CRS Lesson Plan - DRAFT Jennifer Frederick

Global Ocean Currents and Fluid Densities

Objective: Students will be able to explain what liquid density is and how it is affected by temperature and salt. They will also be able to explain how differences in density drive ocean currents around the globe.

Goal: Show how temperature or solute concentration affects the density of water. Explain how water temperature drives ocean currents and how a large increase in fresh water from melting ice at the north and south pole can affect ocean currents.

Grade level: 5th

Standards connection: Most of earth's water is salt water in oceans; the oceans influence the weather and the water cycle plays a role in weather patterns

Vocabulary Words: Ocean Currents, Density, Salinity

Materials:
1L or 2L soda bottles (clear) with tops cut off
Eyedroppers
Styrofoam cups
Red & blue food coloring
Thermos for hot water
Ice for cold water
Room temp water
Salt
Stirring stick/spoon
Paper towels (in case of spills)
5-Gal bucket (for waste water)

Lesson Cycle	Estimated Time of Session
Scientist Introduction - I'm a scientist. - I study how climate change affects the North and South Pole, and what might happen if all of the ice melts. - I also study how the ocean might react to all of the ice melting at the North and South Poles. - Today we will be scientists and we will try to figure out what might happen by conducting an experiment.	2 minutes
Preliminary Experiment Setup	5 minutes

- Split classroom into groups of 4. - Each group takes one 2L plastic bottle. - Fill each group's 2L bottle with room temp water. - Tell students: "DO NOT DISTURB the water!"	
Motivational Questions (Ocean Currents) - Have you ever had an experience with an ocean current? - The ocean has currents which circle the globe. - How do these currents begin and why do they move? - Show globe/map and point to ocean currents. - What is the temperature of the water at the Equator or the North Pole? Do you think the temperature drives the current? - As a scientist, I am interested in answering these questions by doing experiments. - Let's make our own currents by doing an experiment. **Experimental Setup (simultaneously in the background)** - Set up a container of ice water (blue) and a thermos of hot water (red).	5 minutes
Directions (Temp. Experiment) - Hand out two eyedroppers, two Styrofoam cups, and one worksheet to each group. - Explain the hot-red/cold-blue water and what is represents. - Show how to inject colored water into the 2L water with the eyedroppers. - Explain that each group's recorder will have to fill out the worksheet. - Fill each groups' Styrofoam cups with some hot-red water and cold-blue water.	5 minutes
Temperature Experiment - Each group will inject hot and cold water with the eyedroppers into the 2L container and watch what happens. The cold water will sink, while the hot water will rise. - If enough colored water is injected, the top layer of water in the 2L will be red, while the bottom layer will be blue. The water may begin to "mix itself" depending on where it is injected.	15 minutes
Review of Temperature Experiment - Ask the students what happened. Did everybody get the same results? If not, why? What was supposed to happen? - Explain what density is: hotter water is less dense, colder water is more dense (draw on board)	10 minutes

- Denser water is heavier, while less dense water is lighter - Pass out sheet with ocean currents and relate it to the difference in density due to temperature	
Motivational Questions (Salinity) - What is the difference between the ice at the North/South Pole and the ocean? (Ice: cold, solid, fresh) (Ocean: warmer, liquid, salty) - Show globe/map and point to polar ice and oceans. - Ice is fresh and melts into very cold fresh water - Ocean water is salty and warmer - What happens if we mix fresh water and salty water? Do you think that salt affects the density? What do you think will happen? Form a 'hypothesis.'	5-10 minutes
Salty Water Demo	5 minutes
Conclusion - Salty water is heavier (more dense) so it stays on the bottom, while fresh water is lighter (less dense), so it stays at the top. - We know cold water sinks and warm water rises, which causes the ocean currents. - If a lot of very cold fresh water from melting polar ice enters the warmer ocean, it will not sink because it isn't salty! - Ocean currents will STOP!	5 minutes

Issues which may arise:

- We might run out of time. If this happens, we will have to cut out the salinity section and keep the lesson specifically about ocean currents driven by temperature (and mention briefly how salt water in the oceans and fresh water in the North & South Pole play a role in possibly stopping these currents).
- The experiment may not work if the kids bump the water and create a lot of motion. In this case we should try to make a demo after they all tried it so that they know what it should have looked like.

Questions to ask the classroom teacher:

- Is there a water source near or in the classroom?
- Should we bring ice or will it be available at the school?
- Are there paper towels in the classroom or do we need to supply them?
- What have the students already learned about our topic?
- Is there a large map of the world to use while explaining ocean currents?
- Can we use a projector to show a map of ocean currents?