

Water is Everything!



Water is vital for our existence. Not only do we drink it for survival, the majority of the human body is also composed of water. The earth's weather patterns are closely linked to water too, as they are determined by the complex patterns of changes and movement of water in the atmosphere. Since the ocean covers 70% of the earth's surface, it plays a major role determining what happens in the environment. One of its most important roles is distributing the heat around the world; it soaks up energy in the form of heat, and releases it more evenly across the earth.

Water and Temperature

Since the ocean is so effective at absorbing heat, the first few meters of the ocean's surface hold as much heat as the earth's entire atmosphere. But how does water control the earth's weather? First, it's important to know that the temperature of the water in the ocean and its salt content affect the water's density. So the saltier or the colder the water, the denser it is. Denser water sinks to the bottom of the ocean, while less dense water floats at the surface. The temperature of water is closely related to ocean currents, since the former affects the latter.

Ocean Currents

Simply put, ice triggers the movement of ocean currents. As water freezes in the North and South Poles, the water surrounding the ice becomes saltier and colder, since the salt leaves the water upon freezing. The ice then cools the water surrounding it. The cold, salty water then sinks due to its increased density. Once it gets to the bottom of the ocean floor, it has to move somewhere, so it travels horizontally to spread out over the surface of the earth. This is cold current. Warm water replaces it on the surface and moves to the North. This motion is called the global conveyor belt. The global conveyor belt is a global-wide current that circulates cold and warm water around the earth. So, the warm water that replaces the cold on the surface travels northward, increasing the temperature of the Atlantic Ocean. That's why countries that border the Atlantic Ocean are relatively warmer than landlocked countries during the wintertime.

However, the cold water doesn't always stay at the bottom of the ocean. Instead, it comes up at different places around the globe called upwelling. Since the ocean floor contains many nutrients important for survival, the cold water that rises to the surface brings these nutrients with it, attracting all forms of life. Usually every level of the food chain is present at these upwellings, making them great spots for fishing. In fact, upwellings are common in areas where winds blow water away from the surface. In coastal areas, sometimes winds (called longshore winds) blow perpendicular to the land over the ocean, pushing the warm water away from the coast. This allows the cold water at the bottom to rise up and replace the warmer water. Therefore, some coastal areas are effective places to fish due to the upwelling that attracts more fish to the area.

The Global Conveyor Belt

As previously mentioned, the global conveyor belt describes the current that runs throughout the earth's waters, driven by the cold waters at the poles. The "belt" starts in the North Atlantic Ocean, where the cold water that surrounds the ice sinks, and starts to flow around the world. A current is created as warm water rushes to the surface to replace the sinking cold water. The cold, dense water moves southward in between the continents toward South America and Africa—and as it passes the equator, the water warms. As the water passes Antarctica, it is re-cooled by the ice near the South Pole. It continues to move on from there and splits into two paths: one that veers off toward the Indian Ocean, and the other toward

the Pacific Ocean. These two paths gradually warm up as they travel northward, causing them to rise to the surface (which, as we know, is called an upwelling). The currents eventually return to the North Atlantic, where the journey begins again. Although the path of the global conveyor belt can be quickly explained, the actual travel time occurs very slowly—the waters travel at slow speeds when compared to tidal currents.

Ocean Currents and Climate

The effect that ocean currents have on the earth's climate is still being studied by scientists around the world, but we know a few things for sure. The ocean plays a huge role in redistributing heat around the globe, like we previously explained. However, there are certain ocean currents, like the Gulf Stream (which is part of the global conveyor belt) that have a direct effect on the climates of countries they pass. The Gulf Stream travels past the Caribbean and Florida, carrying warm water, then turns off to the right toward Europe—specifically England and Ireland. That's why the northeastern part of the United States and Canada has a cooler climate; the Gulf Stream doesn't bring warm water to its shores, causing colder temperatures. And since the direction of currents is always affected by wind direction (like we previously described with upwellings), climate is indirectly affected by wind as well.

Global Warming

The gradual increase of the earth's temperature has been a topic of much debate for several years as scientists discover more and more about the phenomenon. Global warming is caused mainly by an increase in carbon dioxide levels in the atmosphere. This increase can potentially cause the ice caps in the North and South Poles to melt, disrupting the global conveyor belt. Even though the phenomenon is called "global warming," it is more accurately described as climate change—if the ice caps melt, there will be less dense water to move around the globe. And if there's less dense (and therefore cold) water to circulate around the earth, the Gulf Stream will be slowed down. This will result in a cooling of the Caribbean and Western Europe. So, even though we call it global warming, it can also result in colder temperatures in some areas. That's why we must always be careful to take care of the environment—the earth's temperature is carefully maintained by specific mechanisms. We sure wouldn't want to disrupt them!

Name: _____ Date: _____

1. Cold water rises from the bottom of the ocean to the surface of the ocean at different places around the globe. What is this process called?

- A global warming
- B climate change
- C upwelling
- D cold water current

2. How does the author describe the global conveyor belt?

- A the cooling of the Caribbean and Western Europe
- B the role the ocean plays in redistributing heat around the globe
- C a globe-wide current that circulates cold and warm water around the earth
- D cold water rising from the bottom of the ocean to the surface of the ocean at different places around the globe

3. Ocean currents have an effect on the earth's climate.

What evidence from the passage supports this conclusion?

- A Some ocean currents, like the Gulf Stream, have a direct effect on the climates of the countries they pass.
- B The gradual increase of the earth's temperature has been a topic of much debate.
- C Cold water does not always stay at the bottom of the ocean.
- D As water freezes in the North and South Poles, the water surrounding the ice becomes saltier and colder.

4. Based on the passage, why is the global conveyor belt important?

- A It helps the ocean absorb heat from the countries which it surrounds.
- B It circulates the warm and cold water that regulate the temperature of the earth.
- C It helps the polar ice caps stay frozen. This ice triggers the movement of ocean currents.
- D It is the cause of upwellings that provide nutrients to various forms of life in the ocean.

5. What is this passage mostly about?

- A the effects of global warming on the future of the planet
- B the human need to stay hydrated
- C the excellent fishing on the Gulf Stream
- D the role of the ocean's currents in maintaining the earth's temperature

6. Read the following sentences from the passage: "Water is **vital** for our existence. Not only do we drink it for survival, the majority of the human body is also composed of water."

As used in the passage, what does the word "**vital**" mean?

- A unimportant
- B essential
- C additional
- D minor

7. Choose the answer that best completes the sentence below.

When ice freezes, the water around it becomes saltier and colder. _____, its density increases.

- A Therefore
- B On the other hand
- C In contrast
- D Especially

8. How does ice in the North and South Poles trigger the movement of ocean currents?

9. Explain why the phenomenon called global warming is more accurately described as climate change. Use information from the passage to support your answer.

10. Explain how excess carbon dioxide in the atmosphere can ultimately change the temperature of the earth. Use information from the passage to support your answer.

Teacher Guide & Answers

Passage Reading Level: Lexile 1170

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8. How does ice in the North and South Poles trigger the movement of ocean currents?

Suggested answer: The ice in the North and South Poles causes the water surrounding the ice to become saltier and colder. The cold, salty water then sinks due to its increased density. Once it gets to the bottom of the ocean floor, it travels horizontally to spread out over the surface of the earth. This is cold current. Warm water replaces it on the surface and moves to the North. Thus, the movement of cold and warm currents has been ultimately triggered by the ice.

9. Explain why the phenomenon called global warming is more accurately described as climate change. Use information from the passage to support your answer.

Suggested answer: Students should indicate that while global warming is the gradual increase of the overall temperature of the Earth, this increase can disrupt the global ocean currents that help to maintain the earth's temperature, causing the temperature of certain areas to change. For example, changes in current can actually make some parts of the planet, like the Caribbean and Western Europe, colder. Thus, the term "global warming" can be misleading as the climate in all areas of the Earth is subject to change, either becoming warmer *or* colder.

10. Explain how excess carbon dioxide in the atmosphere can ultimately change the temperature of the earth. Use information from the passage to support your answer.

Suggested answer: Students should explain that excess carbon dioxide can trigger the melting of polar ice caps. Less ice means less cold, dense water moving in currents around the world and regulating the earth's temperature. This changes the climate of specific areas and increases the overall temperature of the earth.