Moving Water - Ocean Currents and Winds

by

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Introduce the various types of currents and their locations. Describe how these currents affect our daily lives and how these currents are affected by changes in winds, climate, and other related abiotic factors.

An ocean current can be defined as any continuous flow of water along a definite path in the ocean. The flow may occur at the surface or far below it. The flow may be vertical or parallel to the surface. The circulation of these water masses in motion can be categorized as either wind driven or thermohaline. Thermohaline currents have a significant vertical component and account for the thorough mixing of the deep masses of ocean water. Wind driven circulation is set into motion by moving air masses with the motion being confined primarily to horizontal movement in the upper waters of the oceans. Currents carry enormous amounts of warm water away from the equator and currents return equal amounts of cold water. Current flow can affect temperatures, biotic systems, and climate.

OBJECTIVES:

Students will be able to:

1. Define ocean currents; describe the general pattern of wind-driven and thermohaline currents; and describe the effects of these currents.

2. Discuss the relationship between winds and ocean currents.

3. Locate and describe major ocean currents, their features, and their effects on climate.

MATERIALS:

* Freshwater

* Salt

* Ice

* Fifteen gallon (or larger) fish tank

* Food coloring

* Large heat lamp or two hot plates

* Soup plates (four to six depending on group numbers)

* Two-liter soda bottles (two/group)

* Tygon® tubing

* Silicon sealant

* Blow dryer

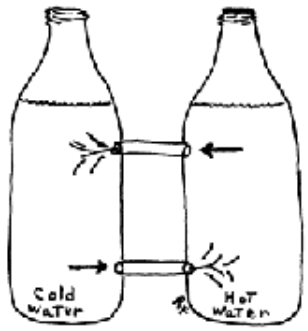
* Journal notebook (one per student)

ACTIVITY:

Density Current:

Divide students into cooperative learning groups of five or six. Provide each group with a soup plate with a wide, flat rim. Have each group fill the soup plate with water until the rim is covered. The soup plate will simulate the depths of the ocean while the rim of the plate will simulate the continental shelf. Have one student in each group squirt a few drops of ink (tip: mix solution of salt and ink for increased density) into the water at the very edge of the plate. The ink will form a current which slowly moves over the edge of the rim down the side to the bottom. Ask students whether this kind of movement would be considered a current and why. Lead a discussion relative to the definition of an ocean current. Have students record results in a journal.

Convection Current:



Each group will need two, empty two-liter soda bottles with the tops cut away. Have one student in each group cut two holes into both of the bottles so each bottle has a hole two inches from the bottom and six inches from the bottom. A six inch piece of Tygon® tubing should be siliconed into the holes so the bottom holes of each bottle are connected. The top holes should also be connected by Tygon® tubing. Note: Be sure the tubing is level. Clamp both tubes in the middle. Fill one bottle with cold water dyed blue. Fill the other bottle with hot water dyed red. Remove the clamps. Ask students whether this kind of movement would be considered a current and why. Have students record results and observations in a journal.

Thermohaline Current:

Have students fill a 15-gallon or larger aquarium with freshwater. Prepare large ice blocks made from water dyed blue. Place an ice block in one corner of the tank. Place a rock on top of the block to hold it on the bottom. Place a heat lamp over the opposite side of the tank and turn it on. Prepare 200 ml of a mixed solution of water, concentrated salt, and red food coloring. Pour the saltwater mixture into the tank on the side with the ice. Explain what happens and record observations in the journal.

Wind Driven Current:

Conduct experiment number one again. This time turn on a blow dryer in a "low-cool" setting. Observe the ink now flowing in a horizontal pattern and record results in the journal.

POSSIBLE EXTENSION:

1. LUCKY DUCKS-In January 1992, a Pacific storm caused a box of 29,000 toy ducks to tumble from a container ship and start "bobbing" their way around the Pacific. Oceanographers, Curtis Ebbesmeyer and Jim Ingraham, have tracked the landings of these ducks and charted ocean current routes in order to predict the routes oil will follow in the event of a spill. Write an essay on why this is a "bad situation turned good."

2. Place a few drops of watercolor paint on a paper; drop fresh water on the paint using an eyedropper. Blow gently (or use a blow dryer) and create colorful swirl designs.

3. History Discussion-What happened to Columbus? In your journal, write where he wanted to go; what route he attempted; and what currents took him off course.

TEACHER EVALUATION:

1. Have students illustrate the four current types they created.

2. Observe student performance in laboratory exercises and notes made in science journals. Observe student responses during class discussions. Test students on the concepts.

3. Illustrate and label three types of currents.

4. If the Earth were to spin in the opposite direction, diagram or explain what would happen to the Gulf Stream, the Equatorials, and the Canary Currents.

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