

WHY IS THE OCEAN SALTY?

Purpose

For students to observe how salt concentration increases in water. Also, how the salt remains after the water evaporates. The students will be able to explain why the ocean is salty.

Background

Everyone who has been to the beach knows that seawater is salty. Everyone also knows that fresh water in rain, rivers, and even ice is not salty. Why are some of Earth's waters salty and others not? There are two clues that give us the answer.

1. First, "fresh" water is not entirely free of dissolved salt. Even rainwater has traces of substances dissolved in it, picked up during passage through the atmosphere – including pollution.

As rainwater passes through soil and percolates through rocks, it dissolves some of the minerals, a process called weathering. This is the water we drink. However, we cannot taste the salt because its concentration is too low. Eventually, this water with its small load of dissolved minerals or salts reaches a stream and flows into lakes and the ocean.

The annual addition of dissolved salts by rivers is only a tiny fraction of the total salt in the ocean. The dissolved salts carried by all the world's rivers would equal the salt in the ocean in about 200 to 300 million years.

2. A second clue to how the sea became salty is the presence of salt lakes such as the Great Salt Lake and the Dead Sea. Both are about 10 times saltier than seawater. Why are these lakes salty while most of the world's lakes are not? Lakes are temporary storage areas for water. Rivers and streams bring water to the lakes, and other rivers carry water out of lakes.

The Great Salt Lake, Dead Sea, and other salt lakes have no outlets. All the water that flows into these lakes escapes only by evaporation. When water evaporates, the dissolved salts are left behind. So a few lakes are salty because rivers carried salts to the lakes, the water in the lakes evaporated and the salts were left behind. After years and years of river inflow and evaporation, the salt content of the lake water built up to the present levels. The same process made the seas salty. Rivers carry dissolved salts to the ocean. Water evaporates from the oceans to fall again as rain and to feed the rivers, but the salts remain in the ocean.

3. Rivers are not the only source of dissolved salts. On the crest of oceanic ridges there are places where sea water that has seeped into the rocks of the oceanic crust has become hotter and dissolved some of the minerals from the crust, then the hot water flows back into the ocean (at a hydrothermal vent). With the hot water comes a large amount of dissolved minerals. Estimates of the amount of hot sea water now flowing from these vents indicate that the entire volume of the oceans could seep through the oceanic crust in about 10 million years. Thus, this process has a very important effect on salinity (=saltiness). The reactions between seawater and oceanic basalt, the rock of ocean

crust, are not one-way, however; some of the dissolved salts react with the rock and are removed from the water.

4. A final process that provides salts to the oceans is submarine volcanism, the eruption of volcanoes under water. This is similar to the previous process in that seawater is reacting with hot rock and dissolving some of the mineral constituents.
- Will the oceans continue to become saltier? Not likely. In fact the sea has had about the same salt content for many hundreds of millions if not billions of years. The salt content has reached a steady state. Dissolved salts are being removed from seawater to form new minerals at the bottom of the ocean as fast as rivers and other processes are providing new salts.
 - Just so you don't think seawater is worthless, a cubic mile of it also can contain up to 25 tons of gold and up to 45 tons of silver! Before you go out and try alchemy on seawater, though, just think about how big a cubic mile is.

Materials

- Rock salt
- Water
- Containers / Plastic Cups
- Measuring cup
- Beaker
- Food coloring
- Paper
- Small paint brushes
- Strainer
- Hot plate
- Pan

Activities

1. As you introduce the lesson for the day, prepare the salt water solution. Pour 2 cups water over approx 1/3 cup rock salt which is contained in a strainer (will almost fill strainer to solid band). The water plus dissolved salt will be collected in a plastic cup. Optional: Students can taste the water sample.
2. Pour 1 cup of the Salty water into a pie tin on the hot plate. Bring the water to a boil. The goal is to boil all of the water off in approximately 15-20 min. Students will observe that the salt remains.
3. While waiting for the water to boil off, students will do a Saltwater Painting to observe the evaporation process.
 - a) Pour the remaining salt water into 20 individual cups. For each group of students there should be 4 to 5 cups of salt water. Make additional salt water as necessary.
 - b) Add 2-3 drops different colors of food coloring to each cup in the group.
 - c) Instruct students to paint pictures (maybe ocean/island theme or water cycle?) with the mixture on white paper. Let dry.
 - d) Finish lesson by showing students that the water has evaporated, but the salt remains, creating a salt layer in the pan and beautiful pictures on their paper.

