Name: _____ Date: _____ Period: _____

Ocean Currents and Their Effect on Climate

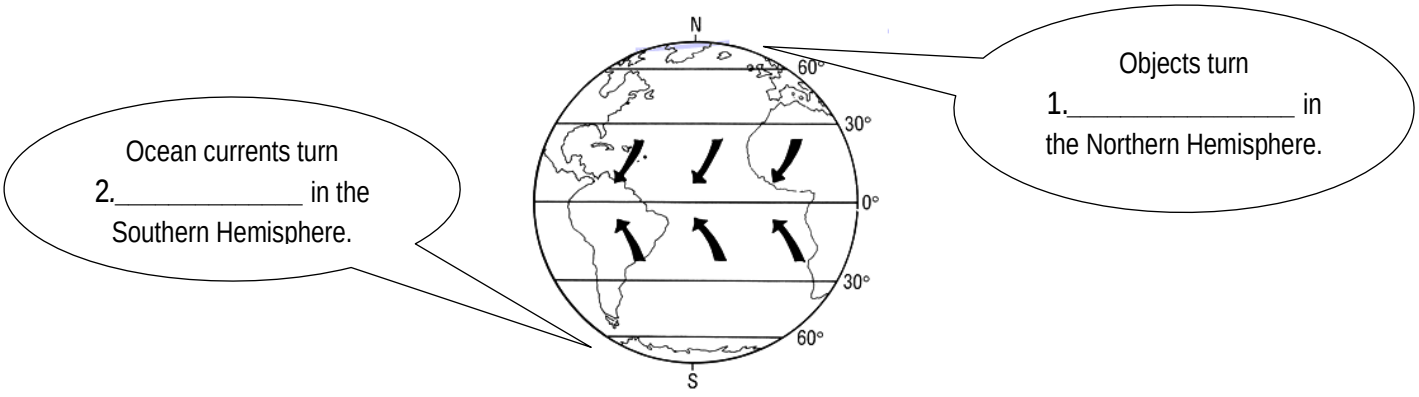
Surface waters of the Earth's oceans are forced to move, primarily by winds. Where winds blow in the same direction for a long period of time, currents will develop that transport large masses of water over considerable distances across ocean surfaces. Ocean currents are separated into two groups; surface currents, which are warmer and stay near the surface and deep ocean currents, which are cooler and flow along the ocean floor as a result of their density. The ocean plays a key role in the climate zones (different climates) we observe on land. Despite being hundreds of miles away from coastal areas, climates are impacted by the ocean's global conveyor belt system. The ocean currents move warm water from the tropics to the poles, and cold water from the poles back to the tropics. Consequently, the ocean is critical to heating and cooling the planet.

When the water molecules are heated they begin to evaporate in the atmosphere as water vapor. Water over the ocean is constantly evaporating, increasing the temperature and humidity of the surrounding air. The water vapor rises in the atmosphere, where the air is cooler, which causes condensation and eventually precipitation.

Why do ocean currents and global winds move in a circular pattern? The circular pattern is caused by the **Coriolis Effect**. The Earth's rotation on its axis causes ocean currents and winds to curve to the right (clockwise direction) in the Northern Hemisphere and to the left (counter clockwise direction) in the Southern Hemisphere. As the winds and currents move, the Earth rotates underneath them. The currents appear to curve in relation to the Earth's surface. If the Earth did not spin on its axis then the currents and winds would appear to move in a straight direction.

Part One:

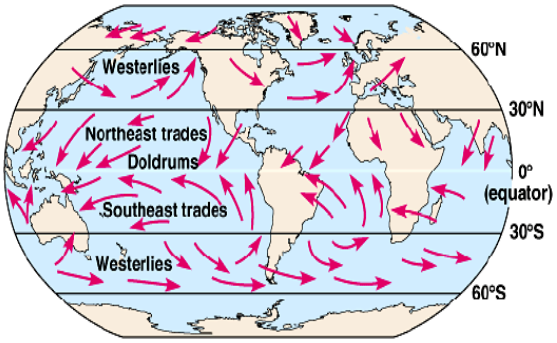
- **Directions:** *Identify the direction in which ocean currents turn.*



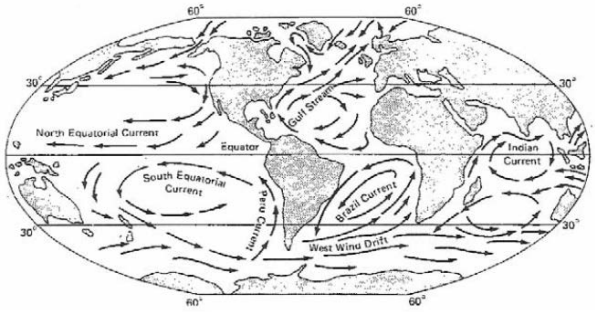
Part Two:

Compare the two pictures of Global Wind Patterns and Ocean Surface Current Patterns and answer the questions below.

Global Wind Patterns



Ocean Surface Current Patterns



1. Take a look at the two pictures above. What do you notice about the global wind and surface current patterns? In general, the direction of the wind flows in the _____ direction as the ocean surface currents.

2. The global winds in the first map generally travel in either a **clockwise or counterclockwise** direction. Look at the global winds and compare the general direction of flow in the Northern Hemisphere with the general direction in the Southern Hemisphere.

   a. In the Northern Hemisphere the general direction is _____.

   b. In the Southern Hemisphere the general direction is _____.

3. The difference in direction is caused by the _____ _____.

Part Three:

In this activity you will identify some surface currents and determine their effect on the temperatures of the continents they border. All you will need for this activity is a pencil and colored pencils. Color the current blue if it is cold and color the current red if it is warm.

The following chart lists some surface currents in the ocean. Each current is identified with a number and classified as a cold or warm current. These same currents are represented by arrows and identified by numbers on the map on the next page.

Number	Name of Surface Current	Characteristic Temperature of Water Transported by Current
1	California Current	Cold
2	Canary Current	Cold
3	Gulf Stream	Warm
4	Kuroshio Current	Warm
5	East Australian Current	Warm
6	Benguela Current	Cold
7	Brazil Current	Warm
8	Peru Current	Cold
9	Antarctic Circumpolar Current	Cold

1. The ocean currents on your map generally travel in either a **clockwise or counterclockwise** direction. Look at the ocean currents and compare the general direction followed by currents in the Northern Hemisphere with the direction of those in the Southern Hemisphere.

    a. In the Northern Hemisphere the general direction is _____.

    b. In the Southern Hemisphere the general direction is _____.

2. What happens to the direction of an ocean current when it approaches the coast of a large landmass?

3. Cold water currents tend to have a cooling effect on the continental coastlines that they border, while warm water currents tend to have a warming effect. Look at the pattern of currents in the Northern and Southern hemispheres and describe the effect the currents have on the temperature of the coastal areas they border.

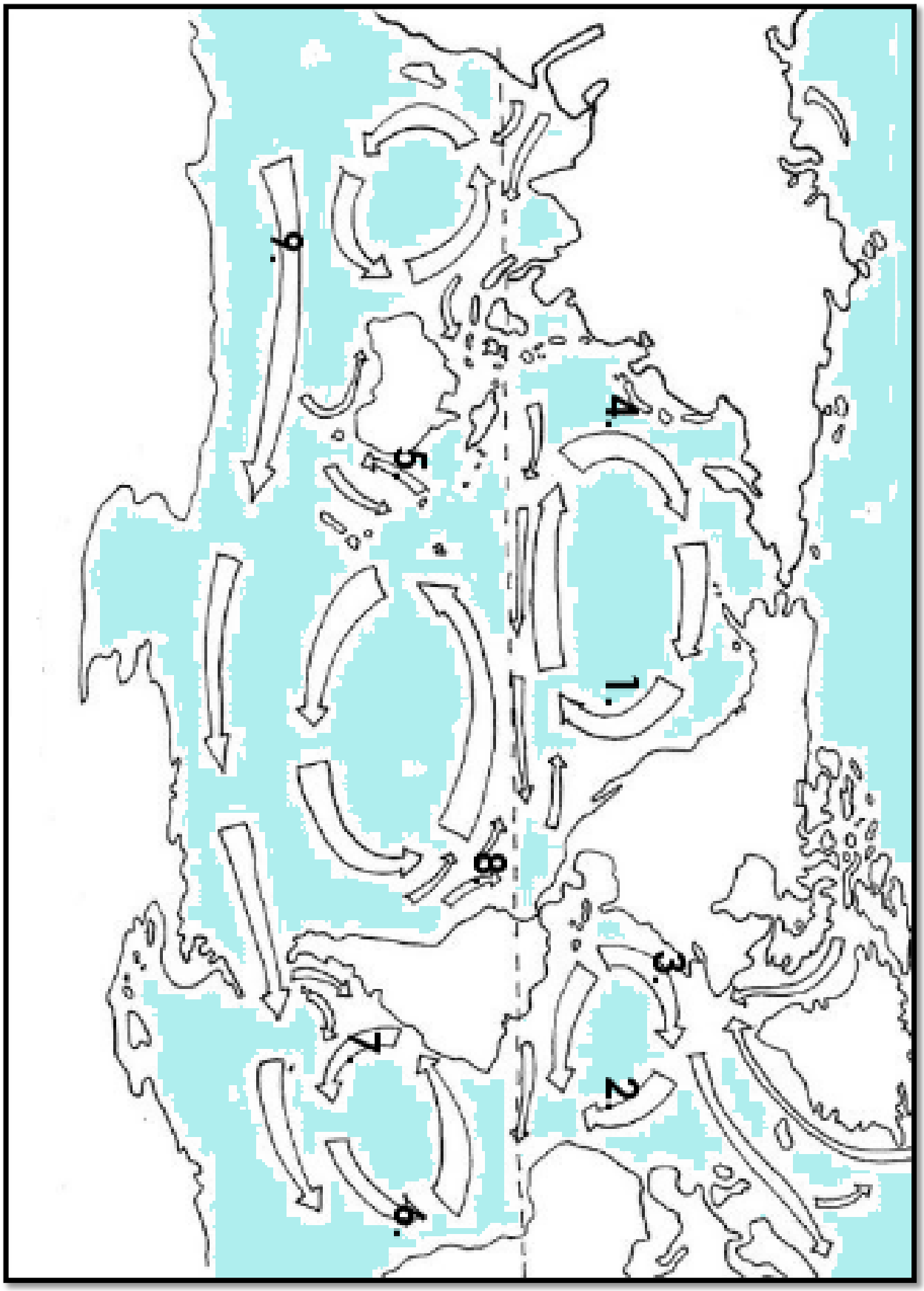
    a. The East coasts generally have _____ (warm or cold) water currents.

    b. The West coasts generally have _____ (warm or cold) water currents.

    c. The East coast climates will generally be _____ (warmer or cooler) than it's supposed to be.

    d. The West coast climates will generally be _____ (warmer or cooler) than it's supposed to be.

4. Look at the pattern of cold and warm water currents. What seems to determine whether a current carries warm or cold water? Explain why this is so.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ANSWER KEY

Ocean Currents and Their Effect on Climate

Surface waters of the Earth's oceans are forced to move, primarily by winds. Where winds blow in the same direction for a long period of time, currents will develop that transport large masses of water over considerable distances across ocean surfaces. Ocean currents are separated into two groups; surface currents, which are warmer and stay near the surface and deep ocean currents, which are cooler and flow along the ocean floor as a result of their density. The ocean plays a key role in the climate zones (different climates) we observe on land. Despite being hundreds of miles away from coastal areas, climates are impacted by the ocean's global conveyor belt system. The ocean currents move warm water from the tropics to the poles, and cold water from the poles back to the tropics. Consequently, the ocean is critical to heating and cooling the planet.

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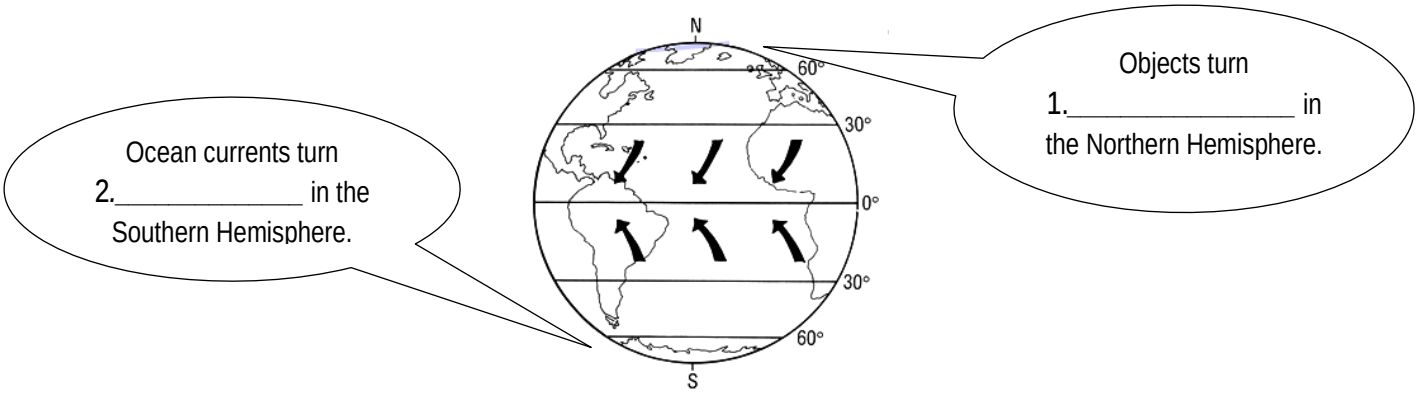
Why do ocean currents and global winds move in a circular pattern? The circular pattern is caused by the **Coriolis Effect**. The Earth's rotation on its axis causes ocean currents and winds to curve to the right (clockwise direction) in the Northern Hemisphere and to the left (counter clockwise direction) in the Southern Hemisphere. As the winds and currents move, the Earth rotates underneath them. The currents appear to curve in relation to the Earth's surface. If the Earth did not spin on its axis then the currents and winds would appear to move in a straight direction.

Part One:

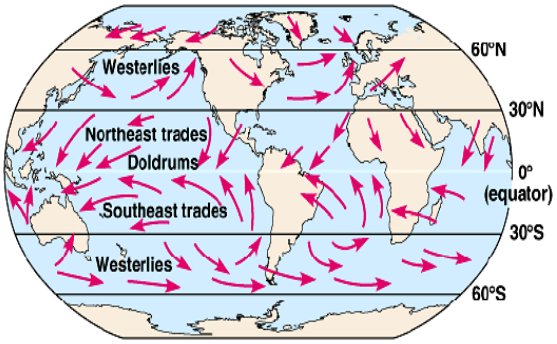
- **Directions:** *Identify the direction in which ocean currents turn.*



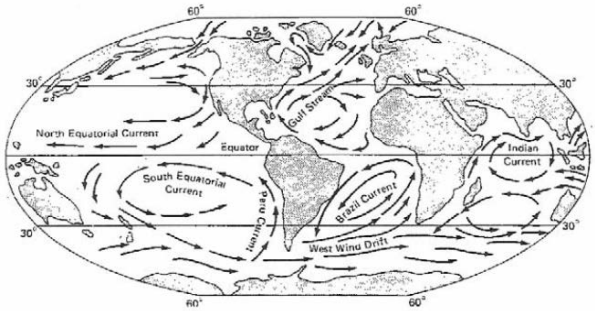
Part Two:

Compare the two pictures of Global Wind Patterns and Ocean Surface Current Patterns and answer the questions below.

Global Wind Patterns



Ocean Surface Current Patterns



1. Take a look at the two pictures above. What do you notice about the global wind and surface current patterns? In general, the direction of the wind flows in the _____ direction as the ocean surface currents.
   - **Same**
2. The global winds in the first map generally travel in either a **clockwise or counterclockwise** direction. Look at the global winds and compare the general direction of flow in the Northern Hemisphere with the general direction in the Southern Hemisphere.
   a. In the Northern Hemisphere the general direction is _____.
      - **Clockwise**
   b. In the Southern Hemisphere the general direction is _____.
      - **Counter Clockwise**
3. The difference in direction is caused by the _____ _____.
      - **Coriolis Effect**

Part Two:

In this activity you will identify some surface currents and determine their effect on the temperatures of the continents they border. All you will need for this activity is a pencil and colored pencils.

The following chart lists some surface currents in the ocean. Each current is identified with a number and classified as a cold or warm current. These same currents are represented by arrows and identified by numbers on the map on the next page.

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1. The ocean currents on your map generally travel in either a **clockwise or counterclockwise** direction. Look at the ocean currents and compare the general direction followed by currents in the Northern Hemisphere with the direction of those in the Southern Hemisphere.
    a. In the Northern Hemisphere the general direction is _____.
        - **Clockwise**

    b. In the Southern Hemisphere the general direction is _____.
        - **Counter Clockwise**

2. What happens to the direction of an ocean current when it approaches the coast of a large landmass?
    - **Changes direction – is deflected**

3. Cold water currents tend to have a cooling effect on the continental coastlines that they border, while warm water currents tend to have a warming effect. Look at the pattern of currents in the Northern and Southern hemispheres and describe the effect the currents have on the temperature of the coastal areas they border.

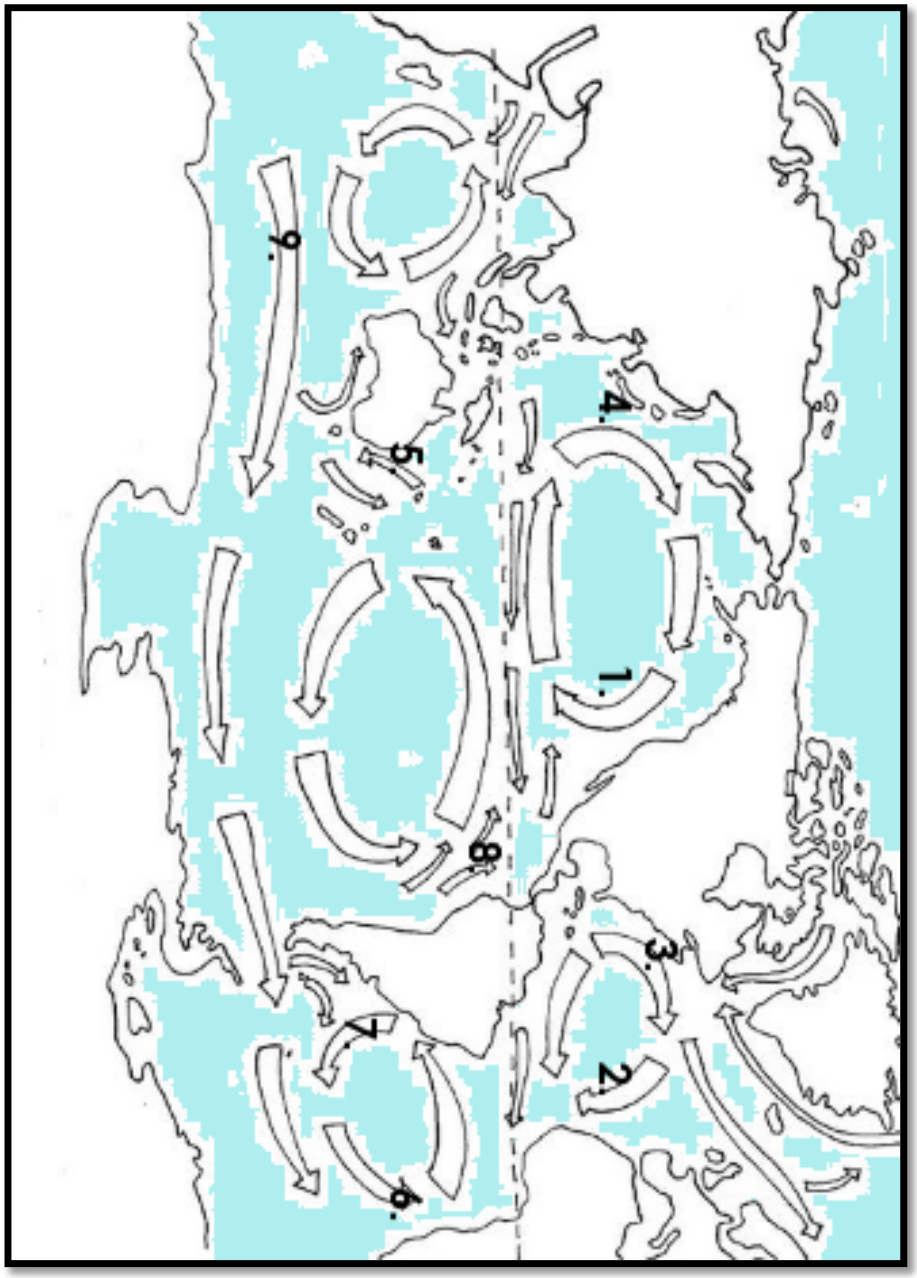
    a. The East coasts generally have _____ (warm or cold) water currents.
        - **Warm**

    b. The West coasts generally have _____ (warm or cold) water currents.
        - **Cold**

    c. The East coast climates will generally be _____ (warmer or cooler) than it's supposed to be.
        - **Warmer**

    d. The West coast climates will generally be _____ (warmer or cooler) than it's supposed to be.
        - **Cooler**

4. Look at the pattern of cold and warm water currents. What seems to determine whether a current carries warm or cold water? Explain why this is so.
    - **Warm water currents are carried from the equator to the poles. The sun's rays are strike the Earth directly at the equator (they are more concentrated) and so, it warms up the water in this area.**
    - **Cold water currents are carried from the poles to the equator. The sun's rays strike the Earth at a low angle at the poles (they are spread out) and so, the water is cold in this area.**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