**The Restless Ocean**

As we’ve observed in our explorations of density and temperature, water likes to be moving. Let’s examine some of the scientific reasons behind the ocean’s incessant movement.

**Waves:** If you have ever been to the ocean, you know that waves are constantly moving through the water. Ocean waves are primarily caused by wind blowing across the surface of the water.

**Tides:** The gravitational pull between the Earth and the Moon (and a little from the Sun as well) causes tides. Tides are twice-daily changes in the height of the ocean that result from huge masses of ocean water trying to get as close to the Moon as possible.

**Surface Currents**: Surface currents are movements of ocean water that flow across (horizontally) the surface of the sea. These currents are caused primarily by wind, and can flow (like a river) for thousands of miles.

**Upwelling:** As the wind pushes water across the surface of the ocean, colder water from deep in the ocean can flow upwards into the space that was created by the movement of the surface water.

**Coriolis Effect**: Because the Earth is spinning (around an axis), the waters of the ocean are also spinning. As water flows from south to north, or from north the south, the spinning of the Earth causes to the moving water to “curve”, like a big spinning wheel.

**Deep Ocean Circulation**: Differences in ocean water temperature and density cause water to flow between the surface of the earth and the darkest depths of the ocean. Water that is more dense (due to cold temperatures and/or higher salinity) will sink, while less dense water (due to being warmer and/or lower in salinity) while rise upwards.

**What Causes the Tides?**

As humans living and growing up on this planet, we are all aware of ocean tides. But why are there tides??? Let’s find out.

Please use the following website (on your laptop!!!!) to learn about the tides.

[*http://www.pbs.org/wgbh/nova/earth/what-causes-the-tides.html*](http://www.pbs.org/wgbh/nova/earth/what-causes-the-tides.html)

Launch the ocean tide interactive, and CAREFULLY read through each of the frames. PLEASE ASK FOR HELP IF YOU DON’T UNDERSTAND WHAT YOU ARE SEEING AND READING!!

According to this website, the tides of the ocean result from TWO different influences. In the space below, draw a picture of the Earth and Moon that explains each of these two causes of tidal force. Use colored pencils in your sketch, and CLEARLY LABEL AND DESCRIBE YOUR SKETCH!

The two causes of the ocean’s tides are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

And \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

What is the Coriolis Effect???

Have you ever played on a merry-go-round at a park, the kind that spins around and around and around, until you get dizzy and fall off?? Imagine that you and a friend were sitting on merry-go-round while it was spinning, and you wanted to play catch with a ball. Like in this video!

Watch: <http://www.youtube.com/watch?v=mcPs_OdQOYU>

Notice what happens as the two “people” try to play catch. Because the marry-go-round is spinning, the person that is being thrown to moves out of the way before the ball ever makes it to them. Instead, the ball follows the path that it was originally thrown in, and thus ends up far away from the intended receiver. Each person thinks that the ball curved out of the way, but it really went in a straight line—it just LOOKS like it curved to each of the merry-go-rounders.

A similar thing happens to ocean water that moves north or south across the Earth. Watch the following video:

<http://www.youtube.com/watch?v=i2mec3vgeaI>

and think about why weather patterns form big swirling circles. Water behaves the same was as the air in the weather patterns. Look at the Ocean Surface Currents diagram on page 449 of the textbook .

What do you notice about the paths of the major ocean currents in the Northern Hemisphere?

What do you notice about the paths of the major ocean currents in the Southern Hemisphere?

**The Giant Ocean Conveyor Belt:**

Turn to pages 452 and 453 of the textbook. On page 453 there is a diagram of the “conveyor belt” model of ocean circulation.

Where is the ocean water red, and where is it blue?

What makes the “red” water warm?

What makes the “blue” water cool?

In general, where does the warmer water flow from, and to?

In general, where does the colder water flow from, and to?

Examine Figure 6 on page 452. The Key describes 4 bodies of water (AIW, MW, NADW, and ABW).

Find each of these 4 water bodies in Figure 7 (approximate locations). Which two of these water bodies would probably be warmer water? Why?

Which two would be warmer water? Why?