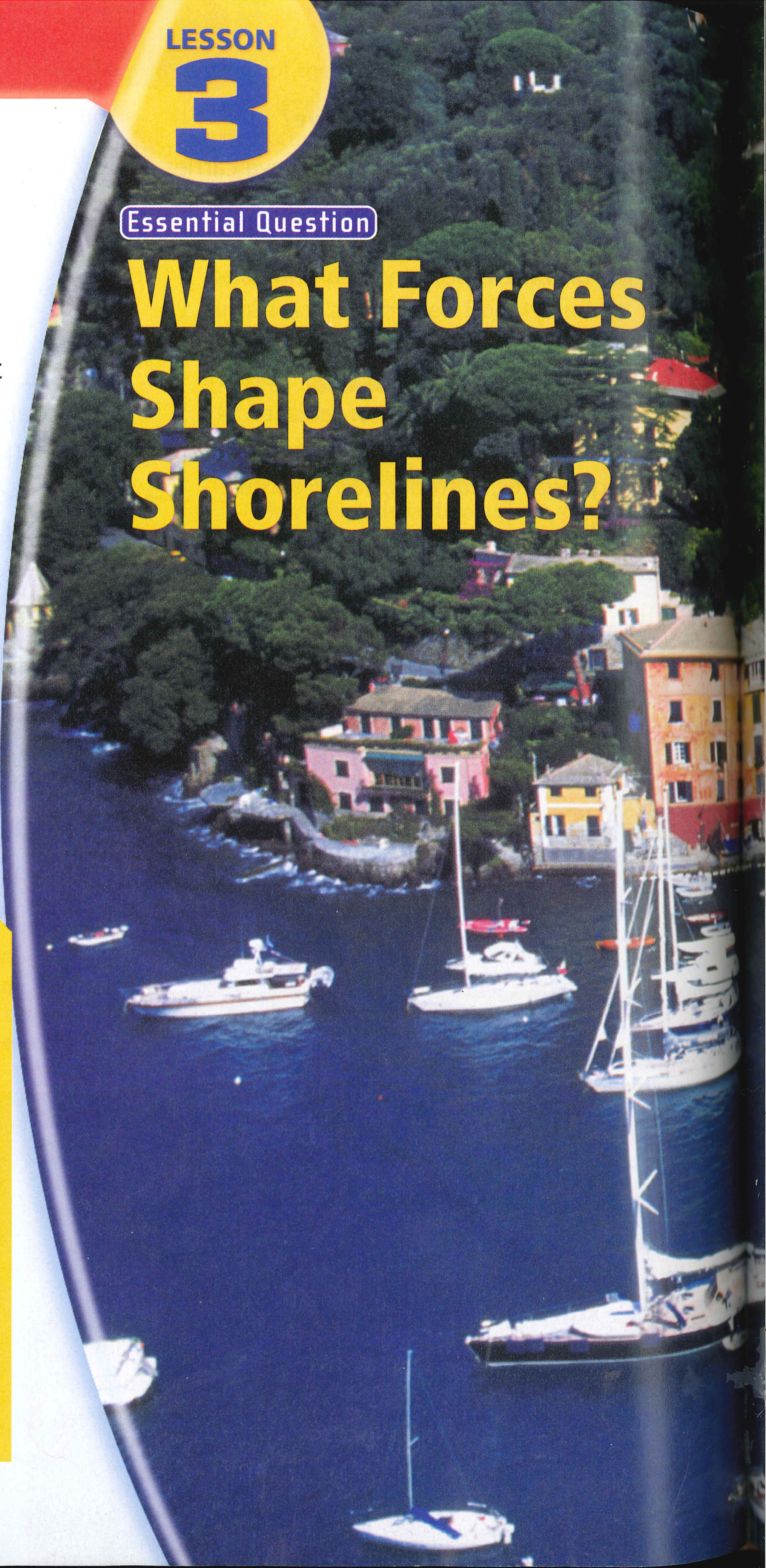
Describe Patterns

Find tide tables in an almanac or a newspaper. Study the four tides listed for one day. At what times do the high tides occur? At what times do the low tides occur? How much time is there between the two high tides?

Language Arts

Editing

After writing the first draft of your wave story, exchange stories with a classmate for comments and corrections. Check your classmate's spelling, grammar, and story construction.



LESSON 3

Essential Question

What Forces Shape Shorelines?

Investigate one of the forces that shapes shorelines.

Read and learn about the different features on a shoreline and how they can change.

Fast Fact

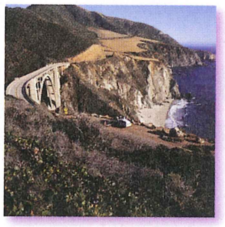
Ocean View

These houses were built in Portofino, Italy, along the edge of the Mediterranean Sea. Houses along the shore and on nearby cliffs have changed the natural patterns of coastal erosion. In the Investigate, you can make a model to see how waves change a beach.

Portofino, Italy

Vocabulary Preview

shore [SHAWR] The area where the ocean and the land meet and interact (p. 456)



headland [HED•luhnd] A point of land at the shore where hard rock is left behind and other materials are washed away (p. 456)

tide pool [TYD POOL] A temporary pool of ocean water that gets trapped between rocks when the tide goes out (p. 457)

jetty [JET•ee] A wall-like structure that sticks out into the ocean to prevent sand from being carried away (p. 459)

VOCABULARY
shore p. 456
headland p. 456
tide pool p. 457
jetty p. 459

SCIENCE CONCEPTS
- what features are found along a shore
- how a shore can be changed

Focus Skill **MAIN IDEA AND DETAILS**

Look for examples of ways a shore can be changed.

Main Idea
detail | detail | detail

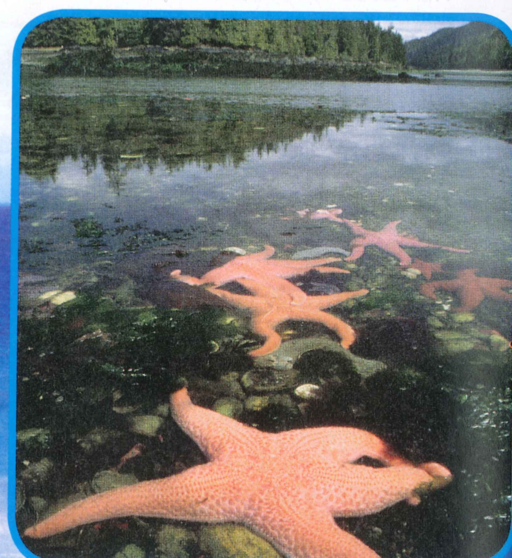
Shores

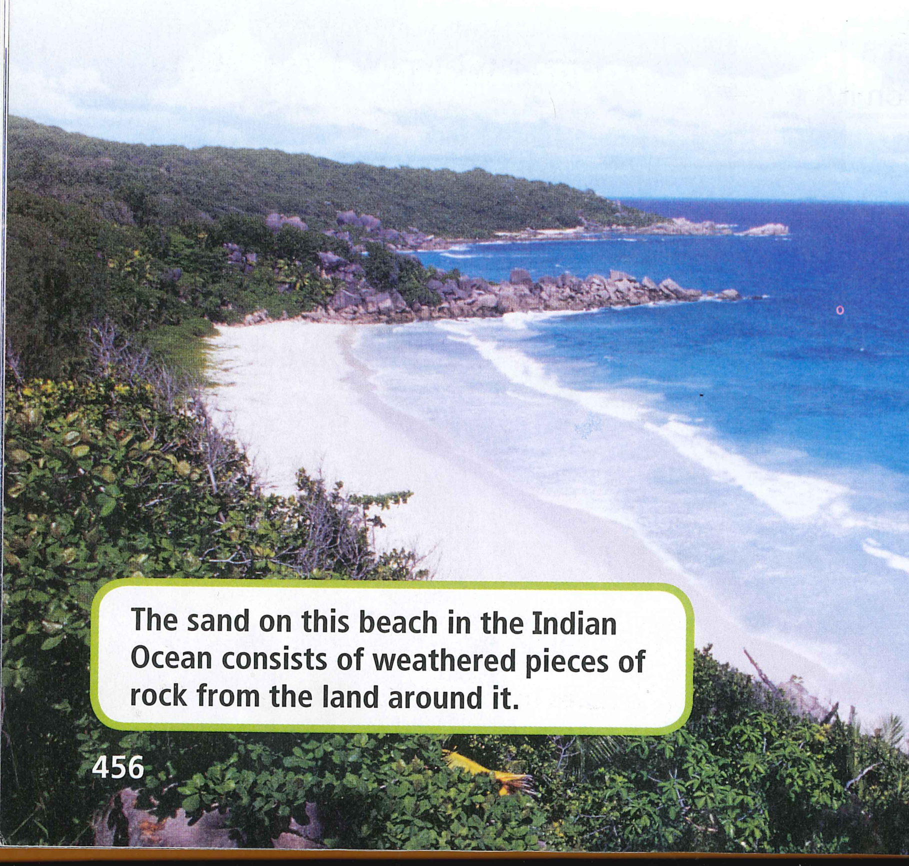
Have you ever been to the coast along an ocean? Was there a sandy beach, or were there rocky cliffs? The area where the ocean and the land meet and interact is called a **shore**. Shores have many different features.

At some places, the shore is a flat beach covered with sand or pebbles. This kind of shore is like the first beach in the Investigate. As you observed, waves can carry the sand away. At other places along a shore, there may be a steep cliff, like the second beach in the Investigate.

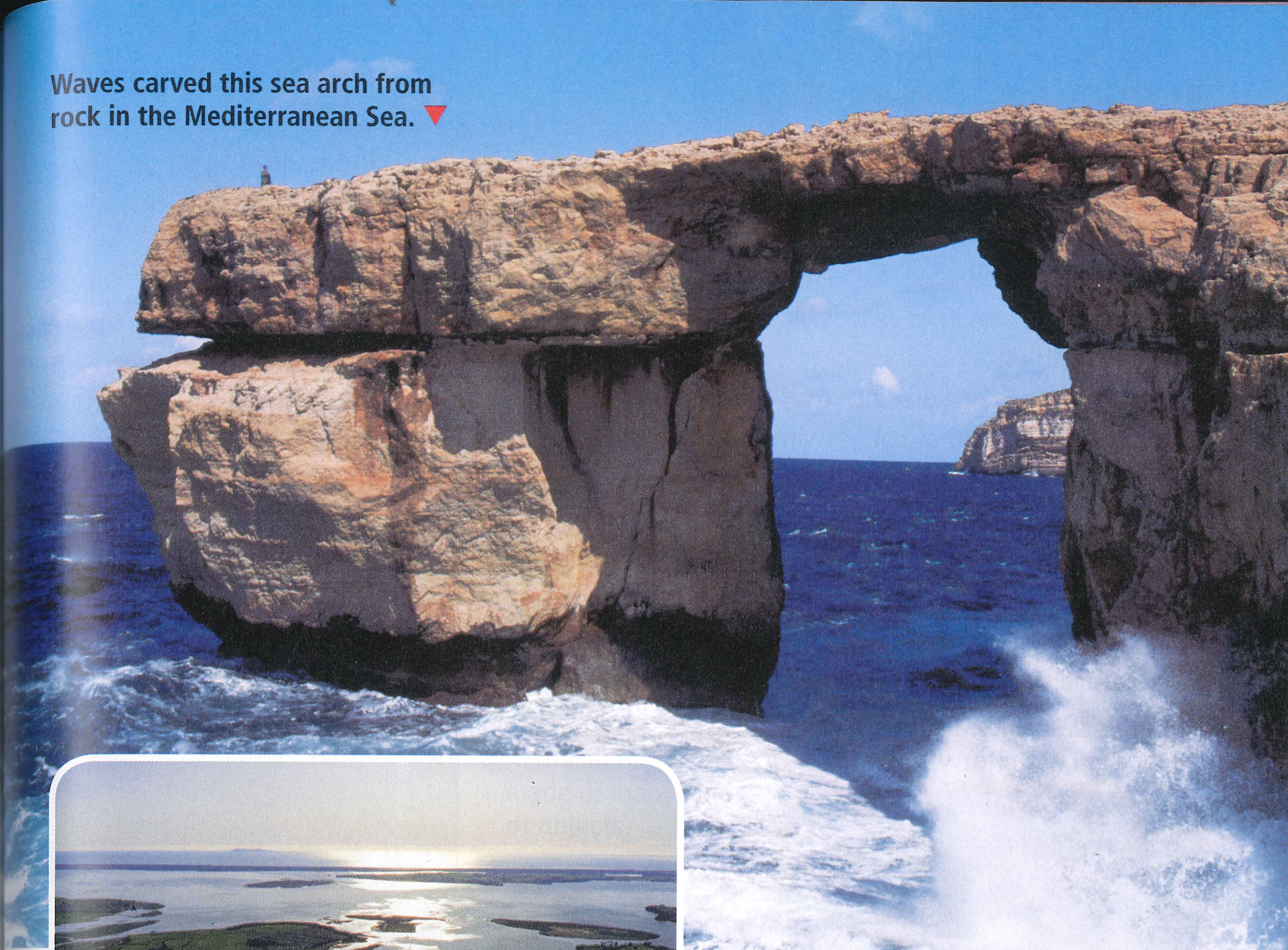
In the Investigate, the sand was the same all along the shore. But the materials of a shore may vary. At some places, there may be sand or soft rock that waves easily wear away. At other places, there may be hard rock that does not wear away as easily. Soft rock and hard rock may also be together. When the soft rock is worn away, the hard rock left behind may form a point of land called a **headland**.

At low tide, a tide pool keeps many small ocean animals from drying out. Sea stars, such as those seen here, can often be found in tide pools. ▼





The sand on this beach in the Indian Ocean consists of weathered pieces of rock from the land around it.



Waves carved this sea arch from rock in the Mediterranean Sea. ▼

◀ **The area where a river meets the ocean is an estuary. The depth and salinity of an estuary change with the tides. Plants and animals that live in estuaries must survive these changes.**

After a headland forms, waves wear away its rock slowly, sometimes forming caves in the rock. Over time, the waves can make these caves deeper and deeper. Eventually, the waves may cut all the way through the rock, making a hole called a *sea arch*.

All beaches have an area that is underwater at high tide and exposed at low tide. On rocky beaches, small pools of water can be trapped between rocks when the tide goes out. A temporary pool of ocean water is called a **tide pool**.

At high tide, water fills in the area around the pools. Some animals are then free to leave or enter the pools. At low tide, these animals are trapped until the water rises again. Some plants and animals live their entire lives in the same tide pool.

Where a river flows into the ocean, an *estuary* (ES•tyoo•air•ee) forms. Estuaries are rich in plant and animal life. Many kinds of fish breed in estuaries.

Focus Skill **MAIN IDEA AND DETAILS** **What are two features that can be seen along a shore?**

Human Activities Affect Shores

Waves erode sand from beaches every day. This erosion is a natural process. The sand that is washed away by waves is deposited either at other places along the shore or on the floor of the ocean.

Currents also cause erosion from beaches. Longshore currents that carry swimmers along a beach also carry sand. Sand that is eroded by a current is deposited at another place when the current slows. Often, the sand is deposited in a channel at the mouth of a river.

The movement of sand causes two problems for humans. First, it makes some beaches smaller and others larger. Second, it fills in channels, which then become too shallow for boats to pass through.

People sometimes solve these two problems at the same time. Sand is dredged, or scooped out, from a channel and then dumped on a beach. Workers use bulldozers to spread out the sand, making sure the beach has the correct slope.

This process of replacing sand is called *beach restoration*. It can cost millions of dollars, but many people think saving beaches is worth the cost. Beach restoration is not permanent, however. Natural processes take over as soon as the work is finished. After several years, people must do the work again.

▲ **People build jetties, like this one at Coos Bay, Oregon, to stop the loss of sand from beaches.**

People need huge machines to move sand in a beach restoration project.

▲ Hundreds of old subway cars from New York City have been dropped into the ocean. They now form artificial reefs off the coasts of New Jersey, Virginia, Delaware, South Carolina, and Georgia.

◀ Artificial reefs are made of many kinds of objects.

Replacing sand is very expensive, so it's better to keep the sand from being lost in the first place. People have tried many ways to prevent the loss of sand, including building structures that block currents. This prevents the currents from carrying away sand and eroding the beach.

One structure that can do this is a **jetty**, a wall-like structure that sticks out into the ocean. Jetties are usually built of large rocks. As a longshore current moves along the coast, the jetty traps sand and small rocks. This protects the beach above the jetty. But because the current is blocked, beaches below the jetty don't get the sand they normally would. As a result, one beach benefits and the others don't.

In some parts of the world, huge coral reefs near the coast absorb the energy of waves before they hit the shore. In this way, the reefs protect the coast from damage. People have suggested building artificial reefs to protect beaches. In Australia, a long reef of huge containers of sand was built offshore. When a storm approaches, the waves hit the reef. By the time the waves reach shore, they are smaller and weaker.

Artificial reefs are being built in places all around the world. Most of these, however, are not meant to protect beaches. Instead, they provide homes for fish and other sea life. Mussels, barnacles, corals, and sponges grow on the reefs. Many kinds of fish hide within the shelter of the reefs. These reefs form their own communities.

Focus Skill **MAIN IDEA AND DETAILS**

How do people restore beaches?

Mysteries of the Oceans

People have always been curious about the oceans. Since the oceans are huge and deep, people can't just swim down and take a look.

However, scientists have found ways to travel deep into the oceans, where water pressure is high. Diving bells, diving suits, and submarines have made deep-sea exploration possible. Scientists also send down remote-controlled vehicles equipped with cameras.

Deep-sea exploration has led to the discovery of some interesting things, such as *hydrothermal* (hy•droh•THER•muhl) *vents*. These are cracks in the ocean floor that release hot water and minerals into the ocean. Worms that live near these vents can be up to 3 m (10 ft) long! Further exploration may help us understand such mysteries of the oceans.

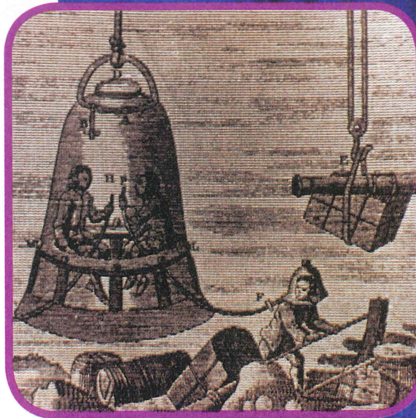
Focus Skill **MAIN IDEA AND DETAILS**

How have explorers been able to travel deep into the oceans?

Insta-Lab

A Diving Bell

Crumple a piece of paper, and push it into the bottom of a small plastic cup. Turn the cup upside down, and lower it straight down into a container of water. Remove the cup, and take the paper out. What do you observe about the paper? Explain what you see.



▲ Sir Edmond Halley invented a diving bell in the 1690s. It was lowered into the ocean with barrels of air to let the diver breathe.

▲ Hard suits like this one make it possible for divers to work at great depths.

Water heated by molten rock beneath the ocean floor rushes out through hydrothermal vents like these "black smokers."

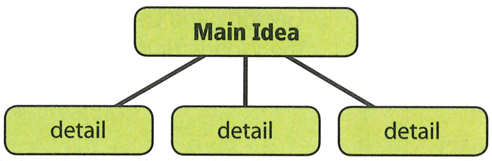
Lesson Review

Essential Question

What Forces Shape Shorelines?

In this lesson, you learned some different characteristics of shores and how these characteristics are influenced by nature and human activities. You also learned about some ways people have explored the deep ocean.

1. Focus Skill **MAIN IDEA AND DETAILS** Draw and complete a graphic organizer with supporting details for this main idea: Coastal formations and features are shaped in many ways.



2. **SUMMARIZE** Write a one-paragraph summary about ways that humans help slow down beach erosion.

3. **DRAW CONCLUSIONS** If you're in an airplane flying over a beach, you might see that sand is piled up on one side of a jetty but not on the other side. Explain why.

4. **VOCABULARY** Write a paragraph that uses all the vocabulary terms from this lesson.

Test Prep

5. **CRITICAL THINKING** Why is a tide pool considered a temporary feature of a beach?

6. What does a beach restoration project try to replace?
   A. coral reefs
   B. headlands
   C. sand
   D. sea animals

Make Connections

Writing

Persuasive Writing

Suppose you live near a beach that is wearing away. Write a **letter** to local government officials, urging them to protect the beach.

Math

Solve a Problem

A diver using a hard diving suit can go down to 600 m below the surface in 20 minutes. How far down can the diver go in 1 minute?

Social Studies

The Color of Sand

The sand on many beaches is white. But it's black on some beaches in Hawai`i and Iceland and pink on Bermuda beaches. Do research to find out why beach sand is different colors.

Chapter 12 Review and Test Preparation

Vocabulary Review

Match the terms to the definitions. The page numbers tell you where to look in the chapter if you need help.

continental shelf p. 438

continental slope p. 438

abyssal plain p. 438

wave p. 446

current p. 448

tide p. 450

headland p. 456

tide pool p. 457

1. the up-and-down movement of surface water
2. the part of the ocean floor that slopes gently away from the land
3. a stream of water that flows through the ocean
4. a sharp point of rock that extends from the coast
5. the part of the ocean floor that drops steeply
6. a large, flat area on the ocean floor
7. an area in which ocean water collects during low tide
8. the rise and fall of the ocean level

Check Understanding

Write the letter of the best choice.

9. **MAIN IDEA AND DETAILS** What is the main purpose of this structure?

Focus Skill

A. to protect beaches
B. to increase wave action
C. to form estuaries
D. to form an artificial reef

10. **COMPARE AND CONTRAST** How are waves and currents alike?

Focus Skill

F. Both decrease during an El Niño.
G. Both result from earthquakes.
H. Both strengthen coastal areas.
J. Both form shoreline features.

11. Which increases as you go deeper into the ocean?
A. salinity
B. amount of light
C. water pressure
D. water temperature

12. Marie wades into the ocean. On what structure is she standing?
   F. continental rise
   G. continental shelf
   H. abyssal plain
   J. mid-ocean ridge

13. What caused this structure to form?

   A. Waves wore away some of the rock.
   B. Currents washed sand away from the rock.
   C. Waves piled up rocks near the coast.
   D. People piled rocks to protect the shore.

14. Henry and his dad floated in the ocean for a half hour. When they came out onto the beach, they couldn't see the rest of the family. What kind of current had carried them away from their family?
   F. deep-ocean
   G. longshore
   H. rip
   J. surface

15. What is beach restoration?
   A. rebuilding houses near the shore
   B. building new roads to a beach
   C. replanting trees along a beach
   D. putting sand back on a beach

16. What causes tides?
   F. an earthquake under the ocean
   G. winds blowing across the ocean
   H. the pull of the moon
   J. currents lifting water to the surface

Inquiry Skills

17. You put a cup of fresh water and a cup of salt water into a freezer at the same time. **Predict** which will freeze first.

18. You visit a beach you haven't seen in five years. The shore looks very different. What can you **infer**?

Critical Thinking

19. You are at the beach, and you notice that the sand above the water level is wet. Is the tide rising or falling? Explain your answer.

20. An El Niño is forming, and a friend wants to know what that means. How will you explain the cause of the El Niño? What might be some of the effects of the El Niño?

The Big Idea