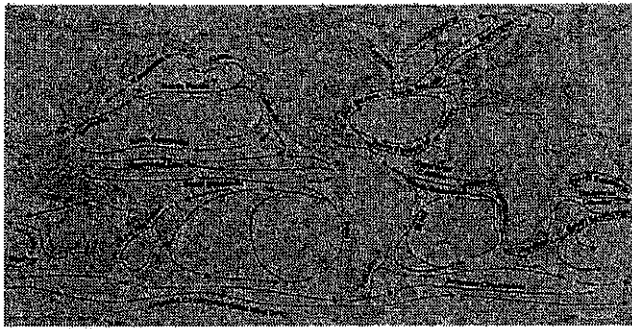


## 13.1 The oceans are a connected system



————— Warm-water current      - - - - - Cold-water current

## I. Ocean water covers much of Earth

\* \_\_\_\_\_ % of Earth is covered by oceans



Satellite Image of Earth from space

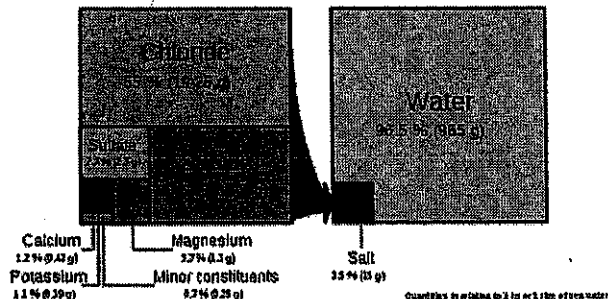


## II. Ocean water contains salts and gases

\* \_\_\_\_\_ is the most plentiful substance dissolved in ocean water.

### Sea salts

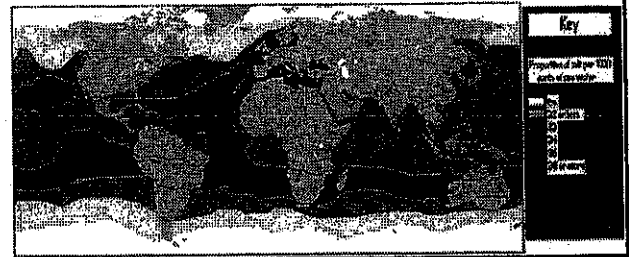
### Sea water



## A. Salts

1. \_\_\_\_\_ - a measure of the amount of dissolved salt contained in water.

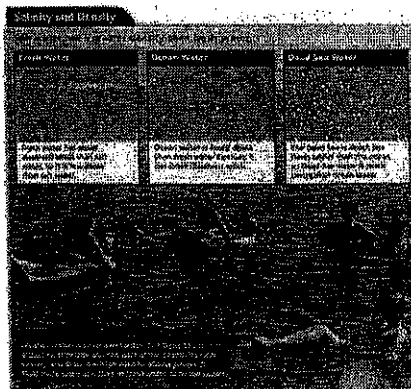
\*Every 1000g of seawater contains an average of \_\_\_\_\_ g of salt. **Salinity of the Oceans**



2. \_\_\_\_\_ - a measure of the amount of matter packed in a given volume

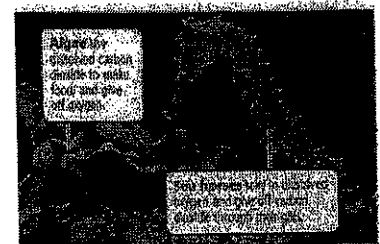
\*Salt water is

\_\_\_\_\_ than freshwater

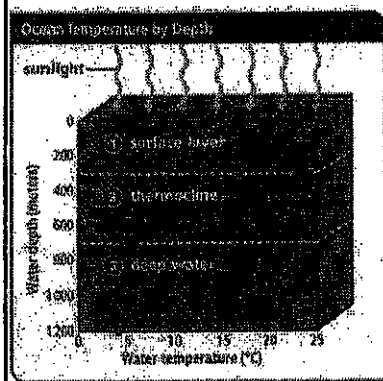


## B. Oxygen & Other Gases

\*Plants and animals exchange oxygen and \_\_\_\_\_ above and below the surface of the water.

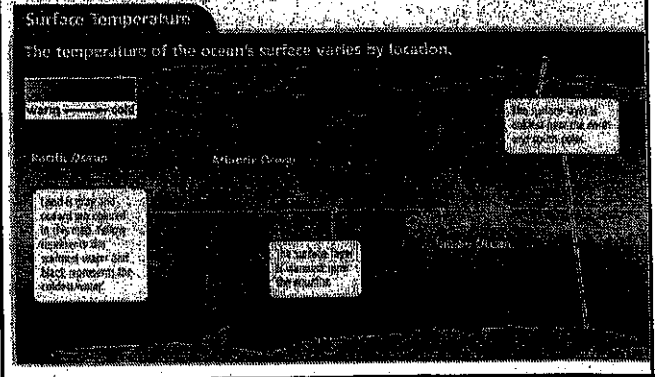


### III. Ocean temperatures vary



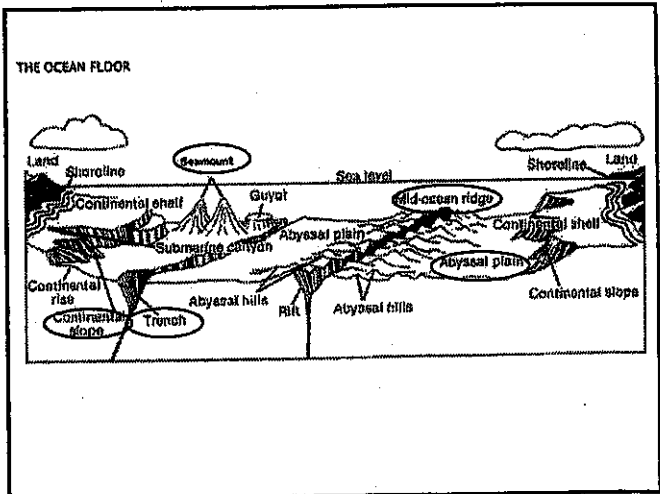
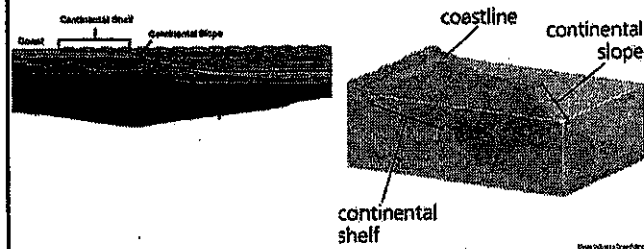
A. Oceanographers divide the ocean into \_\_\_\_ layers based on temperatures.

B. Temperature at the surface varies by \_\_\_\_ and \_\_\_\_.



### IV. The ocean floor has many features

A. \_\_\_\_ - the flat or gently sloping land that lies submerged around the edges of a continent and that extends from the shoreline out to a continental slope.



### B. Ocean Exploration

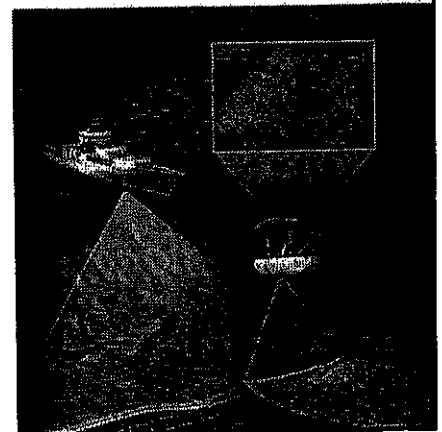
\* \_\_\_\_ increases as you go deeper due to the weight of the water.

\* Scuba equipment, submarines, and ROV's offer views of areas too deep for humans to reach.



### C. Mapping the ocean floor

\* \_\_\_\_ - a system that uses sound waves to measure distances and locate objects.



## SECTION

THE OCEANS ARE A CONNECTED SYSTEM.

**13.1 Reading Study Guide A****BIG IDEA** The oceans are a connected system of water in motion.**KEY CONCEPT** The oceans are a connected system.**Vocabulary****salinity** the amount of salt dissolved in water**density** the amount of matter in a unit of volume**continental shelf** underwater land that slopes down around the edges of a continent**sonar** a technique that uses sound waves to measure distance and locate features on the ocean floor.**Review**

1. If the sentence is true, write *true*. If the sentence is false, replace the underlined term to make the sentence true.

Most water on Earth is fresh water. \_\_\_\_\_

The ocean plays an important role in the water cycle. \_\_\_\_\_

**Take Notes****I. Ocean water covers much of Earth.**

2. When Earth formed, water vapor rose into the atmosphere. When the air cooled, water vapor \_\_\_\_\_.

**II. Ocean water contains salts and gases.**

3. What is salinity?

\_\_\_\_\_

4. Which is denser—water with a lot of salt or water with low salt?

\_\_\_\_\_

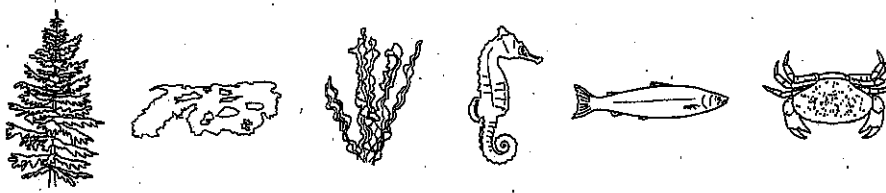
5. What happens to salinity in a warm area with a lot of evaporation?  
What happens to the salinity in an area where rainfall is very high?

\_\_\_\_\_

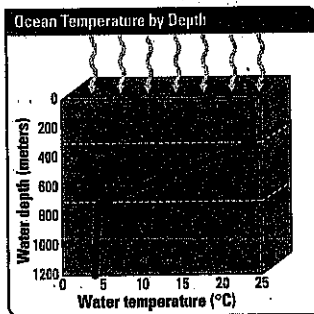
\_\_\_\_\_

**A. Salts and Oxygen and Other Gases**

6. Circle the organisms that take in carbon dioxide and release oxygen.

**III. Ocean temperatures vary.**

7. Label each ocean layer with its name.

**IV. The ocean floor has many features.**

8. Use the picture in your textbook to write one fact about each part of the ocean floor.

a. continental shelf

\_\_\_\_\_

b. submarine canyons

\_\_\_\_\_

c. abyssal plains

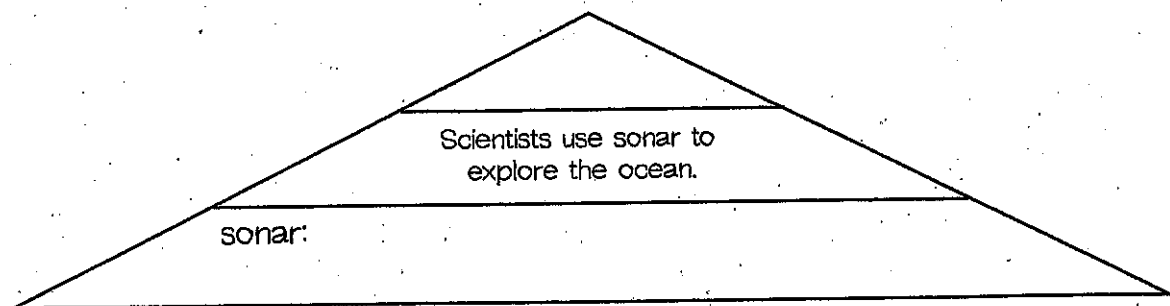
\_\_\_\_\_

d. mid-ocean ridge

\_\_\_\_\_

**A-B. Ocean Exploration and Mapping the Ocean Floor**

9. Fill in the word triangle diagram for *sonar*.



## 13.2 Ocean water moves in currents

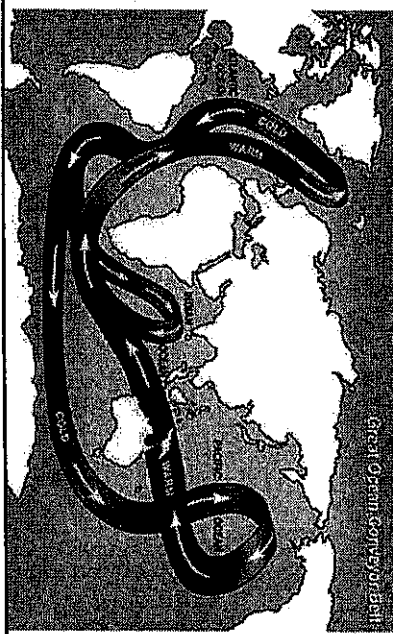


### A. Surface currents



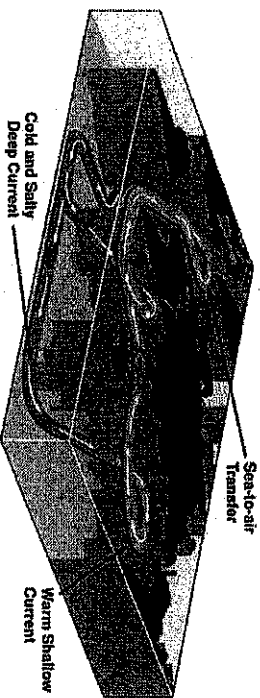
- \* Caused by \_\_\_\_\_ blowing over the ocean set in motion by uneven heating of Earth's surface.
- \* Surface currents carry warm water \_\_\_\_\_ from the equator and cool water \_\_\_\_\_ from poles; creating moderate global temperatures.

- ### I. The oceans have major currents
- \* \_\_\_\_\_ - a mass of moving water.
- These distribute heat and nutrients around the globe.



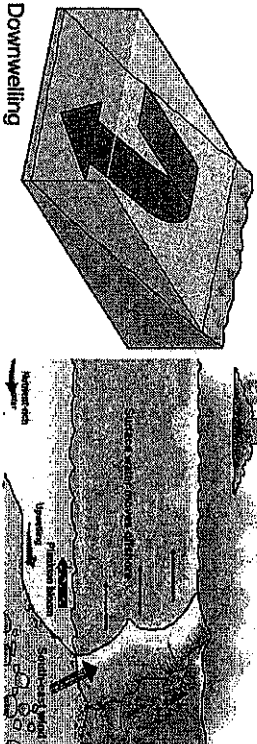
### B. Deep Currents

- \* Driven by differences in \_\_\_\_\_.
- \* Seawater can become more dense because of cooling, an increase in \_\_\_\_\_ or both.
- \* Move from poles to equator.



A. \_\_\_\_\_ - movement of water from the surface to greater depths.  
 \* Oxygen sinks allowing animals to live in deep ocean.

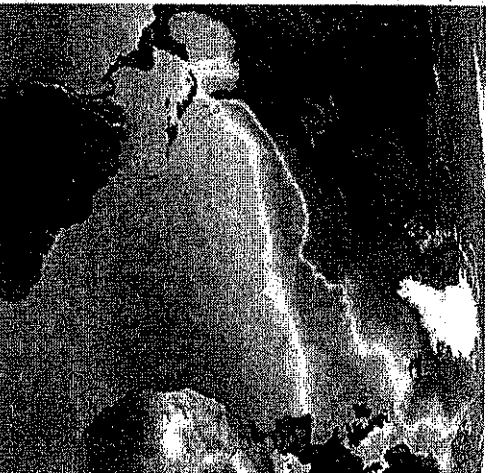
B. \_\_\_\_\_ - the movement of water up to the surface.  
 \* Brings nutrients up from deep ocean.



The diagram illustrates two ocean circulation processes. On the left, 'Downwelling' is shown with a 3D box representing a water column. A large blue arrow points downwards from the surface, indicating the movement of water from the surface to deeper depths. On the right, 'Upwelling' is shown in a cross-section of the ocean. A large blue arrow points upwards from the deep ocean towards the surface. Labels include 'Surface Water', 'Deep Water', 'Upwelling', and 'Downwelling'.

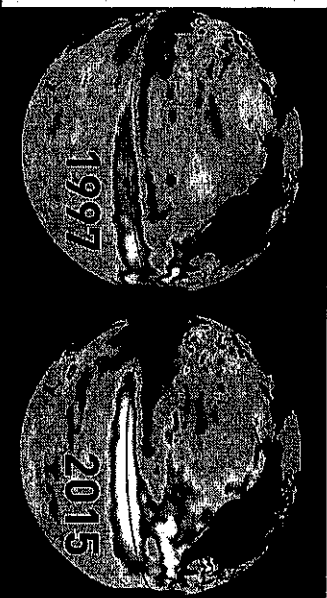
## II. Currents interact with climate and weather

\* \_\_\_\_\_ is a surface current that moves warm water northeast toward Great Britain and Europe.



The map shows the North Atlantic Ocean with a large blue arrow indicating the movement of warm water from the southwest towards the northeast, specifically towards Great Britain and Europe. The arrow is labeled 'Gulf Stream'.

\* \_\_\_\_\_ - A disturbance of wind patterns and ocean currents in the Pacific Ocean that causes temporary climate changes in many parts of the world. (Precipitation and temperatures may be affected—detectable & predictable)



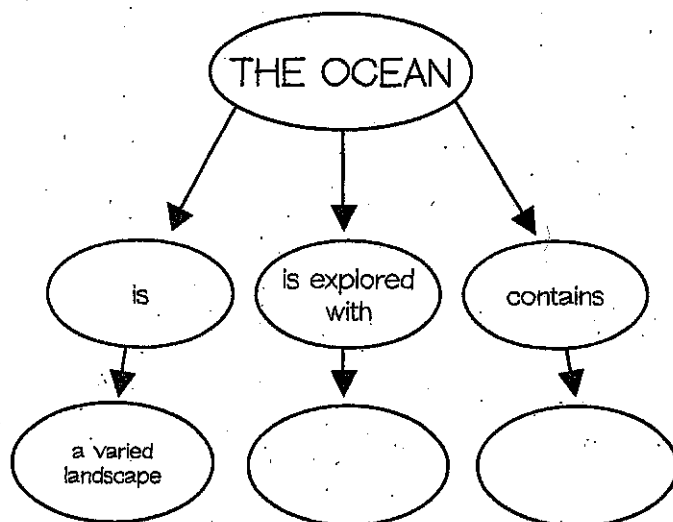
The image shows two satellite images of the Pacific Ocean. The left image is labeled '1997' and shows a large, dark, irregular shape in the central Pacific, representing a disturbance in wind patterns and ocean currents. The right image is labeled '2015' and shows a similar disturbance in the same region.

## SECTION

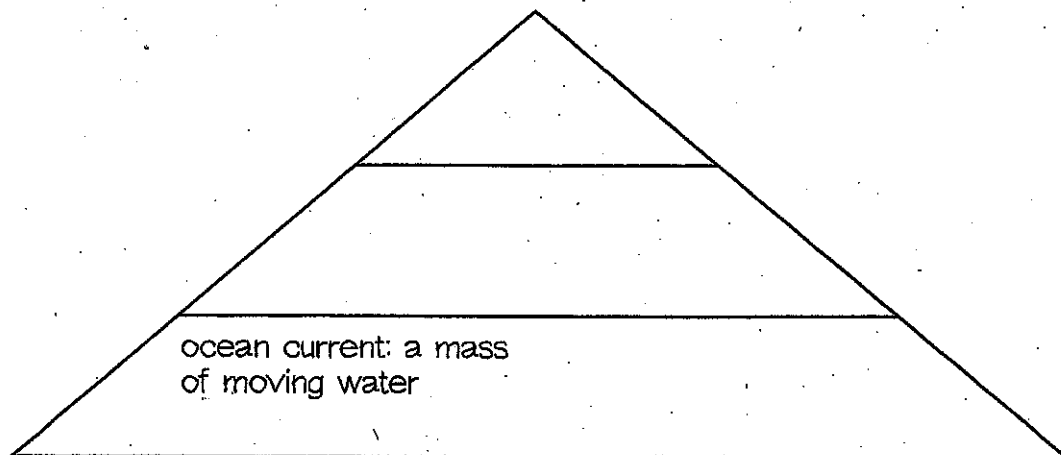
OCEAN WATER MOVES IN CURRENTS.

**13.2 Reading Study Guide A****BIG IDEA** The oceans are a connected system of water in motion.**KEY CONCEPT** Ocean water moves in currents.**Vocabulary****ocean current** a mass of moving water**downwelling** the movement of water from the surface down to lower depths**upwelling** the movement of water up to the surface**El Niño** a global weather event involving many changes in air and water movement**Review**

1. Fill in the concept map for *ocean*.

**Take Notes**

1. The oceans have major currents.
2. Fill in the word triangle for *ocean current*.



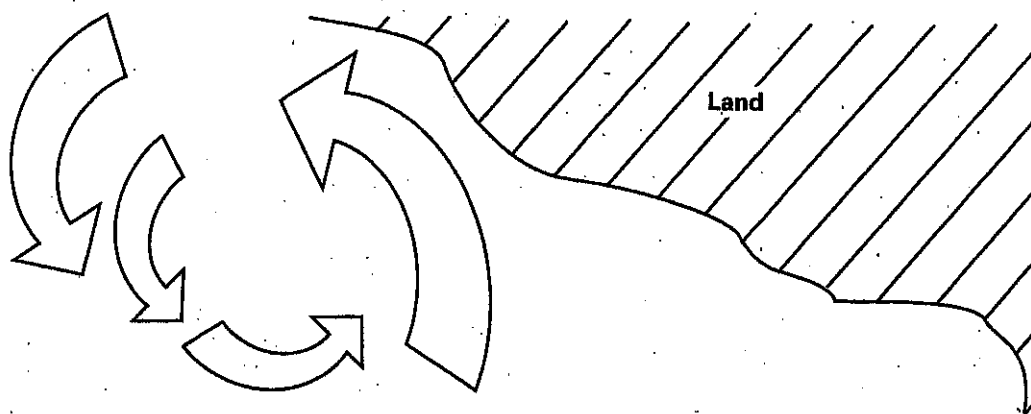
Name \_\_\_\_\_

Period \_\_\_\_\_

Date \_\_\_\_\_

**A. Surface Currents**

3. Is the current shown below moving clockwise or counterclockwise? How does the direction of the current tell you what hemisphere it is probably in?

**B. Deep Currents**

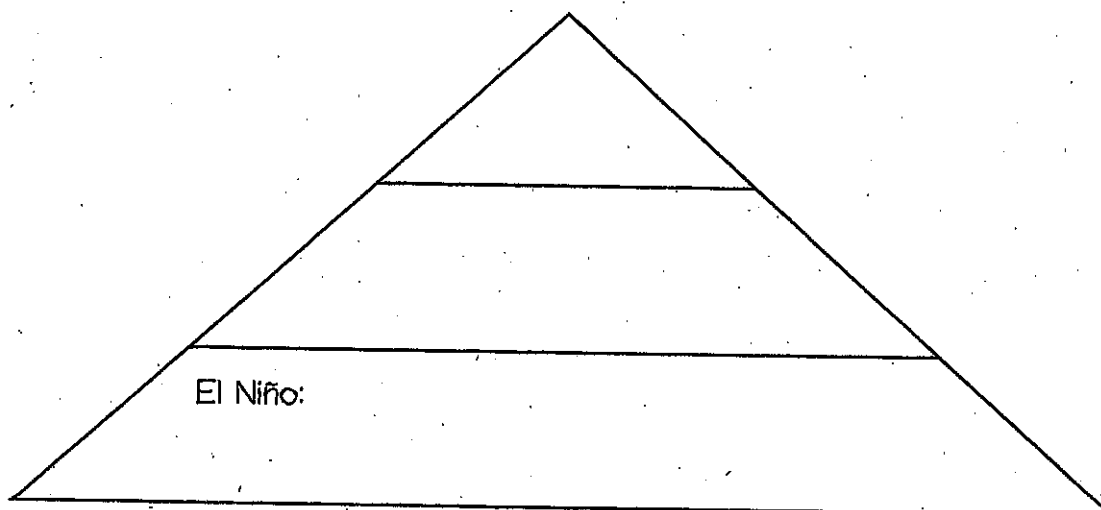
4. Write two facts about upwelling and downwelling in the chart below.

Upwelling	Downwelling
1. _____	1. _____
2. _____	2. _____

**II. Currents interact with climate and weather.**

5. What is one example of how ocean currents affect climate and weather?

6. Fill in the word triangle for *El Niño*.

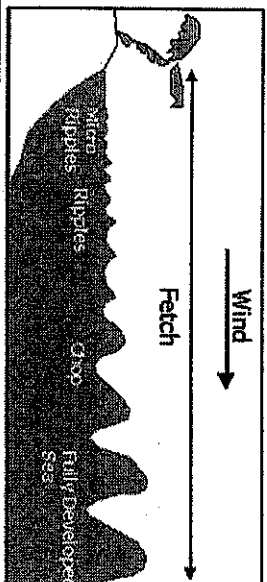




### 13.3 Waves move through oceans

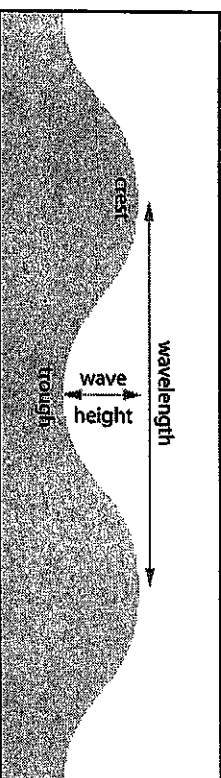
1. Waves form in the open ocean.

- \* Waves are usually caused by \_\_\_\_\_.
- \* Can also be caused by earthquakes, landslides, and underwater volcanic eruptions



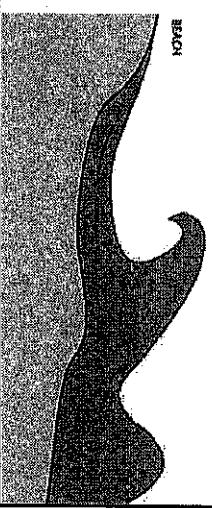
### A. Wave action at the water's surface

- \* \_\_\_\_\_ - high point of a wave
- \* \_\_\_\_\_ - the low point of a wave.
- \* \_\_\_\_\_ - vertical distance between the top of the crest and bottom of trough.
- \* \_\_\_\_\_ - distance between one wave crest and the next.



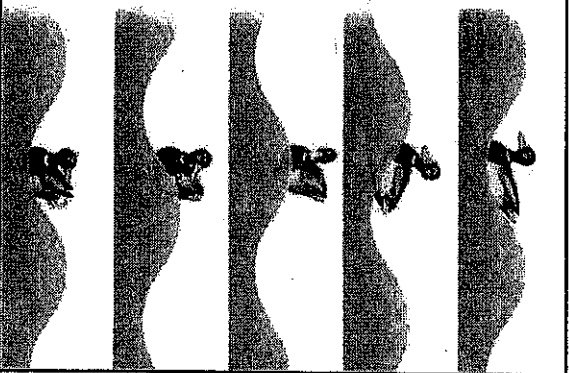
### B. Wave action near shore

1. Waves lose speed and eventually topple over, losing their \_\_\_\_\_ as they break on shore.
2. When waves break on a beach, the water runs back down the sand into the ocean.
3. An \_\_\_\_\_ is the pull of the water as it runs back into the sea.



\* Waves move  
\_\_\_\_\_ NOT  
water.

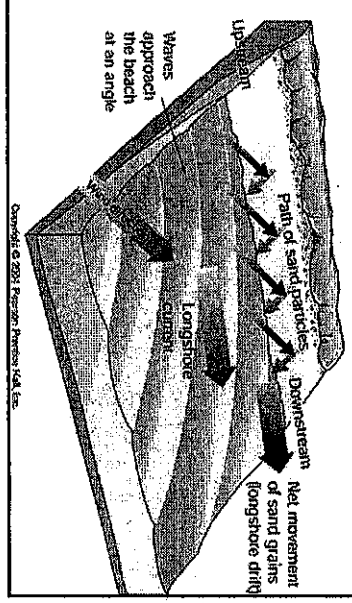
\* Waves only  
affect water near  
the \_\_\_\_\_.



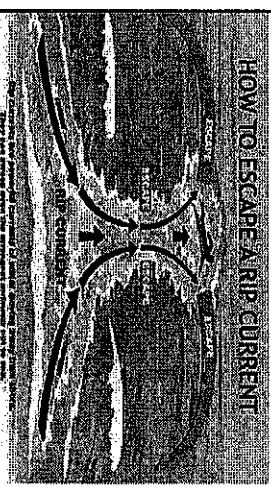
## II. Waves cause currents near shore

A. \_\_\_\_\_ - the overall direction and movement of water as waves strike the shore at an angle.

\*Longshore currents move water \_\_\_\_\_ to the shore.



B. \_\_\_\_\_ - narrow streams of water that break through sandbars and drain rapidly back to sea.



- Like undertows, rip currents can be \_\_\_\_\_.
- To escape a rip current swim \_\_\_\_\_ to the shore.

## SECTION

WAVES MOVE THROUGH OCEANS.

**13.3 Reading Study Guide A****BIG IDEA** The oceans are a connected system of water in motion.**KEY CONCEPT** Waves move through oceans.**Vocabulary****longshore current** currents that move water parallel to the shore**rip current** narrow streams of water that break through sandbars and drain back to sea**Review**

1. Answer the questions about currents.

What are surface currents driven by? \_\_\_\_\_

What are deep currents driven by? \_\_\_\_\_

**Take Notes**

1. Waves form in the open ocean.

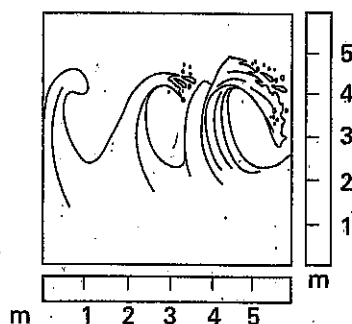
2. Name four things that can cause waves.

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**A. Wave Action at the Water's Surface**

3. Label a trough, a crest, the wave height and the wavelength on one of the waves below.



4. What is the height of the wave shown above? \_\_\_\_\_

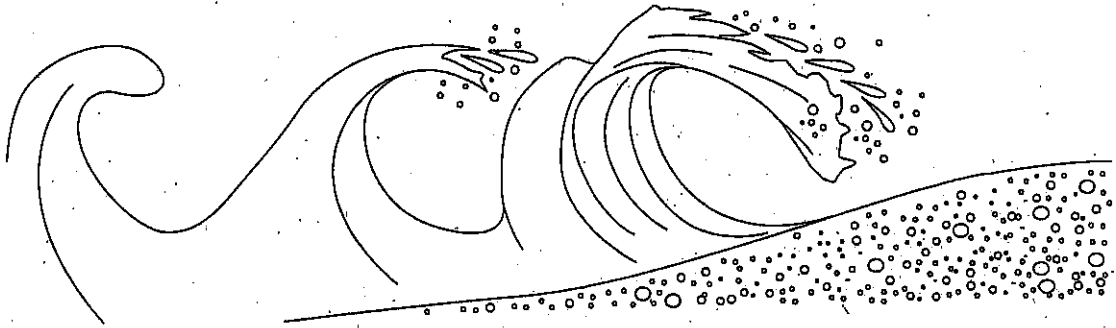
Name \_\_\_\_\_

Period \_\_\_\_\_

Date \_\_\_\_\_

**B. Wave Action near Shore**

5. Draw an arrow on the wave below to show the direction of the undertow.

**II. Waves cause currents near shore.****C. Rip Currents**

6. Use the space below to sketch a longshore current and a rip current. Use arrows to show the direction of the current.

longshore current	rip current

7. How is a rip current different from a longshore current?

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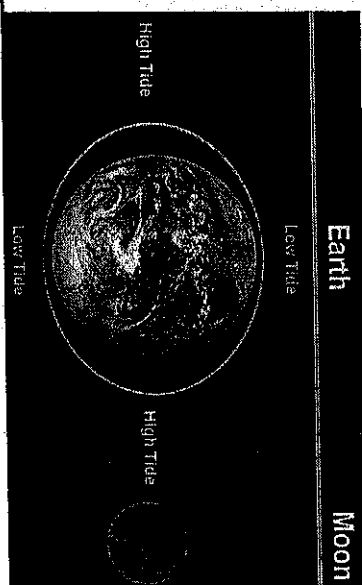
### 13.4 Waters rise and fall in tides

HIGH TIDE

LOW TIDE

### I. Coastal waters rise and fall each day

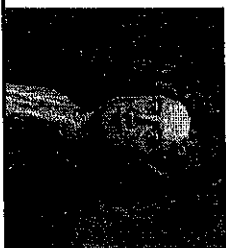
A. \_\_\_\_\_ - periodic rise and fall of the water level of the ocean due to the gravitational pull of the Moon and the Sun.



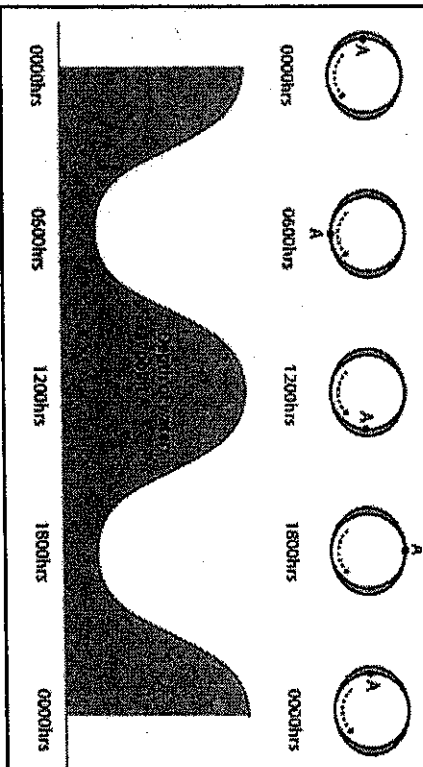
II. The gravity of the Moon and the Sun causes tides

A. In 1687, \_\_\_\_\_ developed his theories of gravity and linked the tides to the Moon's pull.

B. \_\_\_\_\_ is the force of attraction between objects.

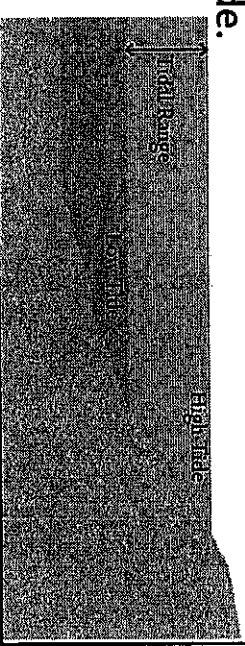


C. Daily Tides- Most coastlines experience \_\_\_\_\_ high tides and \_\_\_\_\_ low tides each day.



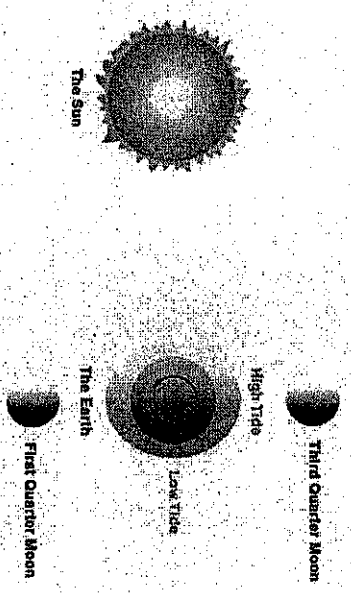
1. Places further \_\_\_\_\_ along a coastline will experience high and low tides earlier in the day, because it passes through the tidal bulge first.

2. \_\_\_\_\_ - the difference in height between a high tide and the next low tide.



2. \_\_\_\_\_ - a tide of small range occurring during the first and third quarter phases of the moon.

Neap tides

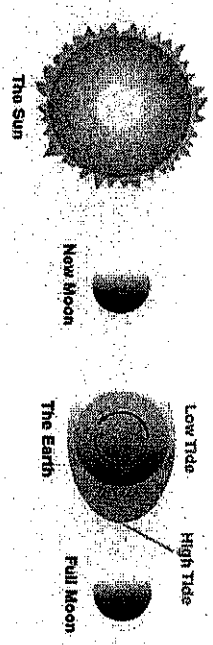


### D. Monthly Tides

\* Tides are mainly caused by the \_\_\_\_\_, but are also affected by the \_\_\_\_\_.

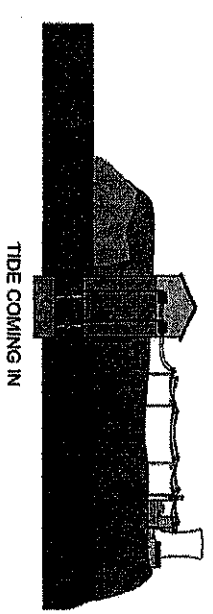
1. \_\_\_\_\_ - an extra-high tidal bulge and an extra-low tidal dip. (Occurs at New Moon & Full Moon)

Spring tides



### III. Tides can be used to generate \_\_\_\_\_.

\* Tidal dams create \_\_\_\_\_ energy that causes much less pollution than other sources but few places are \_\_\_\_\_ for such dams and can affect marine life.



Name \_\_\_\_\_

Period \_\_\_\_\_

Date \_\_\_\_\_

SECTION

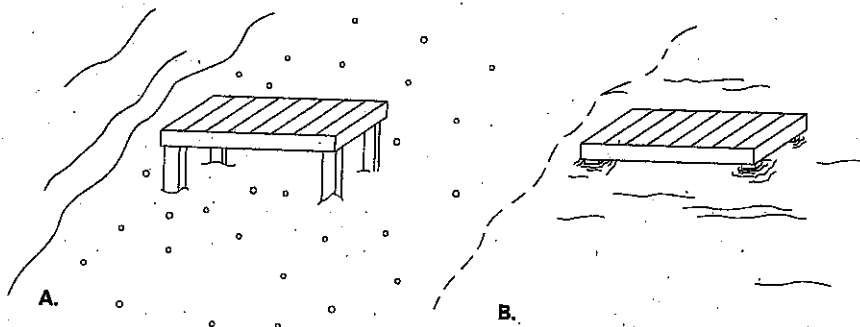
WATERS RISE AND FALL IN TIDES.

**13.4 Reading Study Guide A****BIG IDEA** The oceans are a connected system of water in motion.**KEY CONCEPT** Waters rise and fall in tides.**Vocabulary****tide** the periodic rising and falling of the ocean's water level**tidal range** the difference in height between high tide and the next low tide**spring tide** an extra high bulge and extra low dip in the tide that happens twice a month**neap tide** a less extreme bulge and dip in the tide that happens twice a month**Review**

1. If the sentence is true, write *true*. If the sentence is false, change the underlined word or words to make it true.

The ocean is a national body of water. \_\_\_\_\_Ocean waves stay the same near shore. \_\_\_\_\_The energy to form waves is provided by water. \_\_\_\_\_**Take Notes**

- I. **Coastal waters rise and fall each day.**
2. Which of the pictures below shows the area at high tide? How do you know?

**II. The gravity of the Moon and the Sun causes tides.**

3. Complete the following sentences to explain tides.

a. Because of the Moon's gravity, Earth's water \_\_\_\_\_

b. Because Earth itself is pulled toward the Moon, \_\_\_\_\_

**A-B. Daily Tides and Monthly Tides**

4. On the diagram below, label the two places that have high tides and the two places that have low tides.



Moon

5. Compare and contrast spring tides and neap tides.

Spring Tide	Neap Tide

**III. Tides can be used to generate electricity.**

6. Use the diagram in your textbook to explain in three steps how a tidal dam works.

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_



**13 Vocabulary**

salinity	current	rip current	neap tide
density	upswelling	tide	
continental shelf	El Niño	tidal range	
sonar	longshore current	spring tide	

**A. ANSWER AND QUESTION**

The answers to each vocabulary word are given below. On the blank, provide the question for each answer.

*Example*

A: The continual movement of water from Earth's atmosphere to Earth's surface and back again.

Q: What is the water cycle?

1. A: Narrow streams of water that break through sandbars and drain rapidly back to sea.

Q: \_\_\_\_\_

2. A: A global weather event that may last for 12 to 18 months and is caused by changes in air and water movements.

Q: \_\_\_\_\_

3. A: A mass of moving water.

Q: \_\_\_\_\_

4. A: The difference in height between high tide and the next low tide.

Q: \_\_\_\_\_

5. A: A tidal bulge that is smaller than normal, resulting in less extreme high and low tides.

Q: \_\_\_\_\_

6. A: The vertical movement of deep water up to the surface.

Q: \_\_\_\_\_

7. A: A measure of the amount of matter packed into a unit of volume.

Q: \_\_\_\_\_

8. A: The periodic rising and falling of the water level of the ocean.

Q: \_\_\_\_\_

9. A: An extra-high tidal bulge and an extra-low tidal dip that occurs at the time of the new Moon or full Moon.

Q: \_\_\_\_\_

10. A: The movement of water parallel to the shore; occurs in places where the waves meet the land at an angle rather than head-on.

Q: \_\_\_\_\_

11. A: A system that uses sound waves to measure distance and locate objects.

Q: \_\_\_\_\_

12. A: The amount of dissolved salt contained in water.

Q: \_\_\_\_\_

13. A: The sloping land that lies submerged around the edges of a continent.

Q: \_\_\_\_\_

### B. WHICH ONE?

Choose the vocabulary word that matches each description and write it on the line.  
Use the bolded words in the sentences as clues.

14. This brings nutrients **up from the bottom of the ocean to the surface.**

rip currents

upwelling

density

15. The gravity of the Sun and the gravity of the Moon **combine to pull on Earth's waters from the same direction**, resulting in this.

spring tide

longshore current

neap tide

16. Because **waves rarely meet the land exactly head-on**, these occur along almost every shore.

longshore currents

neap tides

upwelling

17. This is lower in areas where the ocean is **diluted by fresh water.**

salinity

upwelling

tide

18. During these years, **weather patterns change around the planet.**

spring tides

neap tides

El Niño