



LESSON 2: EARTH'S WATER MOVES

INTRODUCTION

The ocean is one body of water that is interconnected across the world. Ocean currents serve as nurseries for some animals while others spend their whole lives in them. There are many kinds of plants and animals that live in and around ocean currents. This biodiversity shows how important the ocean and its currents are for so many different types of living things.

OBJECTIVES

- Students will be able to describe how much of the Earth is covered by water.
- Students will explore ocean currents and gyres.
- Students will learn the locations of the major ocean gyres across the world, and what moves with these currents.

ESTIMATED TIME

60 minutes. If you would like to complete this lesson over 2 days, consider pausing the lesson between steps 5 and 6.

STANDARDS ADDRESSED

Science (NGSS): 2-ESS2-2. Develop a model to represent the shapes and kinds of land and bodies of water in an area.

OCEAN LITERACY PRINCIPLES

1a The ocean as a defining physical feature of our planet

1c “Global ocean conveyor belt”

3a The interaction of oceanic and atmospheric processes controls weather and climate.

3c Heat exchange between the ocean and atmosphere can result in dramatic global and regional weather phenomena.

3f The ocean has had, and will continue to have, a significant influence on climate change.

3g Changes in the ocean-atmosphere system can result in changes to the climate that in turn, cause further changes to the ocean and atmosphere.

Geography: Standard 1.4 The interpretation of geographic representations.

Standard 3.2 The distribution of people, places, and environments form spatial patterns across Earth's surface.

FOCUS QUESTION

- Print and cut apart the Ocean Dwellers card setside, as shown on the Ocean Depth Chart master.

MATERIALS

- Map that includes the area where students live and the nearest ocean, to project or display. Students should be able to clearly see where they live and the nearest ocean basin on the map, so a map with colors and state/country boundary lines may be helpful depending on your location. Maps on the Internet often allow for different views or layers, which will allow you to project a version that will support your students.
- World Map handout, one per student and one to project using a document camera or LCD projector

- Markers, crayons, or colored pencils, in sets of one blue and one green or brown. One set per 1-2 students.
- Small paper straws, one per student. Please do not use plastic straws as they are a major source of litter, marine debris, and have a very detrimental impact on all types of animals living on land and in the ocean. Paper straws can be placed in paper recycling following use.
- Baking dish or pie pan, one per group of 4 students
- Enough water to fill each baking dish or pie pan to a depth of approximately 1 inch
- Coarse ground pepper
- Gyres of the world handout, see “Preparation”

PREPARATION

- Make enough copies of the Gyres handout for each group of 2-3 students to have one description. There are 4 descriptions per handout, so for a class of 30 (with 10 groups of 3 students) make 3 copies of the handout. Cut apart the descriptions.

FACILITATION

Step 1. Project or display a map that includes where your students live in relation to the nearest ocean. Help students locate where they live and the nearest ocean on the map. For your own information, and to share with students as it comes up, the ocean is one body of water that is interconnected across the world. Ocean basins are bounded by the continents and have distinct characteristics. The ocean basins include the North and South Pacific, North and South Atlantic, Indian, and Arctic Ocean basins. Scientists also recognize the Southern Ocean, which circles Antarctica.

Step 2. Help students understand that the ocean is a very large body of water that is all interconnected. You might have them compare the closest ocean basin to a pond, lake, or river that is close to where they live and is visible on the map.

Step 3. Tell students that you can get an idea of how big the ocean is based on the map. Distribute the World Map handout. Ask students to color in squares that are all or mostly water with blue and squares that are all or mostly land with green or brown. You may wish to also display a world map that shows water in a different color from land so that students can use it as a reference.

Step 4. When students have colored in all the squares, ask them to count the number of blue squares and record that number in the appropriate place on the handout. Have them do the same for the number of brown squares.

Step 5. Ask students to draw a bar graph to show the amount of land and the amount of water on Earth. To do this, they should graph the number of squares they counted for each surface. Then have students compare how much of the Earth is covered in water versus land. They should be able to say that there is more water than land on Earth. About 70 percent of the Earth's surface is covered by water, so the bar for that surface should be more than twice as high as the bar for land.

Step 6. Share with students that there is more to the ocean than the map shows. The wind affects the way the water in the ocean moves. Have the students complete the activity in the NOAA resource, [How It is Currently Done](https://www.noaa.gov/ocean/ll-current) (<https://www.noaa.gov/ocean/ll-current>). Ask them, what is happening when the “wind” is blowing the water?

How it is done:

The constant pushing of air molecules into each other is the reason we feel wind. As one molecule bumps into another, it transfers energy into the next molecule. The wind constantly pushing on the ocean's surface also transfers energy to the water.

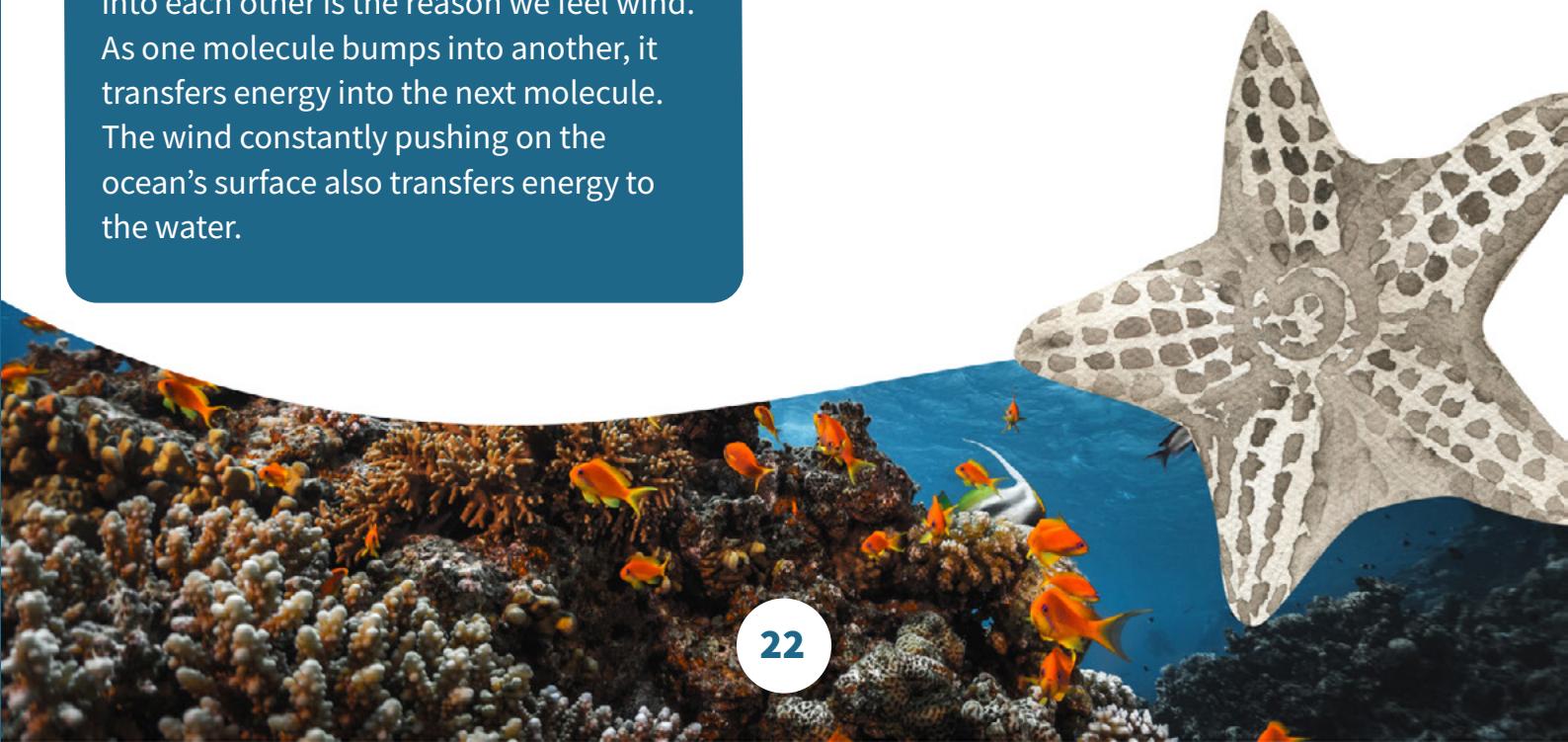
This energy transfer is responsible for the motion of the world's ocean currents. Students will make their own ocean currents using straws and black pepper.

Total time: 10 minutes

Supplies: One small paper straw per student, one baking pan (or pie pan) for each group of 4 students, coarse ground black pepper

Procedure:

1. Fill the baking pan with water to about 1 inch deep.
2. Position one student on each corner of the pan.
3. Sprinkle some black pepper in one corner of the baking pan.
4. At each corner position, have the students aim their straw along the side of the pan to their left.
5. Have each student gently blow through the straw across the top of the water and observe the motion of the pepper.



Step 7. Tell students the following information.

As you've seen, one of the ways that water moves is because wind blows it. In the oceans, there are five areas where winds and the rotation of Earth cause major, permanent currents. The water in these currents travel in a circular motion over thousands of miles. These currents are known as gyres.

For additional discussion: The wind systems over the Atlantic and Pacific Oceans in the northern hemisphere move in a clockwise motion. The wind transfers some of its energy to the sea surface generating currents in the same clockwise direction. In the Southern Hemisphere, the wind moves in a counter-clockwise motion. As a result, the ocean's currents also move in a counter-clockwise direction.

Step 8. Divide students into groups of 2-3 and give each group a description from the Gyres handout. Have them read the information and determine how they would draw the gyre on the map. You will likely have multiple groups with the same information. When groups share, they can discuss if all groups agree on where to draw the gyre.

Step 9. Project the world map handout and hold a class discussion about the location of the gyres. Point out where North America is and ask if, in the previous step, any groups read about a gyre that was near that continent. Have one of the groups come forward to point out where their gyre should be. If you are projecting the map onto a board, have them draw the gyre where it belongs. If you are projecting on a screen or have a physical map, give them one of your prepared pictures of a gyre and have them tape it where it goes. If more than one group had the same description, allow one group to share where they think the gyre should go and allow the other group to agree or share their ideas.

Step 10. Share with students that the currents in the ocean help to move heat and warm water, food, and salt around the world. These materials help plants and animals, including humans, live by bringing nutrients to different parts of the world and spreading heat out across the globe.





EXTENSION

If your students are interested in the gyres, a NOAA resource called [JetStream Max: Major Ocean Currents](https://www.noaa.gov/jetstream/ocean/circulations/jetstream-max-major-ocean-currents) (<https://www.noaa.gov/jetstream/ocean/circulations/jetstream-max-major-ocean-currents>) is an interactive map that can help students visualize the different currents. If you would like to have your students explore this, share the link with them, along with the information in the following table that includes the currents associated with each gyre, and in different parts of the ocean. Students can check the specific currents to see where the water in the gyre is warm and where it is cold, so they can look for patterns in both the temperature and direction of the water.

GYRES (POTENTIAL EXTENSION)

Gyre	North Atlantic	South Atlantic
Currents	<ul style="list-style-type: none">• Gulf Stream• North Atlantic• Canary• North Equatorial	<ul style="list-style-type: none">• South Equatorial• Brazil• West Wind Drift• Benguela

North Pacific	South Pacific	Indian
<ul style="list-style-type: none">• North Equatorial• Kuroshio• North Pacific• California	<ul style="list-style-type: none">• West Wind Drift• Peru• South Equatorial• East Australia	<ul style="list-style-type: none">• West Wind Drift• West Australia• South Equatorial• Agulhas

WORLD MAP



North Atlantic Gyre

- This gyre makes a large circle.
- It is north of the equator.
- It is east of North America.
- It is west of Europe and Africa.

North Pacific Gyre

- This gyre makes a large circle.
- It is south of the equator.
- It is east of South America.
- It is west of Africa.

South Atlantic Gyre

- This gyre makes a large circle.
- It is north of the equator.
- It is east of Asia.
- It is west of North America.

South Pacific Gyre

- This gyre makes a large circle.
- It is south of the equator.
- It is east of Australia.
- It is west of South America.