Experiment E-1
Properties of Sea water and Fresh water

Objectives

- To examine the properties of sea water and fresh water in terms of salinity and pH.
- To explore environmental issues related to these properties.

Modules and Sensors

- PC + NeuLog application
- USB-200 module
- NUL-206 pH logger sensor
- NUL-228 Salinity logger sensor

Equipment and Accessories

▪ Utility stand	1
▪ Right angle clamp	1
▪ Extension clamp	1
▪ 50 ml beaker	3
▪ Wash bottle	1
▪ Plastic container	1

- The items above are included in the NeuLog Utility accessories, UTL-KIT.

Materials

▪ 50 ml of fresh water (tap water could be used as fresh water)
▪ 50 ml of sea water
▪ 20 ml of pH 7 buffer
▪ Water for the wash bottle

Introduction

About 70% of the Earth is covered with water; while 97% of it is sea water. Sea water contains around 3.5% by weight of salt or 35 g/L (35,000 mg/L). Usually 90% of the dissolved salt in sea water is sodium chloride (table salt).

Fresh water has a low salt concentration with usually less than 1000 mg/L of salt. Fresh water is divided into surface water (rain water collected on the Earth's surface) and ground water (located beneath the Earth's surface).

Salinity is the quantity of dissolved salts in water and is measured by electrical conductivity.

Sea water's pH is maintained within relatively narrow limits due to the 'carbonate buffer' (the relations of CO_2, HCO_3^- and CO_3^{2-}). Increased amounts of CO_2 absorbed by the sea decrease the capacity of the buffer to restrict pH changes. Human-released CO_2 dissolves in the ocean and lowers its pH. This process is called ocean acidification. Though the ocean's pH is still basic, there was a 0.1 unit drop in the average pH of the ocean's surface from 8.2 in preindustrial times to 8.1 today. The average pH of fresh water is more neutral (around 7) than that of sea water.

In this experiment, sea water and fresh water will be examined by measuring their salinity and pH levels.

Procedure

Experiment setup

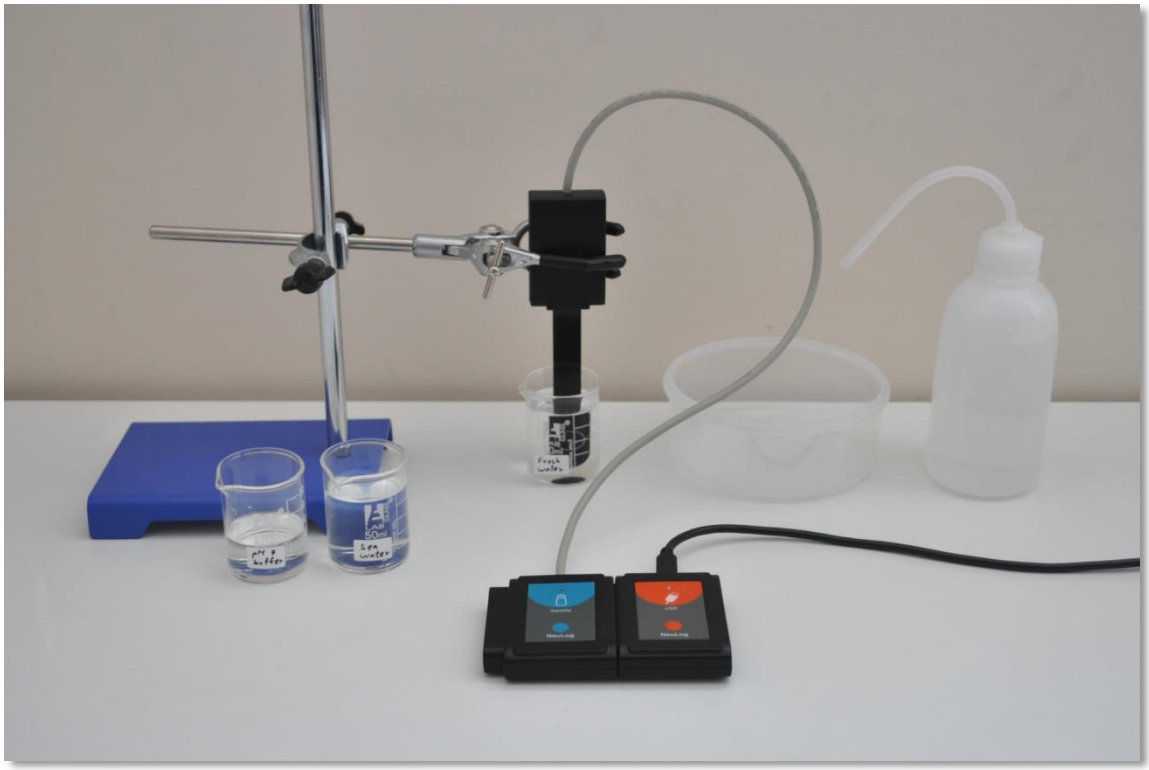
Caution:

It is recommended to wear personal protective equipment. Material Safety Data Sheets (MSDS) are available online.

1. Make sure you have fresh and sea water samples. Fresh water could be taken from a river or a lake. Alternatively, you can use tap water.

2. Attach the salinity sensor to the utility stand using the extension clamp.

3. Insert the salinity sensor probe into the fresh water sample.



Sensor setup

4. Connect the USB-200 module  to the PC.

5. Check that the salinity sensor  is connected to the USB-200 module. The pH sensor  will be used in the second part of the experiment.

Note:

The following application functions are explained in short. It is recommended to practice the NeuLog application functions (as described in the user manual) beforehand.

6. Run the NeuLog application and check that the salinity sensor is identified.

Settings

7. Click on the **Sensor's Module** box.

8. Select the mg/L button to change the sensor's units.

9. This experiment is done in single step mode so the experiment duration and sample rate will not be set.

Testing and measurements

10. Make sure that the electrodes (in the shape of a circle with a dot inside it) are covered with water.

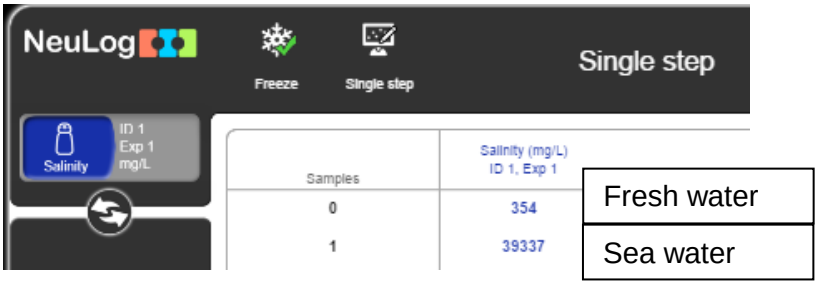
11. When the reading stabilizes, click on the **Single Step** icon in order to measure the salinity of the fresh water.

12. Click on the **Table** icon on the bottom part of the screen. A table will be displayed for data record.

13. Replace the fresh water beaker with the sea water beaker. If you used water from a river or a lake, wash the probe with the wash bottle and the plastic container.

14. When the reading stabilizes, click on the **Single Step** icon in order to measure the salinity of the sea water.

15. Your data should be similar to the following (salinity levels of fresh and sea water may vary between different locations).



16. Click on the **Export** Icon and then on the **Save value table (.CSV)** button to save your data.

17. Move the sea water sample aside.

18. Disconnect the salinity sensor and connect the pH sensor to the USB-200 module. Also attach the pH sensor's probe to the utility stand.

19. Check that the pH sensor is identified.

20. Wash the pH sensor's probe with the wash bottle and the plastic container.

21. In order to offset the sensor, insert the probe into the pH 7 buffer solution (If a buffer solution is not available distilled water can be used instead).

    Wait until the value has stabilized; press on the sensor's offset button continuously (3 seconds), or use the reset button in the **Module setup** menu (after clicking on **Extra command**). This will offset the sensor to a value of 7 (the value appears in the module window).

22. Wash the sensor's probe again and put it in the fresh water sample.

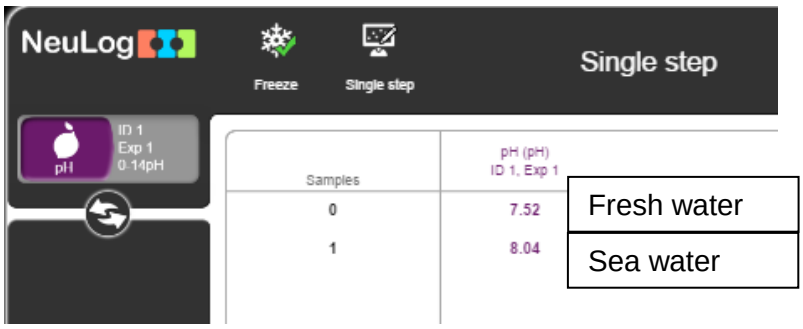
23. When the reading stabilizes, click on the **Single Step** icon in order to measure the pH of the fresh water.

24. Click on the **Table** icon on the bottom part of the screen. A table will be displayed for data record.

25. Replace the fresh water beaker with the sea water beaker. If you used water from a river or a lake, wash the probe with the wash bottle and the plastic container.

26. When the reading stabilizes, click on the **Single Step** icon in order to measure the pH of the sea water.

27. Your data should be similar to the following (pH levels of fresh and sea water may vary between different locations).



28. Click on the **Export** Icon and then on the **Save value table (.CSV)** button to save your data.

29. Fill the following table with your results.

	Salinity [mg/L]	pH [mg/L]
Fresh water		
Sea water		

30. In the sample experiment, the sea water had a salinity level of 39,337 mg/L, which is around 100 times more than the fresh water measurement. As expected, the pH of the sea water (8.04) was higher than the fresh water (7.52).

Summary questions

1. What is the source of salt in sea water?

2. What is the impact of ocean acidification on marine life?

3. Population growth, industrialization and urbanization are creating an imbalance between water use and water resources. Desalination is the removal of salt from water and is proposed as one of the solutions for water scarcity.

   Read about the topic and write your opinion about this solution.

   Propose another solution for this problem.