

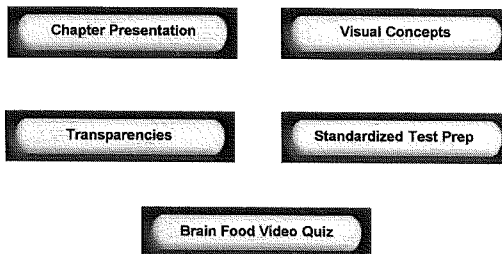
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Chapter 19 Ocean Basins

Table of Contents

Section 1 The Water Planet

Section 2 Features of the Ocean Floor

Section 3 Ocean-Floor Sediments



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Chapter 19 Section 1 The Water Planet

Objectives

- **Name** the major divisions of the global ocean.
- **Describe** how oceanographers study the ocean.
- **Explain** how sonar works.



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Chapter 19 Section 1 The Water Planet

The Water Planet

global ocean the body of salt water that covers nearly three-fourths of Earth's surface

- The global ocean contains more than 97% of all of the water on Earth.
- Although the ocean is the most prominent feature of Earth's surface, the ocean is only about 1/4,000 of Earth's total mass and only 1/800 of Earth's total volume.



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Chapter 19 Section 1 The Water Planet

Divisions of the Global Ocean

- The global ocean is divided into five major oceans. These major oceans are the Atlantic, Pacific, Indian, Arctic, and Southern Oceans.
- The Pacific Ocean is the largest ocean on Earth's surface. The next largest ocean is the Atlantic Ocean.
- The Indian Ocean is the third-largest ocean and has an average depth of 3.09 km. The Arctic Ocean is the smallest ocean, and it surrounds the North Pole.



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Chapter 19 Section 1 The Water Planet

Divisions of the Global Ocean, *continued*

sea a large, commonly saline body of water that is smaller than an ocean and that may be partially or completely surrounded by land

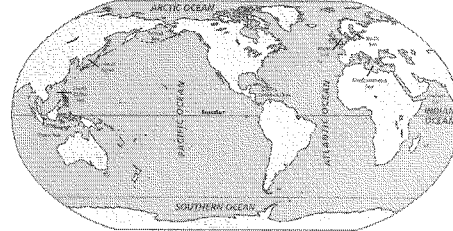
- Examples of major seas include the Mediterranean, Caribbean, and South China Seas.



Chapter 19 Section 1 The Water Planet

Division of the Global Ocean, *continued*

The diagram below shows a map of the global oceans.



Chapter 19 Section 1 The Water Planet

Exploration of the Ocean

The Birth of Oceanography

oceanography the scientific study of the ocean, including the properties and movement of ocean water, the characteristics of the ocean floor, and the organisms that live in the ocean

- The voyage of the HMS *Challenger* laid the foundation for the modern science of oceanography.
- Today, many ships perform oceanographic research.



Chapter 19 Section 1 The Water Planet

Reading Check

List three characteristics of the ocean that oceanographers study.



Chapter 19 Section 1 The Water Planet

Reading Check

List three characteristics of the ocean that oceanographers study.

Oceanographers study the physical characteristics, chemical composition, and life-forms of the ocean.



Chapter 19 Section 1 The Water Planet

Exploration of the Ocean, *continued*

Sonar

sonar *sound navigation and ranging*, a system that uses acoustic signals and returned echoes to determine the location of objects or to communicate

- Scientists measure the time that the sound waves take to travel from the transmitter, to the ocean floor, and to the receiver in order to calculate the depth of the ocean floor.
- Scientists then use this information to make maps and profiles of the ocean floor.



Chapter 19 Section 1 The Water Planet

Exploration of the Ocean, *continued*

Submersibles

- Underwater research vessels, called *submersibles*, also enable oceanographers to study the ocean depths.
- One such submersible is the *bathysphere*, a spherical diving vessel that remains connected to the research ship for communications and life support.
- Another type of piloted submersible is called a *bathyscaph*, is a self-propelled, free-moving submarine.



Chapter 19 Section 1 The Water Planet

Exploration of the Ocean, *continued*

Submersibles

- Other modern submersibles are submarine robots.
- These robot submersibles are remotely piloted and allow oceanographers to study the ocean depths for long periods of time.



Chapter 19 Section 1 The Water Planet

Exploration of the Ocean, *continued*

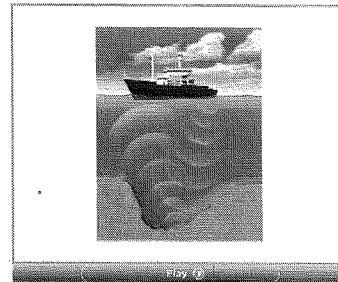
Underwater Research

- Submersibles have helped scientists make exciting discoveries about the deep ocean.
- During one dive in a submersible, startled oceanographers saw communities of unusual marine life living at depths and temperatures where scientists thought that almost no life could exist.
- Many of these life-forms have unusual adaptations that allow them to live in hostile environments.



Chapter 19 Section 1 The Water Planet

Sonar



Chapter 19 Section 2 Features of the Ocean Floor

Objectives

- Describe the main features of the continental margins.
- Describe the main features of the deep-ocean basin.



Chapter 19 Section 2 Features of the Ocean Floor

Features of the Ocean Floor

continental margin the shallow sea floor that is located between the shoreline and the deep-ocean bottom

deep-ocean basin the part of the ocean floor that is under deep water beyond the continental margin and that is composed of oceanic crust and a thin layer of sediment

- The ocean floor can be divided into two major areas.



Chapter 19

Section 2 Features of the Ocean Floor

Continental Margins

- The line that divides the continental crust from the oceanic crust is not abrupt or distinct.
- Shorelines are not the true boundaries between the oceanic crust and the continental crust.
- The boundaries are actually some distance offshore and beneath the ocean and the thick sediments of the continental margin.



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Chapter 19

Section 2 Features of the Ocean Floor

Continental Margins, *continued*

Continental Shelf

- Continents are outlined in most places by a zone of shallow water where the ocean covers the end of the continent.
- The part of the continent that is covered by water is called the *continental shelf*.
- The shelf usually slopes gently from the shoreline and drops about 0.12 m every 100 m.



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Chapter 19

Section 2 Features of the Ocean Floor

Continental Margins, *continued*

Continental Shelf, *continued*

- The average depth of the water covering a continental shelf is about 60 m.
- Although it is underwater, a continental shelf is part of the continental margin, not the deep-ocean basin.
- Changes in sea level affect the continental shelves.



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Chapter 19

Section 2 Features of the Ocean Floor

Continental Margins, *continued*

Continental Slope and Continental Rise

- At the seaward edge of a continental shelf is a steep slope called a *continental slope*.
- The continental shelf and continental slope may be cut by deep V-shaped valleys. These deep valleys are called *submarine canyons*.



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Chapter 19

Section 2 Features of the Ocean Floor

Continental Margins, *continued*

Continental Slope and Continental Rise, *continued*

- Other canyons may form over time as very dense currents called *turbidity currents* carry large amounts of sediment down the continental slopes.
- Turbidity currents form when earthquakes cause underwater landslides or when large sediment loads run down a slope.
- These sediments form a wedge at the base of the continental slope called a *continental rise*.



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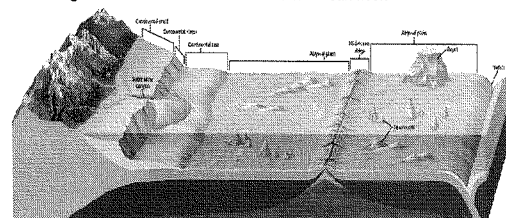
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Chapter 19

Section 2 Features of the Ocean Floor

Continental Margins, *continued*

The diagram below shows the features of the ocean floor.



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Chapter 19

Section 2 Features of the Ocean Floor

Deep-Ocean Basins

- Deep-ocean basins also have distinct features.
- These features include broad, flat plains; submerged volcanoes; gigantic mountain ranges; and deep trenches.
- In the deep-ocean basins, the mountains are higher and the plains are flatter than any features found on the continents are.



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Chapter 19

Section 2 Features of the Ocean Floor

Reading Check

What features are located in the deep-ocean basins?



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Chapter 19

Section 2 Features of the Ocean Floor

Reading Check

What features are located in the deep-ocean basins?

Trenches; broad, flat plains; mountain ranges; and submerged volcanoes are part of the deep-ocean basins.



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Chapter 19

Section 2 Features of the Ocean Floor

Deep-Ocean Basins, *continued*

Trenches

trenches a long, narrow, and steep depression that forms on the ocean floor as a result of subduction of a tectonic plate, that runs parallel to the trend of a chain of volcanic islands or the coastline of a continent, and that may be as deep as 11 km below sea level; also called an *ocean trench* or a *deep-ocean trench*

- Earthquakes occur near trenches. Volcanic mountain ranges and volcanic island arcs also form near trenches.



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Chapter 19

Section 2 Features of the Ocean Floor

Deep-Ocean Basins, *continued*

Abyssal Plains

abyssal plain a large, flat, almost level area of the deep-ocean basin

- Abyssal plains cover about half of the deep-ocean basins and are the flattest regions on Earth.
- Layers of fine sediment cover the abyssal plains.
- The thickness of sediments on the abyssal plains is determined by three factors.



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Chapter 19

Section 2 Features of the Ocean Floor

Deep-Ocean Basins, *continued*

Mid-Ocean Ridges

- The most prominent features of ocean basins are the *mid-ocean ridges*, which form underwater mountain ranges that run along the floors of all oceans.
- Mid-ocean ridges rise above sea level in only a few places, such as in Iceland.
- Fault-bound blocks of crust that form parallel to the ridges as the lithosphere cools and contracts are called *abyssal hills*.



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Chapter 19 Section 2 Features of the Ocean Floor

Deep-Ocean Basins, *continued*

Mid-Ocean Ridges, *continued*

- As ridges adjust to changes in the direction of plate motions, they break into segments that are bounded by faults.
- These faults create areas of rough topography called *fracture zones*, which run perpendicular across the ridge.



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Chapter 19 Section 2 Features of the Ocean Floor

Deep-Ocean Basins, *continued*

Seamounts

- Submerged volcanic mountains that are taller than 1 km are called *seamounts*. Seamounts form in areas of increased volcanic activity called *hot spots*.
- Seamounts that rise above the ocean surface form oceanic islands.
- As tectonic plate movements carry islands away from a hot spot, the islands sink and are eroded by waves to form flat-topped, submerged seamounts called *guyots* or *tablemounts*.

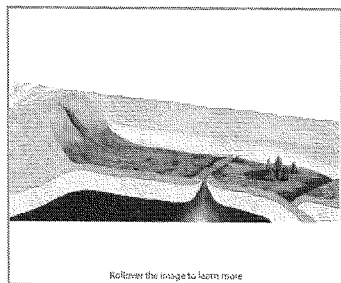


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Chapter 19 Section 2 Features of the Ocean Floor

The Ocean Floor



Roll over the image to learn more.



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Chapter 19 Section 3 Ocean-Floor Sediments

Objectives

- **Describe** the formation of ocean-floor sediments.
- **Explain** how ocean-floor sediments are classified by their physical composition.



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Chapter 19 Section 3 Ocean-Floor Sediments

Ocean-Floor Sediments

- The composition of ocean sediments varies and depends on which part of the ocean floor the sediments form in.
- Coarse gravel and sand are usually found close to shore because these heavier sediments do not move easily offshore.
- Lighter particles are suspended in ocean water and are usually deposited at a great distance from shore.



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Chapter 19 Section 3 Ocean-Floor Sediments

Sources of Deep Ocean-Basin Sediments

- core sample** a cylindrical piece of sediment, rock, soil, snow, or ice that is collected by drilling
- The study of sediment samples show that most of the sediments in the deep-ocean basins are made of materials that settle slowly from the ocean water above.
 - These materials may come from organic or inorganic sources.



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Chapter 19 Section 3 Ocean-Floor Sediments

Sources of Deep Ocean-Basin Sediments, *continued*

Inorganic Sediments

- Some ocean-basin sediments are rock particles that were carried from land by rivers.
- Other deep ocean-basin sediments consist of fine particles of rock, including volcanic dust, that have been blown great distances out to sea by the wind.
- Icebergs also provide sediments that can end up on the ocean basins. Even meteorites contribute to deep ocean-basin sediments.



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Chapter 19 Section 3 Ocean-Floor Sediments

Sources of Deep Ocean-Basin Sediments, *continued*

Biogenic Sediments

- The word *biogenic* comes from the Latin words *bios*, which means "life," and *genus*, which means "origin."
- Biogenic sediments are the remains of marine plants and animals. The two most common compounds found in organic sediments are silica, SiO_2 , and calcium carbonate, CaCO_3 .



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Chapter 19 Section 3 Ocean-Floor Sediments

Sources of Deep Ocean-Basin Sediments, *continued*

Chemical Deposits

nodule a lump of minerals that is made of oxides of manganese, iron, copper, or nickel and that is found in scattered groups on the ocean floor

- When chemical reactions take place in the ocean, solid materials can form.
- When substances that are dissolved in ocean water crystallize, these materials settle to the ocean floor as potato-shaped lumps of minerals called nodules.



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Chapter 19 Section 3 Ocean-Floor Sediments

Reading Check

How do nodules form?



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Chapter 19 Section 3 Ocean-Floor Sediments

Reading Check

How do nodules form?

When chemical reactions take place in the ocean, dissolved substances can crystallize to form nodules that settle to the ocean floor.



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Chapter 19 Section 3 Ocean-Floor Sediments

Physical Classification of Sediments

- Based on physical characteristics, deep ocean-floor sediments are classified as mud or as ooze.
- *Muds* are very fine silt- and clay-sized particles of rock.
- *Calcareous ooze* is ooze that is made mostly of calcium carbonate.
- *Siliceous ooze*, which can be found at any depth, is made of mostly silicon dioxide, which comes from the shells of radiolarians and diatoms.



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Chapter 19 The Ocean Basins

Brain Food Video Quiz



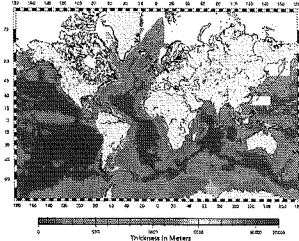
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Chapter 19 Maps in Action

Maps in Action

Total Sediment Thickness of Earth's Oceans



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Chapter 19 Standardized Test Prep

Multiple Choice

1. The global ocean is divided into which of the following oceans, in order of decreasing size?

A. Atlantic, Pacific, Arctic, Indian
B. Arctic, Indian, Atlantic, Pacific
C. Pacific, Arctic, Indian, Atlantic
D. Pacific, Atlantic, Indian, Arctic

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Chapter 19 Standardized Test Prep

Multiple Choice

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D. Pacific, Atlantic, Indian, Arctic

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Chapter 19 Standardized Test Prep

Multiple Choice, *continued*

2. What is the name for a vast, flat area of a deep-ocean basin?

F. trench
G. seamount
H. abyssal plain
I. mid-ocean ridge

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Chapter 19 Standardized Test Prep

Multiple Choice, *continued*

2. What is the name for a vast, flat area of a deep-ocean basin?

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Chapter 19 Standardized Test Prep

Multiple Choice, *continued*

3. What are very fine, silt- and clay-sized particles of rock found on the ocean floor called?
- A. muds
 - B. calcareous ooze
 - C. siliceous ooze
 - D. sand

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Chapter 19 Standardized Test Prep

Multiple Choice, *continued*

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Multiple Choice, *continued*

4. The study of deep-ocean sediment samples show that
- F. most of the sediments came from the crust.
 - G. most of the sediments settled from above.
 - H. sediments cannot be organic.
 - I. sediments cannot be inorganic.

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Chapter 19 Standardized Test Prep

Multiple Choice, *continued*

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Multiple Choice, *continued*

5. Which of the following affects the ocean's salinity?
- A. number of fish
 - B. wave size
 - C. evaporation
 - D. wave speed

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Multiple Choice, *continued*

5. Which of the following affects the ocean's salinity?
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Short Response, *continued*

6. The surface area of Earth is about 511,000,000 km². About 70% of the Earth's surface is covered by water and the Pacific Ocean makes up 50% of this amount. Calculate the surface area of Earth that is covered by the Pacific Ocean.

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Short Response, *continued*

6. The surface area of Earth is about 511,000,000 km². About 70% of the Earth's surface is covered by water and the Pacific Ocean makes up 50% of this amount. Calculate the surface area of Earth that is covered by the Pacific Ocean.

178,850,000 km²

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Chapter 19 Standardized Test Prep

Short Response, *continued*

7. What is the name of the process used to remove salt from seawater?

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Chapter 19 Standardized Test Prep

Short Response, *continued*

7. What is the name of the process used to remove salt from seawater?

desalination

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Chapter 19 Standardized Test Prep

Reading Skills

Read the passage below. Then, answer questions 8–10.

Life on a Continental Shelf

While fish, mammals, and other forms of life can be found throughout these ocean waters, most life in the ocean is concentrated near the continental shores. The shallow waters of the continental shelf, which make up less than 10% of the ocean's total surface area, are home to an amazing array of plants, animals, and microscopic organisms.

Organisms such as coral and seaweed can grow on the ocean floor and still receive much needed sunlight that cannot penetrate deeper waters. The sunlight also makes the shallow waters much warmer than deeper abyssal waters. Algae flourishes in these warm, nutrient-rich waters and serves as food for many small ocean organisms. These organisms are in turn eaten by larger organisms. Even humans have become part of the food chain on the shelf. The vast majority of fish caught for human consumption are caught in waters above a continental shelf.

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Chapter 19 Standardized Test Prep

Reading Skills, *continued*

8. Which of the following statements about why humans catch so many fish in the waters over a continental shelf can be inferred from the information in the passage?

- A. There are no fish in deeper waters.
- B. Fish from deeper waters are inedible.
- C. Humans do not have the technological ability to catch fish in deeper ocean waters.
- D. There are larger more varied fish populations over a continental shelf.

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Chapter 19 Standardized Test Prep

Reading Skills, *continued*

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Reading Skills, *continued*

9. Coral reefs stop actively growing at depths of about 70 m. According to the passage, why might this be true?
- F. Coral feed on algae in shallow waters.
 - G. Coral need sunlight to live, and sunlight can penetrate water only to a certain depth.
 - H. Coral need warmth, and the deeper ocean waters are too cold for them to survive.
 - I. Coral at greater depths are eaten by fish.

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Reading Skills, *continued*

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Reading Skills, *continued*

10. Why might the waters of a continental shelf have more nutrients than abyssal waters?

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Chapter 19 Standardized Test Prep

Reading Skills, *continued*

10. Why might the waters of a continental shelf have more nutrients than abyssal waters?

Continental shelf waters have many benefits over deeper ocean waters. The sun makes waters of the shelf rich in plant life. The proximity to land constantly cycles new nutrients into the system by land and river runoff. Upwelling also brings nutrients up from the deeper waters.

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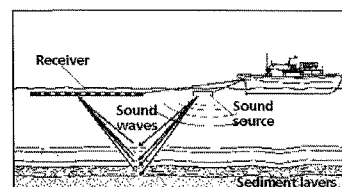
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Interpreting Graphics

Use the figure below to answer question 11. The image shows how sonar equipment works.

Studying the Ocean Floor with Sonar



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Chapter 19 Standardized Test Prep

Interpreting Graphics, *continued*

11. Which of the following best summarizes how sound waves are used?
- A. A sound source dragged behind the boat emits waves that penetrate the different layers of the sea floor and bounce back to the receiver.
 - B. A sound source in front of the boat emits waves that penetrate the different layers of the sea floor and then bounce back to the receiver.
 - C. A receiver dragged behind the boat emits waves that penetrate the different layers of the sea floor and then bounce back to the receiver.
 - D. A receiver in front of the boat emits waves that penetrate the different layers of the sea floor and the bounce back to the receiver.

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Interpreting Graphics, *continued*

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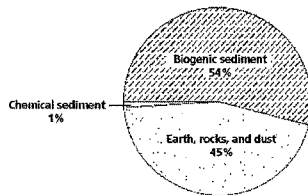
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Chapter 19 Standardized Test Prep

Interpreting Graphics, *continued*

Use the graph below to answer questions 12-13. The graph shows the composition of ocean-floor sediments.

Composition of Ocean-Floor Sediments



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Chapter 19 Standardized Test Prep

Interpreting Graphics, *continued*

12. Why is there such a large difference between the percentage of biogenic sediment and the percentage of chemical sediment?

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Interpreting Graphics, *continued*

12. Why is there such a large difference between the percentage of biogenic sediment and the percentage of chemical sediment?

Answers should include: biologic productivity in the oceans far outstrips the inorganic chemical reactions taking place in the oceans; biologic organisms are also able to reproduce and thus provide a continuous source of sediment as the organisms die; biogenic sediment is found mostly in the form of animal remains.

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Chapter 19 Standardized Test Prep

Interpreting Graphics, *continued*

13. How did the inorganic materials in the two kinds of inorganic sediment shown on the pie graph above form and become part of the ocean floor?

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Interpreting Graphics, *continued*

13. How did the inorganic materials in the two kinds of inorganic sediment shown on the pie graph above form and become part of the ocean floor?

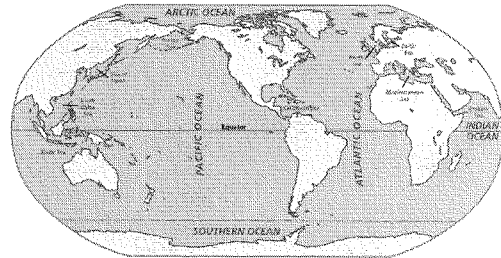
Chemical sediment precipitated from the sea water; rocks and dust formed on land and were carried to the ocean by erosion.

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Chapter 19

The Global Ocean

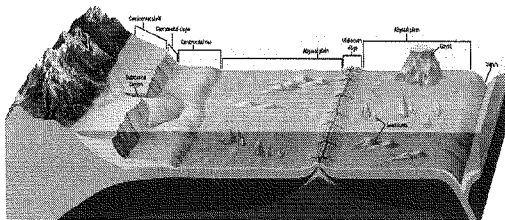


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Chapter 19

Features of the Ocean Floor

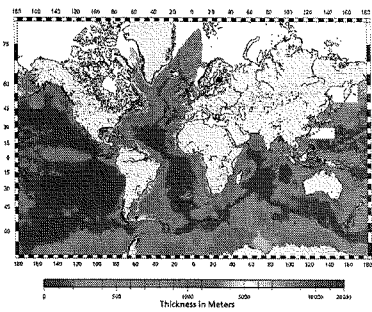


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Chapter 19

Total Sediment Thickness of the Earth's Oceans



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Vocab for snow day packet

Global ocean- the body of salt water that covers nearly three-fourths of Earth's surface

Sea- a large commonly saline body of water that is smaller than an ocean and that may be partially or completely surrounded by land.

Oceanography- the scientific study of the ocean, including the properties and movement of ocean water, the characteristics of the ocean floor, and the organisms that live in the ocean.

Sonar- sound navigation and ranging, a system that uses acoustic signals and returned echoes to determine the location of objects or to communicate

Continental margin- the shallow sea floor that is located between the shoreline and the deep-ocean bottom

Deep-ocean basin- the part of the ocean floor that is under deep water beyond the continental margin and that is composed of oceanic crust and a thin layer of sediment

Trench- a long narrow and steep depression that forms on the ocean floor as a result of subduction of a tectonic plate, that runs parallel to the trend of a chain of volcanic islands or the coastline of a continent.

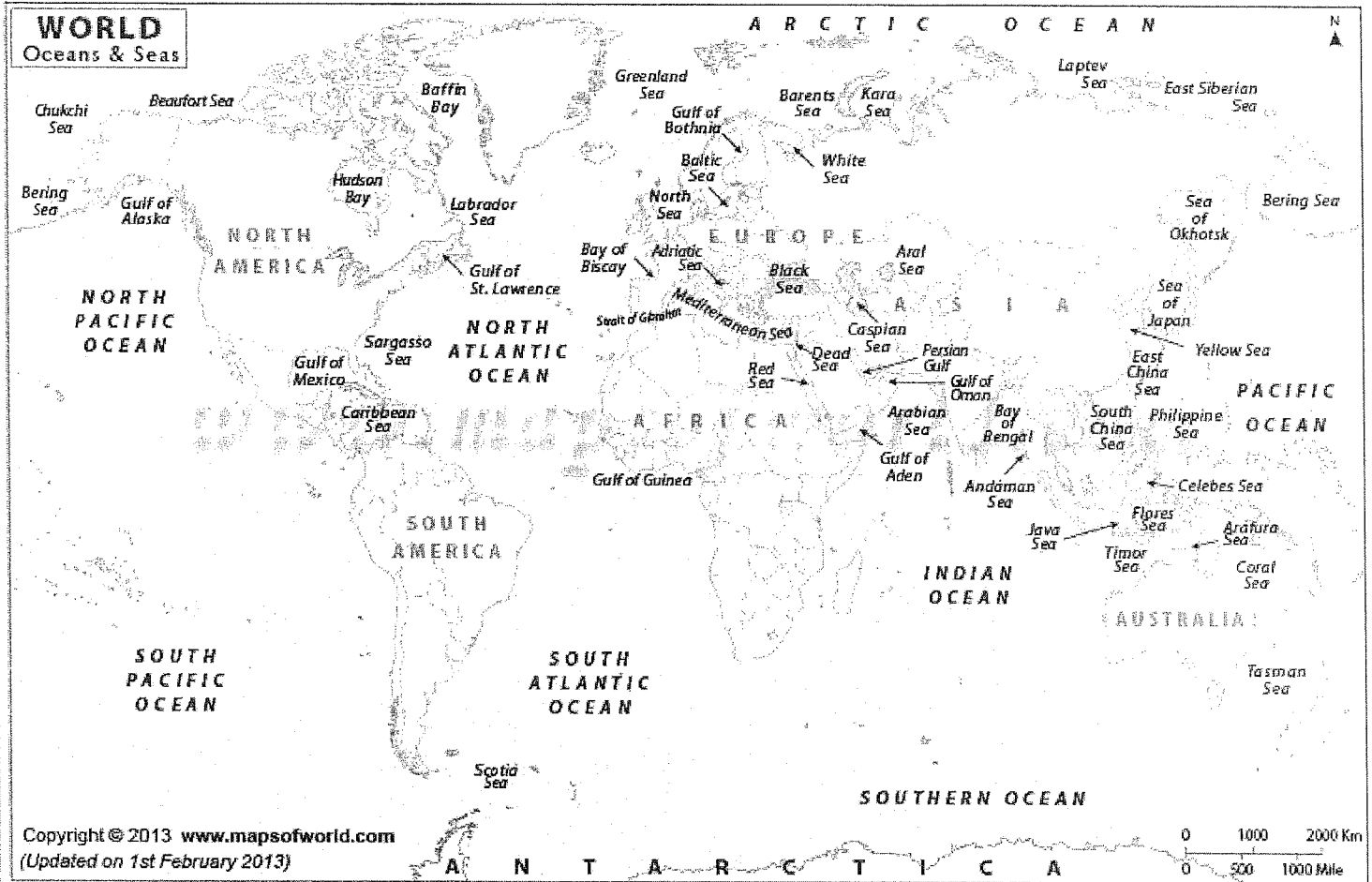
Abyssal plain- a large flat almost level area of deep-ocean basin

Core sample- a cylindrical piece of sediment rock soil snow or ice that is collected by drilling

Nodule- a lump of minerals that is made of oxides of manganese, iron, copper, or nickel and that is found in scattered groups on the ocean floor.

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Skills Worksheet

Directed Reading**Section: The Water Planet**

- _____ 1. The body of salt water covering nearly three-quarters of the Earth's surface is called the
- Earth's ocean.
 - Pacific Ocean.
 - salt-water ocean.
 - global ocean.
- _____ 2. How many of the known planets have a covering of liquid water similar to that of Earth?
- one
 - three
 - all
 - none
- _____ 3. Why is Earth called the water planet?
- Earth is three-quarters water.
 - Earth is the largest planet that has water.
 - No other known planet has water.
 - The global ocean is 1/4,000 of Earth's mass.
- _____ 4. What percentage of water on Earth does the global ocean contain?
- 50%
 - 85%
 - 97%
 - 100%
- _____ 5. The most prominent feature on Earth is
- the Pacific Ocean.
 - the continent of Asia.
 - the continental land mass.
 - the global ocean.
- _____ 6. The global ocean is about 1/800 of Earth's total
- mass.
 - volume.
 - surface area.
 - water area.

Directed Reading *continued*

DIVISIONS OF THE GLOBAL OCEAN

- _____ 7. How many major oceans form the global ocean?
- a. seven
 - b. five
 - c. three
 - d. one
- _____ 8. The major oceans include the Atlantic, Pacific, Indian, Arctic and
- a. Eastern oceans.
 - b. Western oceans.
 - c. Northern oceans.
 - d. Southern oceans.
- _____ 9. The largest ocean on Earth's surface is the
- a. Atlantic Ocean.
 - b. Pacific Ocean.
 - c. Indian Ocean.
 - d. Southern Ocean.
- _____ 10. Earth's deepest ocean is the
- a. Atlantic Ocean.
 - b. Pacific Ocean.
 - c. Indian Ocean.
 - d. Southern Ocean.
- _____ 11. The ocean that contains more than one-half the ocean water on Earth is the
- a. Atlantic Ocean.
 - b. Pacific Ocean.
 - c. Indian Ocean.
 - d. Southern Ocean.
- _____ 12. The second-largest ocean on Earth's surface is the
- a. Atlantic Ocean.
 - b. Pacific Ocean.
 - c. Indian Ocean.
 - d. Southern Ocean.
- _____ 13. The average depth of the Atlantic Ocean is
- a. 4.3 km.
 - b. 3.9 km.
 - c. 2.7 km.
 - d. 1.9 km.

Skills Worksheet

Critical Thinking**ANALOGIES**

In the space provided, write the letter of the pair of terms or phrases that best complete the analogy shown. An analogy is a relationship between two pairs of words or phrases written as $a:b::c:d$. The symbol $:$ is read *is to*, and the symbol $::$ is read *as*.

- | | |
|---|--|
| <p>_____ 1. mid-ocean ridge : ocean basin ::
 a. prairie : mountain
 b. mountain : land
 c. volcano : continent
 d. canyon : mountain</p> | <p>_____ 6. turbidity current : continental slope ::
 a. earthquake : Earth
 b. storm : weather
 c. landslide : mountain
 d. whirlpool : river</p> |
| <p>_____ 2. oceanography : ocean ::
 a. astronaut : space
 b. telescope : star
 c. computer : map
 d. mathematics : numbers</p> | <p>_____ 7. diatom : radiolarian ::
 a. milk : cow
 b. ant : beetle
 c. plant : animal
 d. square : round</p> |
| <p>_____ 3. red clay : mud ::
 a. sand : water
 b. rain : lake
 c. grass : hay
 d. rose : flower</p> | <p>_____ 8. mineral : nodule ::
 a. water : raindrop
 b. oak : tree
 c. tornado : funnel
 d. coin : money</p> |
| <p>_____ 4. submersible : oceanography ::
 a. hammer : carpenter
 b. spaceship : astronomy
 c. submarine : navy
 d. tractor : agriculture</p> | <p>_____ 9. Mariana Trench : ocean ::
 a. Nile River : continent
 b. island : lake
 c. Grand Canyon : land
 d. Florida : North America</p> |
| <p>_____ 5. biogenic : inorganic ::
 a. organism : mineral
 b. huge : large
 c. person : plant
 d. rock : sediment</p> | <p>_____ 10. iceberg : ocean-basin sediment ::
 a. snow : crystal
 b. rock : gold
 c. seed : plant
 d. wind : dust</p> |

Critical Thinking *continued*

INTERPRETING OBSERVATIONS

Read the following passage, and answer the questions below.

A subduction zone called the Ring of Fire surrounds the basin of the Pacific Ocean. It stretches from east of the coast of Australia up along the eastern coast of Asia. It follows the Alaskan coastline and then heads south along the western coasts of North and South America.

The movement of the Nazca Plate indicates what happens all along the Ring of Fire. The Nazca Plate is the tectonic plate in the ocean off the west coast of South America. This heavy plate is subducting beneath the lighter continental plate next to it, the South American plate. As the plates collide, they cut into Earth's mantle, melting the edge of the Nazca Plate.

- 11.** What deep-ocean feature would you expect to find along the edge of the Nazca Plate and the South American Plate? Explain your answer.

- 12.** What event most likely occurs due to the subduction of the Nazca Plate?

- 13.** The Andes Mountains stretch all along the western coast of South America. What process most likely caused the formation of these mountains? Explain your answer.

- 14.** The Ring of Fire includes many island chains. What deep-ocean features would you expect to find along the chain?

Critical Thinking *continued*

AGREE OR DISAGREE

Agree or disagree with the following statements, and support your answers.

15. A bathysphere is the most effective form of submersible.

16. The composition of deep-ocean sediments is very similar to that of minerals found in the interior of continents.

17. Scientists can learn little about the land on Earth by studying its oceans.

18. There is little left to learn about the characteristics of the ocean floor and ocean organisms.

Critical Thinking *continued*

REFINING CONCEPTS

The statements below challenge you to refine your understanding of concepts covered in the chapter. Think carefully, and answer the questions that follow.

19. Is erosion a significant force in shaping the ocean floor? Explain your answer.

20. Which feature of the ocean floor are people most familiar with? What are some ways people utilize this feature? What are some ways in which people may damage this feature?

21. Suppose you studied the features on the floor of the Mediterranean Sea. How similar to or different from the ocean floor would you expect it to be? What similarities and differences would you expect to find? Explain your answer.

Skills Worksheet

Directed Reading

Section: Features of the Ocean Floor

- _____ 1. How many major areas does the ocean floor have?
 - a. one
 - b. two
 - c. three
 - d. four

- _____ 2. The shallow sea floor between the shoreline and the deep-ocean bottom is called the
 - a. continental margin.
 - b. deep-ocean basin.
 - c. continental crust.
 - d. oceanic crust.

- _____ 3. Continental margins are made up of continental crust
 - a. and a thin sediment layer.
 - b. and a thick wedge of sediment.
 - c. without a sedimentary layer.
 - d. or a sedimentary layer.

- _____ 4. The part of the ocean floor under deep water beyond the continental margin is called the
 - a. continental margin.
 - b. deep-ocean basin.
 - c. continental crust.
 - d. oceanic crust.

- _____ 5. The deep-ocean basin is made up of oceanic crust
 - a. and a thin sediment layer.
 - b. and a thick wedge of sediment.
 - c. without a sedimentary layer.
 - d. or a sedimentary layer.

CONTINENTAL MARGINS

- _____ 6. The line that divides the continental crust from the oceanic crust is
 - a. distinct.
 - b. on the surface.
 - c. under thick sediments.
 - d. at the shoreline.

Directed Reading *continued*

- _____ 7. The part of the continent covered by water is called the
a. shoreline.
b. continental margin.
c. continental shelf.
d. deep-ocean basin.
- _____ 8. The continental shelf slopes gently from the shoreline, and drops about 0.12 m every
a. 10 m.
b. 100 m.
c. 1,000 m.
d. 10,000 m.
- _____ 9. the average depth of the water covering a continental shelf is about
a. 6 m.
b. 60 m.
c. 160 m.
d. 600 m.
- _____ 10. The continental shelf is part of the
a. continental margin.
b. deep-ocean basin.
c. ocean surface.
d. oceanic crust.
- _____ 11. During glacial periods
a. sea level rises.
b. sea level falls.
c. sea level is unchanged.
d. continental shelves rise.
- _____ 12. More continental shelf is exposed to weathering and erosion
a. when ice sheets melt and sea level rises.
b. during glacial periods when ice sheets hold water.
c. at the beginning of glacial periods when ice begins to freeze.
d. at the end of glacial periods when ice begins to melt.
- _____ 13. The steep slope at the seaward edge of a continental shelf is called the
a. continental rise.
b. continental slope.
c. oceanic slope.
d. oceanic rise.

Skills Worksheet

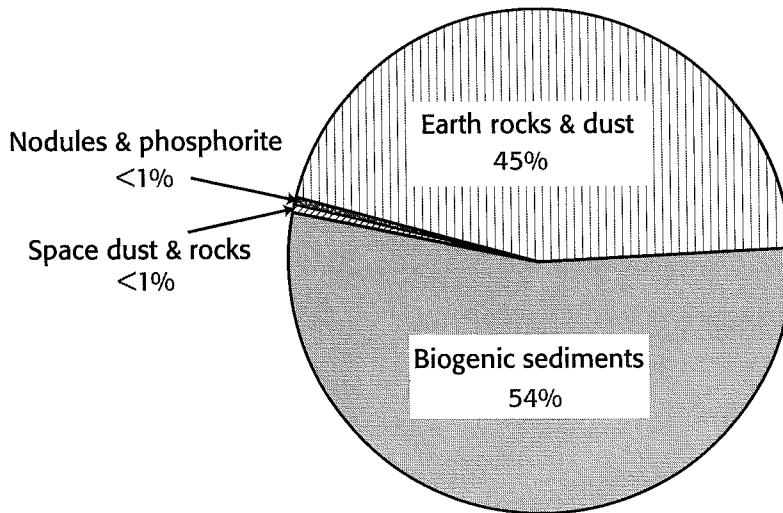
Graphing Skills

Pie Graphs

A pie graph shows how several parts make up the whole. Pie graphs are often created to show data consisting of percentages. For example, you could create a pie graph to show the percentage of each kind of sediment that is present in ocean-floor sediments as a whole.

To make a pie graph, draw a circle to represent the whole, or total. Divide the circle into 100 equal sections of 3.6° each. Or you can use a protractor to measure the number of degrees that are represented by a percentage of the circle. For example, 40% would be equal to $40 \times 3.6^\circ$, or 144° . Mark a section of the circle to represent each percentage. Then use different colors or designs to shade in each portion of the circle.

Composition of Ocean-Floor Sediments



PRACTICE

Use the pie graph above to answer the following questions.

1. Which kind of sediment makes up the largest portion of ocean-floor sediments? What percentage of the total is it?

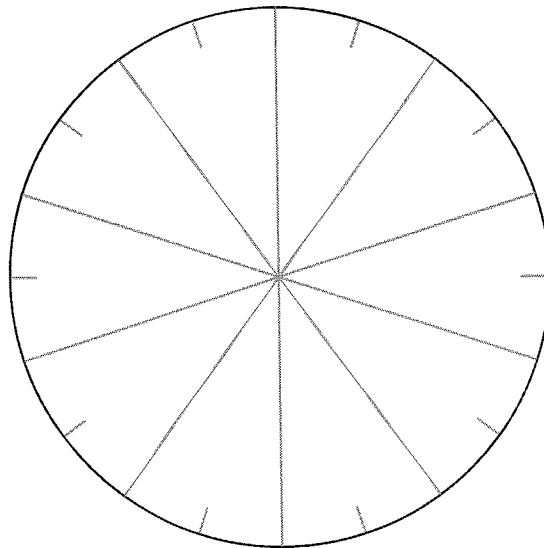
2. Biogenic sediments and Earth rocks and dust together make up what percentage of total ocean-floor sediments?

Graphing Skills *continued*

3. If different types of sediments were evenly dispersed on the ocean floor, how many kilograms of space dust and rocks would you expect to find in a 100 kg sample?

4. The table below shows the approximate surface area of the five major oceans. Use this information to make a pie graph in the circle provided below. Make sure your pie graph has a title.

Ocean	Surface Area
Pacific	156 million km ²
Atlantic	77 million km ²
Indian	69 million km ²
Southern	20 million km ²
Arctic	14 million km ²



Assessment

Section Quiz

Section: Ocean-Floor Sediments

MATCHING

In the space provided, write the letter of the description that best matches the term or phrase.

- | | |
|----------------------------|---|
| _____ 1. nodule | a. remains of marine plants and animals |
| _____ 2. mud | b. fine silt- and clay-sized rock particles |
| _____ 3. calcareous ooze | c. potato-shaped lump of minerals |
| _____ 4. siliceous ooze | d. fine sediment made mostly of silicon dioxide |
| _____ 5. biogenic sediment | e. fine sediment made mostly of calcium carbonate |

MULTIPLE CHOICE

In the space provided, write the letter of the answer choice that best completes each statement or best answers each question.

- | | |
|--|--|
| _____ 6. A piece of sediment collected by drilling is a(n)
a. inorganic sediment.
b. biogenic sediment.
c. core sample.
d. diatom. | _____ 9. The silica in biogenic sediments comes mainly from
a. diatoms and radiolarians.
b. foraminiferans.
c. nodules.
d. calcium carbonate. |
| _____ 7. Meteorite dust is one kind of
a. nodule.
b. inorganic sediment.
c. ooze.
d. core sample. | _____ 10. Most siliceous ooze is found near Antarctica because
a. red clay is common there.
b. the ocean waters contain large amounts of diatoms and radiolarians.
c. silicon dioxide dissolves in cold water.
d. there are many foraminiferans there. |
| _____ 8. Sediments from rivers spread over the deep-ocean basins by means of
a. icebergs.
b. chemical reactions.
c. wind.
d. turbidity currents. | |

Day 9

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Ocean-Floor Sediments

- _____ 1. Continental shelves and slopes are covered with
- a. sediments.
 - b. turbidity currents.
 - c. silica.
 - d. petroleum.
- _____ 2. Ocean sediments are composed of
- a. the same materials no matter which part of the ocean the sediments form in.
 - b. only coarse gravel and sand carried into the water by wind and currents.
 - c. only light particles that have been suspended in ocean water.
 - d. various materials depending on which part of the ocean the sediments form in.
- _____ 3. Sediments in the ocean are well sorted by
- a. shape.
 - b. texture.
 - c. age.
 - d. size.

4. Name three ways sediments get into the ocean.

5. The types of sediments found close to shore are usually _____.

6. The types of sediments usually deposited far from shore are _____.

SOURCES OF DEEP OCEAN-BASIN SEDIMENTS

- _____ 7. Compared to sediments found in shallow water, those found in the deep-ocean basin are usually
- a. coarser.
 - b. sandier.
 - c. heavier.
 - d. finer.

Directed Reading *continued*

_____ **8.** Cylinders of sediment that are taken from sediment layers on the ocean floor are called

- a.** gravel.
- b.** *JOIDES*.
- c.** core samples.
- d.** organic sediments.

_____ **9.** Most of the sediment in deep-ocean basins comes from

- a.** the shoreline.
- b.** rivers.
- c.** ocean water above.
- d.** core samples.

10. What are two ways to take sediment samples in deep ocean basins?

11. What is the name of one research vessel used to study ocean floor sediment core samples?

12. What is one type of sediment carried into the ocean basin by land from rivers?

13. In what two places does a river usually deposit a sediment load with rock particles?

14. Besides the shore and the continental shelf, where do large quantities of sediments occasionally end up?

15. Large quantities of sediments sliding from continental slopes to the ocean floor below create _____ currents.

Day 8

Name _____ Class _____ Date _____

Skills Worksheet

Graphing Skills

Pie Graphs and Water Distribution

A pie graph shows how parts of something make up the whole. Pie graphs are frequently created to show data consisting of percentages. The total of all parts, or pieces of the pie, is 100%.

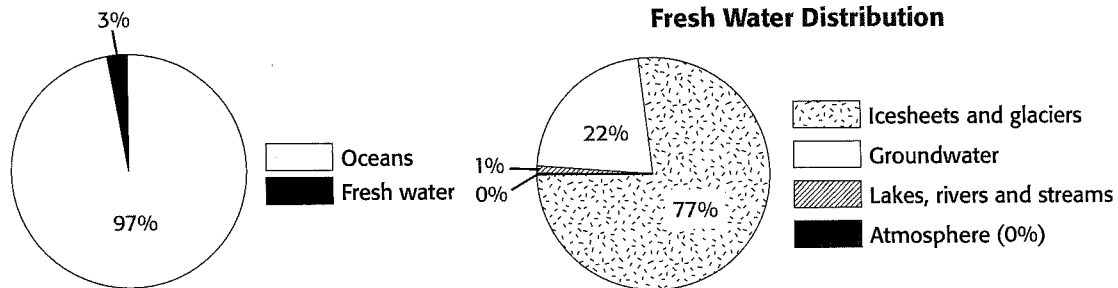
Earth's Total Water Supply	
Oceans	97.2%
Ice sheets and glaciers	2.15%
Groundwater	.625%
Lakes, rivers, streams	.017%
Atmosphere	.001%

To make a pie graph based on the data in the table above, first use a protractor to create a circle. (All circles are 360°, so each 1% of the circle measures 3.6°.) Use the protractor to measure the number of degrees represented in a portion of the circle. For example, ice sheets and glaciers comprise 2.15% of Earth's water supply. That percentage equals $2.15 \times 3.6^\circ$ or 7.74° .

Another way to create a pie graph is to divide the circle into 100 equal portions of 3.6°. Then, shade in the proper number of sections. For a percentage as small as that of total water held in the atmosphere, .001%, use a narrow line on your pie graph.

The pie graphs that follow show the same information as that in the table. Because the data includes values of less than 1%, more than one pie graph has been created. The data has been separated into two categories—ocean water and fresh water.

Now the second graph can magnify those small fractions of percentages in the fresh water category. The fresh water category represents 3% (a rounded figure) of the total water supply. To determine the percentages for the second graph, where 3% equals a whole, multiply each figure in the fresh water group by 3.



Graphing Skills *continued*

PRACTICE

Use the table and graphs to answer the following questions.

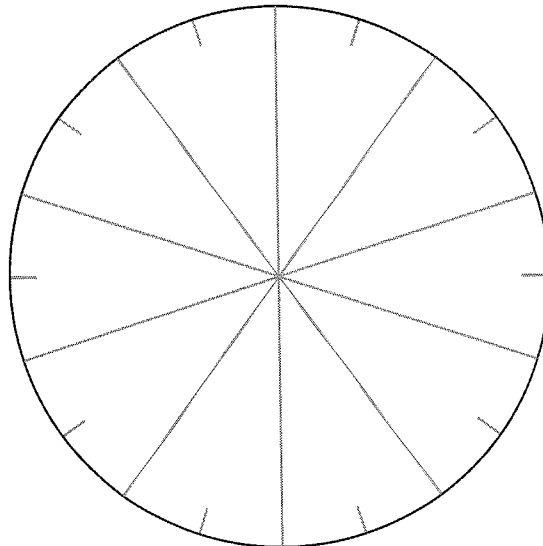
1. Where is most of the water on Earth contained? What percentage of the total is found there?

2. Where is the least amount of water contained? What percentage of the total water supply is found there?

3. Which figure on the graph did you find most surprising? Why?

4. Read the following passage. Then, in the space below, create a pie graph that illustrates the five categories of ocean pollution.

In 1977, the International Maritime Organization (IMO) published a report on the sources and prevention of maritime—or ocean—pollution. This organization determined that 44% of all ocean pollutants are land based (sewage, pesticides, industry by-products, for example). Airborne pollutants account for 33% of ocean pollutants. Maritime transportation (including dumping of ship garbage and accidental oil spills) is responsible for 12% of ocean pollutants. Ten percent of the total can be attributed to dumping (for example, when a barge carries garbage to sea to dump and dispose of it), and the final 1% is attributed to offshore oil production.





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Oceans & Maritime Crossword -- myvocabulary.com

Clues :

ACROSS:

- 1 - A violent tropical cyclone with winds moving at 73 or more MPH, often accompanied by torrential rains (noun)
- 3 - The act, condition or period for blooming (noun)
- 6 - Any surface where an animal or plant grows or is attached (noun)
- 8 - Any individual animal, plant, bacterium, etc. having various parts or systems that function together as a whole to maintain life and its activities (noun)
- 9 - On, near, or living near the sea; of or relating to sea navigation, shipping, etc. (adjective)
- 10 - Tiny plants and animals that live on or near the ocean's surface (noun)
- 13 - Having to do with the area of a seashore between the high-tide mark and the low-tide mark (adjective)
- 14 - The variety of life forms on Earth or in a specific habitat or ecosystem (noun)
- 16 - The middle ocean zone that receives very little sunlight and contains no plants and few animals (noun)
- 18 - Particles of dirt and rock that are carried by water, wind or ice and deposited elsewhere (noun)
- 20 - The process by which living things produce light (noun)
- 21 - To place under or cover with water or the like; to plunge into water (verb)
- 22 - An extended mass of ice formed from snow falling and accumulating over the years and moving very slowly (noun)
- 23 - The part of the river where fresh water mixes with the ocean's salt water (noun)

DOWN:

- 2 - The descending area of land around the edges of each land mass (noun)
- 4 - Having to do with the study of oceans, including their water, biology and geology (adjective)
- 5 - Somewhat salty or briny; distasteful; unpleasant (adjective)
- 7 - A crystalline compound (NaCl) occurring chiefly as a mineral or as a constituent of seawater (noun)
- 11 - A huge wave caused by a great disturbance under the ocean, as a strong earthquake or violent eruption (noun)
- 12 - Strong surface current flowing outward from a shore (noun)
- 15 - Growing or living in or near water (adjective)
- 17 - Of or pertaining to seaman, ships, water or navigation (adjective)
- 19 - A set or arrangement of plants, animals and bacteria interrelated together with its physical and chemical environment (noun)

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Assessment

Chapter Test A**Chapter: The Ocean Basins****MATCHING**

In the space provided, write the letter of the definition that best matches the term or phrase.

- | | |
|-----------------------------|---|
| _____ 1. abyssal plain | a. shallow sea floor between the shoreline and deep-ocean bottom |
| _____ 2. nodule | b. body of water smaller than an ocean |
| _____ 3. sea | c. lump of minerals found on the ocean floor |
| _____ 4. continental margin | d. part of ocean floor made up of oceanic crust and a thin sediment layer |
| _____ 5. core sample | e. long, narrow depression in the deep-ocean basin |
| _____ 6. submarine canyon | f. cylinder of sediment collected by drilling the ocean floor |
| _____ 7. deep-ocean basin | g. flat, almost level area of the deep-ocean basin |
| _____ 8. turbidity current | h. body of salt water that covers nearly three-fourths of Earth's surface |
| _____ 9. global ocean | i. deep valley in the continental shelf or continental slope |
| _____ 10. trench | j. force that spreads sediments over deep-ocean basin |

MULTIPLE CHOICE

In the space provided, write the letter of the answer choice that best completes each statement or best answers each question.

- _____ 11. The deepest and largest ocean on Earth is the
- Atlantic.
 - Pacific.
 - Indian.
 - Southern.
- _____ 12. The soft, fine material that covers about 40% of the ocean floor is
- mud.
 - red clay.
 - ooze.
 - biogenic sediment.

Chapter Test A *continued*

- _____ 13. The voyages of the HMS *Challenger*
- a. provided information about plate tectonics.
 - b. proved there were five oceans.
 - c. provided valuable core samples.
 - d. laid the foundation for oceanography.
- _____ 14. Most river sediments are deposited
- a. on the shore and continental shelf.
 - b. in the deep-ocean basins.
 - c. on abyssal plains.
 - d. on the continental rise.
- _____ 15. Biogenic sediments come from
- a. oxides of minerals.
 - b. marine plants and animals.
 - c. silt and clay.
 - d. glaciers and icebergs.
- _____ 16. The first step in a sonar transmission is to
- a. measure the timing of sound waves.
 - b. make maps and profiles of the ocean floor.
 - c. send out a series of sound waves.
 - d. bounce sound waves off the ocean floor.
- _____ 17. An atoll changes into a guyot because of
- a. volcanic activity.
 - b. wave erosion.
 - c. fracture zones.
 - d. turbidity currents.
- _____ 18. Which is NOT a tool used by scientists to study the deep ocean?
- a. drilling ship
 - b. bathyscaph
 - c. seamount
 - d. sonar
- _____ 19. A continental shelf is part of the
- a. continent.
 - b. abyssal plain.
 - c. deep-ocean basin.
 - d. continental rise.
- _____ 20. The most common compounds in organic sediments are
- a. diatoms and radiolarians.
 - b. foraminiferans.
 - c. silica and calcium carbonate.
 - d. oxides of iron and manganese.