

SALINITY

OVERVIEW	Salinity is the concentration of dissolved salts in water, usually expressed in "parts per thousand" (ppt). Objects float higher in salt water than fresh water because salt water is denser (heavier per unit of volume).
OBJECTIVES	Following completion of this lesson, the students will be able to: <ul style="list-style-type: none">• Determine the salinity of a water sample by using a hydrometer.• Understand how salinity influences an object's ability to float in water.
GRADE LEVELS	4 th -12 th grades
NJCC STANDARDS	Science Indicators: 5.1, 5.2, 5.3, 5.5, 5.8, 5.10
MATERIALS	<ul style="list-style-type: none">• Water, salt, hydrometer,• 100 ml graduated cylinder, thermometer,• Salinity conversion table,• 2 clear containers, 2 eggs,• Optional: refractometer
PROCEDURES	<p>Place two containers on a table, one filled with fresh water and the other filled with salt water. Ask students what they think will happen when an egg is placed in each container. Record predictions. Place an egg in each container. Please note: Test your solutions ahead of time without students. High salinity is required to float an egg and you may have to adjust your salt water solution. The egg will sink in the fresh water and float in the salt water. Why? The egg in the salt water will float due to the fact that the salt water is denser. Since density equals mass/volume, by adding salt we increased the mass of the water and kept the volume constant. This increased the density of the water to a density greater than the egg. Therefore, the egg floated in the saltwater solution. Ask students if they have ever been swimming in the ocean, and if they think it's easier to float in the salty ocean or a freshwater pool.</p> <p>Next, test the salinity of the saltwater solution or ocean ware samples. Fill the graduated cylinder with salt water and obtain a temperature reading. Remove the thermometer and place the hydrometer in the cylinder. Wait until the hydrometer has stopped bobbing around. Be sure that your eye is even with the water level in the graduated cylinder, at the bottom of the meniscus. Viewing at an angle can give an inaccurate reading. Read and record the number on the hydrometer that best matches up with water level. This is the specific gravity of the sample.</p> <p>Open the salinity conversion table to Table 1 (LaMotte hydrometer instructions). Follow along the top row of table to the column with the</p>

temperature (C) of the water sample. Then, follow down the right side of the table, the Observed Reading row, to the reading obtained from the hydrometer. Where the column and the row intersect on the table is the salinity reading for the water sample. It is expressed in parts per thousand (ppt).

BACKGROUND

When we measure the salinity of water, we look at how much dissolved salt is in the water. Salinity is expressed in parts per thousand (ppt). The ocean has a salinity that is approximately 35 ppt, which is the same as saying ocean water is 3.5% salt. About 90 percent of that salt would be sodium chloride, the same as table salt. Other salts that can be found in saltwater are calcium, magnesium, sulfur and potassium.

Fresh water in streams and rivers usually has a salinity ranging from 0-3 ppt. In an estuary, the flow of fresh water from streams and rivers mixes with salty ocean water producing a range of salinity from 0 to 35ppt.

The salt content of water affects the distribution of animal and plant species according to the amount of salinity they can tolerate. Many species can survive only within certain salinity levels. Changes in salinity can have a detrimental effect to a variety of species found in a waterway.

Density equals mass/volume. Saltwater has a higher density than freshwater; this is because the salt in the water adds more mass to the water without changing the volume, or amount, of water. The increased density of saltwater compared to freshwater allows objects to float much easier.

Salinity is also affected by temperature. The warmer saltwater becomes, the more its volume increases, which lowers the density (thermal expansion). As water temperature decreases, volume decreases, increasing the density.

Salinity may be calculated by measuring the specific gravity of a sample of water using a hydrometer. The hydrometer works similar to the egg floating in the saltwater. The greater the salinity, the higher the hydrometer will float. You must correct for the effect of temperature and convert the readings to salinity by means of a salinity conversion table.

VOCABULARY

Density- the mass per volume of a substance

Hydrometer - a floating instrument for determining specific gravities of liquids.

Meniscus - the curved upper surface of a liquid column that is concave when the containing walls are wetted by the liquid and convex when not.

Refractometer - an instrument for measuring indices of refraction caused by the level of salts dissolved in the water.

Specific Gravity - the ratio of the density of a substance to the density of some substance (like pure water), taken as a standard when both densities are obtained by weighing in air.

EXTENSIONS

After obtaining a salinity measurement from the hydrometer, use a refractometer to create a comparison between the two readings. Discuss how the readings may be similar or different.

REFERENCES

Campbell, Gayla and Wildberger, Steve. 1992. The Monitor's Handbook. LaMotte Chemical Company.

Garrison, Tom. 1995. Essentials of Oceanography. Wadsworth Publishing, Belmont CA.

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