11. Soil Salinity

Let the Radish Decide

Driving Question

What impact can increased salinity have upon ecosystems?

Materials and Equipment

For each student or group:

- ☐ Data collection system
- ☐ Conductivity sensor
- ☐ Graduated cylinder, 25- or 50-mL
- ☐ Beaker, 250-mL
- ☐ Test tubes (8)
- ☐ Test tube stoppers (4)
- ☐ Water samples from different locations (3)
- ☐ Soil samples (4)
- ☐ Distilled water, 100 mL
- ☐ Paper towels, for spills
- ☐ Wash bottle with distilled water
- ☐ Small funnel

Safety

Add these important safety precautions to your normal laboratory procedures:

- Wear aprons to protect clothes
- Use gloves if you have a cut or break in your skin
- Wash your hands with soap and water after this activity

Thinking about the Question

You may have read or seen movies about characters stranded on desert islands, who now must survive by their wits and skills. In such scenarios, it is always important for the character to find a source of fresh water, even when the ocean and all of its water is right there. Why can the stranded person not just drink the salt water?

_____

_____

Discuss with your lab group members how you can tell that salt has been dissolved in water.

_____

_____

_____

The amount of dissolved salt, or the "saltiness" of water or soil is known as salinity. Why should we be concerned about salinity levels in our soils and water systems?

_____

_____

_____

Sequencing Challenge

☐ **The steps below are part of the Procedure for this lab activity. They are not in the right order. Determine the proper order and write numbers in the circles that put the steps in the correct sequence.**

Place a stopper in the test tube to seal it, and shake to mix the soil and distilled water.	Collect and label water and soil samples.	Remove sticks, rocks, and other large particles from the soil samples.	Place each soil sample in a test tube and add distilled water to the soil.	Make sure each lab group member is aware of the safety rules and procedures for this lab.

Investigating the Question

☐ **Note:** When you see the symbol "[2]" with a superscripted number following a step, refer to the numbered Tech Tips listed in the Tech Tips appendix that corresponds to your PASCO data collection system. There you will find detailed technical instructions for performing that step. Your teacher will provide you with a copy of the instructions for these operations.

Part 1 – Making predictions

1. ☐ Write your predictions for the following:

   a. Ocean water generally has a conductivity of about 53,000 µS/cm. Predict which, if any, of your water or soil samples will have a conductivity close to that of ocean water.

_____

_____

   b. Predict how the conductivity of your soil samples will differ from the conductivity of your water samples.

_____

_____

Part 2 – Testing the water samples

2. ☐ Identify each sample of water according to its origin. Label the test tubes "A", "B", "C", and "D". Fill test tubes A, B, and C about half full; fill each with a different water sample. Fill test tube D about half full with distilled water.

3. ☐ Start a new experiment on the data collection system. ◆(1.2)

4. ☐ Connect a conductivity sensor to the data collection system. ◆(2.1) Select the appropriate range of sensitivity for the conductivity sensor. ◆(4.2)

5. ☐ Display Conductivity in a digits display. ◆(7.3.1)

6. ☐ Insert the conductivity sensor into test tube A and monitor in the digits display without recording. ◆(6.1)

7. ☐ When the reading has stabilized, record the conductivity in Table 1 below.

8. ☐ Rinse the conductivity sensor with distilled water, using the wash bottle and beaker.

9. ☐ Repeat these conductivity test steps for the other three water samples and record the results in Table 1.

Table 1: Water sample conductivity

	Test Tube A	Test Tube B	Test Tube C	Test Tube D
Conductivity (µS/cm)				

Part 3 – Testing the soil samples

10. ☐ Carefully remove any large particles from the soil samples including sticks, twigs, leaves, or rocks.

11. ☐ Place 1/2 teaspoon of each soil sample in separate test tubes, using the funnel if necessary. Label the test tubes "1", "2", "3", and "4".

12. ☐ Add 25 mL of distilled water to each test tube.

13. ☐ Place a stopper into each test tube and shake gently.

14. ☐ Remove the stopper from test tube 1 and insert the conductivity sensor. Make sure that you have selected the appropriate range for the conductivity sensor. ◆(4.2) Monitor conductivity in the digits display without recording. ◆(6.1)

15. ☐ When the reading has stabilized, record the conductivity in Table 2 below.

16. ☐ Rinse the conductivity sensor with distilled water, using the wash bottle.

17. ☐ Repeat these conductivity test steps for the other three soil samples and record the results in Table 2.

Table 2: Soil sample conductivity

	Test Tube 1	Test Tube 2	Test Tube 3	Test Tube 4
Conductivity (µS/cm)				

Answering the Question

Analysis

1. How did your predictions from Part 1 compare to the results in Parts 2 and 3?

_____

_____

2. The conductivity sensor measures a solution's ability to conduct electrical current. How is conductivity related to the salinity of a solution?

3. Why did you measure the conductivity of distilled water? What is the purpose of this sample in the experiment?

4. What factors do you think contributed to your findings?

5. What relationship is there between soil salinity and water salinity?

6. How will salinity impact the health of an ecosystem?

True or False

☐ **Enter a "T" if the statement is true or an "F" if it is false.**

_____ 1. The conductivity sensor measures the ability of a solution to conduct an electrical current.

_____ 2. The unit in which conductivity is measured is the microsiemens per centimeter, abbreviated µS/cm.

_____ 3. Water is able to dissolve many different types of solids, including salts.

_____ 4. The higher the conductivity measurement, the lower the concentration of dissolved salts in the solution measured.

_____ 5. Ocean water generally has a conductivity of around 53,000 µS/cm.

_____ 6. Rinsing the conductivity sensor between measurements helps avoid contamination from one sample to the next.

_____ 7. In order for the conductivity of a substance to be measured, it must be in liquid form.

_____ 8. Radish or other types of seeds will probably germinate and thrive in soil that has a salinity of 100,000 µS/cm.

Key Term Challenge

☐ **Fill in the blanks from the randomly ordered words below. Words may be used more than once:**

solvent	universal solvent	salinity	solution
mixture	water	solute	control

1. Water is often called the _____ because of its ability to dissolve so many substances.

2. The amount of dissolved salt in water or soil is known as _____.

3. In Part 2 of this lab activity, the conductivity of distilled water was measured because it was the _____ in this experiment.

4. Any substance capable of dissolving another substance is known as a/an _____.

5. A/an _____results when one substance, often a solid, dissolves in another substance, often a liquid, and results in a mixture in which each substance retains its characteristic properties.

6. A/an _____such as sugar water or salt and pepper can be separated into the substances that make it up, based on the physical properties of the individual substances.

7. In a salt water solution, the salt is the _____and the water is the_____.

8. Many different substances, including gases, liquids, and solids, can dissolve in _____ to form solutions.