**STUDENT ACTIVITY: Investigating seawater**

**Activity idea**

In this activity, students investigate some of the properties of seawater.

By the end of this activity, students should be able to:

* discuss how salt dissolves in water.
* explain that dissolved salt does not change the volume of the water
* discuss the differences in density between freshwater and seawater
* discuss how freshwater in the form of rain or melting ice reduces the salinity of the saltwater on the surface.

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**Introduction/background**

Seawater is not just water – it has lots of chemicals packed into it. This means it is denser than pure water. Density describes how tightly a certain amount of matter (atoms or molecules) of a substance is compacted in a given volume. Density is commonly measured in grams per millilitre (g/ml) or grams per cubic centimetre (g/cm3). Interestingly, a kilogram of salt is denser than a kilogram of lead.

Salt is made up of many sodium and chlorine ions stacked together in a lattice. Salt dissolves in water because the attraction between the water molecules and sodium ions or chlorine ions is stronger than the attraction between the sodium ions and chloride ions in the lattice. This allows the sodium and chlorine ions to be pulled apart by the water molecules. The hydrogen of the water molecule is attracted to chlorine ions and the oxygen to the sodium ions.

Water density changes with salinity – the higher the salinity, the higher the density. The salinity of seawater varies from place to place and during different times of the year. Rainfall, river outflows, ice melt and other additions of freshwater dilute salinity and lower density.

Some oceans have higher salinity. As ice forms in the sea, the salt cannot form part of the ice crystal so the ice is almost pure water. The salt that is rejected forms brine beneath the ice and becomes more and more salty until it becomes so dense that it sinks and displaces less dense seawater that moves to the surface. This is why seawater at Antarctica is very salty.

This activity is adapted from the SEREAD Programme developed in conjunction with NIWA.

**What you need**

* Access to the articles [Water density](https://www.sciencelearn.org.nz/resources/1009-water-density), [Ocean salinity](https://www.sciencelearn.org.nz/resources/686-ocean-salinity) and the video [Why salinity and temperature are measured](https://www.sciencelearn.org.nz/videos/346-why-salinity-and-temperature-are-measured)
* Copies of the student handout [Investigating seawater](#handout)
* Large measuring cylinder
* Marker pen
* Warm water
* Salt
* 2 x 250 ml beakers
* Blue and green food colouring
* 2 x 50 ml clear containers
* Dropper
* Paper and coloured pencils

**What to do**

1. Introduce this activity by viewing the articles [Water density](https://www.sciencelearn.org.nz/resources/1009-water-density), [Ocean salinity](https://www.sciencelearn.org.nz/resources/686-ocean-salinity) and the video [Why salinity and temperature are measured](https://www.sciencelearn.org.nz/videos/346-why-salinity-and-temperature-are-measured) with the class.
2. Hand out copies of the student handout [Investigating water](#handout) and assist small groups to gather the materials they need and conduct the experiments. Discuss the results and the questions on the student worksheet.

**Student handout: Investigating seawater**

1. Fill the measuring cylinder ¾ with warm water.
2. Mark the water level on the outside of the cylinder.
3. Add 1 tablespoon of salt and mix until nearly all the salt is dissolved, leaving just a little bit of salt at the bottom.
4. Check the water level.
5. Discuss these questions in your group:

* Are there changes to the water level after adding salt?
* If the water and salt are made up of particles, how can you explain what has happened?
* Would 1 litre of seawater be more/the same/less dense than 1 litre of freshwater? Why?
* What do you think the density of seawater would be like compared to freshwater?

***Will freshwater and seawater mix?***

1. Half fill both beakers.
2. Add 1 tablespoon of salt to one beaker and mix until all the salt is dissolved.

1. ¾ fill one 50 ml container with the saltwater and add a few drops of green food colouring.
2. Repeat with the other container, using the freshwater and blue colouring.
3. Place a few drops of the green saltwater into the freshwater beaker and observe.
4. Repeat adding the blue freshwater to the beaker of saltwater.
5. Draw what you observe happening in the beakers.
6. Discuss these questions in your group:

* Does saltwater mix with the freshwater? Does it float or sink?
* Can you think of a reason for what you see happening when freshwater and seawater come together?
* What do you think happens when it rains out at sea? Does the rainwater and seawater mix straight away?