



Schools on Board Field Program Lesson Plan Example

Density Experiment - Examining the Differences in Density between Freshwater and Sea (salt) Water

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Purpose:

- Students will discover freshwater to be less dense than saltwater
- Students will identify salinity and temperature as factors which affect the density of water
- Students will identify waves, tide, and temperature as forces which control the mixing of freshwater and saltwater in nature

Prior Knowledge:

- Students are expected to understand that density is the mass/unit volume

Lab Activity

Materials:

- Large container (clear on both sides)
- Freshwater
- Saltwater (if you are unable to get real saltwater, make your own using freshwater and salt for the purpose of lab, dissolve 30-35 grams of salt in 1 litre of water)
- Thermometer
- Hair dryer
- Food colouring
- Beakers (1 litre) or something with a scale to measure volume accurately
- Scale for measuring mass
- Hand held CTD for measuring salinity or a conductivity kit

Procedure:

Part A

1. Students will find or be assigned a partner or group to conduct lab activity
2. Fill the container with 1 litre freshwater from the tap. Record the temperature and salinity (conductivity) of the water using the thermometer and CTD. (Chart provided for students)
3. Measure the mass of the beaker. Pour the water back in the beaker and take the mass. Subtract the mass of the beaker from this measurement and record the mass of the freshwater/seawater at room temperature.

4. Calculate the density of both freshwater and saltwater using the formula
Density=Mass/Volume
5. Repeat steps 2 to 4 for saltwater. Record in chart.
6. If you are making your own seawater, you could repeat the procedure using different concentrations of salt.

Before proceeding with the second part of the lab, students will work in their groups to discuss the following questions:

1. Which container contained more density? Why do you think this was so?
2. What factors do you think affect the density of a sample?
3. How does temperature relate to density?
4. How does salinity relate to density?
5. If freshwater and saltwater were mixed, (think of a river (freshwater) flowing into the sea (saltwater)) what do you think would happen?

Part B: As in the case for a river and ocean, use warm (room temperature) freshwater and cold saltwater (at say 4 degrees Celsius)

1. Fill your container with saltwater and again measure the temperature and salinity. Record measurements in chart provided.
2. Fill a beaker (1 litre) with freshwater. Record temperature and salinity. Add drops of red or blue food colouring to the freshwater. Do you think the food colouring will have an effect on the temperature and salinity of the freshwater?
3. Measure the temperature and salinity of the freshwater with the food colouring and record in chart.
4. Slowly add the freshwater mixture to the container of saltwater. Record what happens in your chart. Here it would be useful to use a plate on the saltwater so the freshwater doesn't mix too much in when you pour it in, but slowly slides on the saltwater as a river does.
5. Turn on the hair dryer as a substitute for wind and hold it over the container. Record what happens to the mixture when "wind" is applied. (Or use a sheet to make small waves.)

****** You could also vary the temperature to have students identify if salinity and density might be affected.**

Data and Observations:

Students will answer the following questions to complete the results section of the lab activity.

1. How does salinity affect the density of water?
2. How does temperature affect the density of water?
3. What happens when freshwater and seawater are mixed?
4. What types of forces will affect the mixing of freshwater and seawater?
5. What can be concluded about the relation between the salinity of water and its density?

6. What can be concluded about the relation between the temperature of water and its density? (Use this question if you vary temperature in procedure. In order for this to work, water should probably cool down the to 0 degrees and warm up to 25/50 degrees and then measure the volume and mass very carefully because there is only a 10 g difference in the weight of 1 liter volume of freshwater at 0 and 50 degrees Celsius).
7. Based on the conclusions about density, what do you expect to happen to sea ice as it freezes? (Why does ice float?)
8. How can the information concluded about density be used to help us study climate change?

Student Chart #1 for Recording Information from Procedure Part 1 (add appropriate number of columns depending on how many variables are used)

	Temperature	Salinity	Mass	Volume	Density	Notes
Freshwater						
Salt Water						

Student Chart #2 for Recording Information from Procedure Part 2

	Temperature	Salinity
Freshwater		
Freshwater with Dye		
Salt Water		

Discussion of Results:

1. How does freshwater and saltwater mixed together?
2. What are the effects of wind on the mixture of freshwater and saltwater?
3. How might an increase in freshwater input into the Arctic Ocean have an impact on life in the ocean? On currents?
4. What other properties of the ocean might be affected by these changes?

Application:

How can these results be used to determine the impacts of climate changes in the Arctic?