Salty Sea

Strand		Interrelationships in Earth/Space Systems
Topic		Investigating the salinity of the ocean
Primary SOL	5.6	The student will investigate and understand characteristics of the ocean environment. Key concepts include b) physical characteristics.
Related SOL	5.6	The student will investigate and understand characteristics of the ocean environment. Key concepts include a) geological characteristics; c) ecological characteristics.

Background Information

Different bodies of water can have different amounts of salt in solution: i.e., different *salinities*. Salinity of water is expressed as the number of grams of salt found in 1,000 grams of the water. Therefore, 1 gram of salt in 1,000 grams of water results in a salinity of 1 part per thousand (1 ppt).

Average salinity of ocean water is 35 ppt; however, rainfall, evaporation, river runoff, and ice formation cause this number to vary between 32 and 37 ppt. For example, the Black Sea is so diluted by freshwater river runoff; its average salinity is only 16 ppt.

The salinity of fresh water is usually less than 0.5 ppt. Water between 0.5 ppt and 17 ppt is called *brackish*. *Estuaries*, where fresh river water meets salty ocean water, are examples of brackish waters. The Chesapeake Bay is an excellent example of an estuary.

Materials

- Salt
- Fresh water
- Large, clear plastic cups (enough for two for each student)
- Food coloring
- Spoons (one for every two students)
- Potato slices (one for every two students)
- Ocean water (if ocean water is unavailable, mix salt with fresh water and let it sit overnight)
- Graduated cylinders
- Hand lenses/magnifying glasses, or microscopes
- Droppers
- Clean microscope slides
- Copies of the attached “Salinity Lab Sheet”

Vocabulary

salinity, estuary, brackish

Student/Teacher Actions (what students and teachers should be doing to facilitate learning)

Introduction

1. Ask the students whether they have ever wondered why the oceans are filled with salt water instead of fresh water. Just where did all that salt come from? Is it the same kind of salt you find in a salt shaker?
2. Explain that most of the salt in the oceans came from land. Over millions of years, water flowing in rivers and streams has washed over rocks containing salt — the compound sodium chloride (NaCl) — and carried it into the seas. Some of the salt in the oceans comes from undersea volcanoes and hydrothermal vents. When water evaporates from the surface of the ocean, the salt is left behind. After millions of years, the oceans have become more and more salty — that is, their *salinity* has increased.

Procedure

1. Ask students to make a hypothesis about where the rain water goes when it rains on the ocean since we now know the ocean is salty. Does it rest on top of the rest of the water, does it mix in, or does it sink to the bottom?
2. Assign students to work in pairs. Have each pair of students fill 2 clear plastic cups less than half full with *the same amount* of fresh water.
3. One partner will mix 8 teaspoons of salt into the water in one of the cups while the other partner mixes a few drops of food coloring into the other cup to differentiate it from the salt water.
4. One partner will hold a spoon directly over the salt water and the other will pour the colored water very slowly into the spoon so that it slowly drips out into the salt water. Ensure that the spoons are close to the salt water when pouring the colored water in order to reduce splashing and mixing of the waters. The students will observe that the two different waters do not mix. If the colored fresh water is poured slowly enough, it will float on top of the salt water. *(Salt water is heavier than fresh water, i.e., it has a greater density.*)
5. Partners should very slowly and gently lower a potato slice into their water container without stirring the water. They should note that the slice sinks through the colored fresh water and floats on the salt water.
6. Ask students to share with another partner group what they think the differences between the densities of the fresh water, salt water, and potato slice might be while they clean up their stations.
7. Hand out a copy of the attached “Salinity Lab Sheet” to each student.
8. Give each pair of students an equal quantity of fresh water and ocean water in plastic cups. (If you cannot get ocean water, mix salt with fresh water and let it sit overnight.)
9. Have students follow the directions on the “Salinity Lab Sheet” to determine the following:
    a. Students are to smell both samples and describe what they smell.
    b. Students will use a graduated cylinder to determine the volume of each type of water.

c. Students should put a drop of fresh water on a clean microscope slide and observe it with a magnifying glass (or a microscope, if possible). Then, repeat this process to observe a drop of salt water.
d. Students should predict what they will see when the water evaporates.
e. Students will fan the two drops of water until the water evaporates and then describe the actual result.

Conclusion

1. Discuss the results of the experiment with the class, leading them to draw correct conclusions about what happened. Include in the discussion the layering of waters due to their different salinities and thus different densities as well as the terms brackish and estuary. Does this happen on a large scale in the ocean? Does the water near the bottom of the ocean have a greater density and salinity than that near the top? How might these differences in ocean water salinity in one geographical location affect the marine life that can live there?

Assessment

- **Questions**
  - Which is more dense, ocean water or fresh water? Explain.
- **Journal/writing prompts**
  - Describe/draw the differences in fresh water and ocean water.
  - Describe why the water in the Dead Sea has such a high salinity.
- **Other**
  - Assess the students' lab sheets for understanding.
  - Have students write their own definition of *salinity*, and assess for understanding.

Extensions and Connections (for all students)

- Challenge students to create a "rainbow" of layered waters by using different-colored water of various salinities.
- Have the students repeat the water-layering experiment, but using two samples of the same ocean water at two different temperatures. Have them analyze how the differences in ocean water temperature in one location might affect the marine life that can live there.

Strategies for Differentiation

- Provide adjectives/descriptors of salty and fresh water to assist students in completing the "Salinity Lab Sheet."
- Create a foldable to clarify vocabulary in this lesson with term, definition, and picture to model the concept.
- Create a graphic organizer to compare salt and fresh water habitats.
- Explore salinities of local waters and infer why the salinities are what they are.

Salinity Lab Sheet

Names: _____ Date: _____

1. Describe the odor of each sample of water.

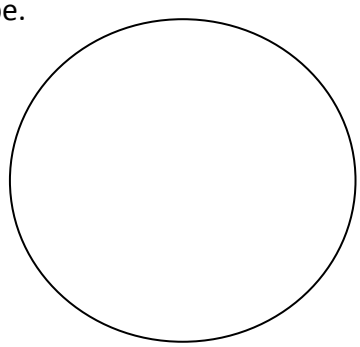
   Fresh water: _____

   Ocean water: _____

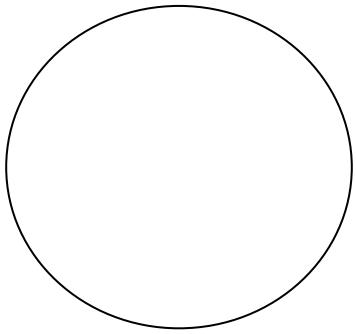
2. Find and record the volume of each sample of water.

   Fresh water: _____ ml Ocean water: _____ ml

3. Draw what you saw when you observed each drop under the magnifying glass or microscope.



Fresh Water



Ocean Water

4. Predict what you will see as the two drops of water evaporate.

   Fresh water: _____

   Ocean water: _____

5. Describe what you actually saw after each drop evaporated.

   Fresh water: _____

   Ocean water: _____