The Tragic Case of Winter Plant Roadkill

On a recent visit to Northville, Up North, you are shocked to see miles and miles of dead and dying plants lining the highway… in the springtime! The snow has melted and the temperatures have risen, but the plants near the road are showing no signs of life. Desperate to revive the perishing landscape, you turn to the internet, some books, and your lab to investigate what might be happening and how you might be able to fix it.

A truck spreading salt on an icy road.

In your research, you encounter the following information about northern climates:

In colder climates that receive lots of snow during winter months, ice and snow can accumulate on roads making driving very difficult and hazardous. In addition to shoveling the snow and ice away, salt trucks often dump tons of rock salt on roads to help melt the ice and make the roads less slippery. While this approach may save human lives from traffic accidents, the runoff of the salt into surrounding ecosystems may have severely damaging effects on both terrestrial and aquatic plants and animals.

You also remember from studying biology that molecules, including water, always move down their concentration gradient. This sometimes causes water to be lost from plant and animal cells, causing them to shrink and shrivel, and sometimes causes water to be gained, causing cells to swell and possibly even burst.

To investigate the situation further, you decide to simulate the salty run-off road conditions for some plants and record your observations and measurements. The question you're trying to answer is:

Why do you think the plants along the road in Northville, Up North were shriveling and dying even though the snow had melted and the temperatures had warmed up?

<u>Part 1</u> – The effect of saltwater on plant roots

To simulate the effect of saltwater from roads on plants' roots, you will use potatoes (a root vegetable) in cups of varying levels of salt.

1. Obtain 4 cups and label them 0%, 5%, 15%, and 25%.
2. Pour 30 mL of the corresponding salt water solution into each labeled cup.
3. Obtain 4 pieces of root potato.
4. Find the mass of one piece of potato, record the mass in your data table, and place the potato in front of the 0% cup.
5. Repeat step 4 for the other pieces of potato, placing each in front of a different cup and recording the mass in the appropriate place in your data table.
6. When all potatoes have been massed, place the potatoes in the cups and allow them to soak overnight.
7. Place your potatoes in the area designated by your teacher.
8. The next day pick up your soaking potato pieces and return them to your lab table.
9. After the potatoes have finished soaking, remove each piece from the cup with a plastic fork (do NOT stab the potatoes, scoop them out), carefully blot it dry with a paper towel, and find the final mass. Use the SAME scale you used to get their initial mass. Record the final mass of each potato in your data table.
10. Find the change in each potato's mass by subtracting the initial mass from the final mass. This number may be positive or negative.
    - change in mass = final mass – initial mass
11. To clean up, throw the pieces of potato away and carefully dump all solutions down the sink. Rinse and dry the cups and return them to their designated locations.

<u>Part 2</u> – Observing plant cells in distilled and salt water under the microscope

1. Obtain a microscope slide containing an elodea leaf (or some other very thin plant leaf).
2. Observe the slide under a microscope at both 10x and 40x resolution. Follow the Microscope Use Instructions.
3. Sketch a diagram of what you observe in your data table. (You may also choose to take a picture of the slide through the microscope lens with your phone.)
4. Add 4 drops of saltwater on the leaf. Cover the leaf with the cover slip.
5. Observe the microscope slide at both 10x and 40x resolution, and sketch a diagram of what you observe in your data table. (You may also choose to take a picture of the slide through the microscope lens with your phone.)
6. To clean up, return the microscope slides to their appropriate location, and turn off the microscope light.

Name: _____ Date: _____ Period: _____

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Data

Part 1

Solution	0% (Water)	5% Saltwater	15% Saltwater	25% Saltwater
Initial Mass				
Final Mass				
Change in Mass				

Part 2

Include the following labels in your diagrams: **cell wall, cell membrane, and chloroplast**

Plant Cells in Water	Plant Cells in Saltwater

Discuss

Part 1 – Discuss these questions with your group and jot down the answers on the white board.

- Was water gained or lost by the potato cells in the 0% (plain water) solution? How do you know? What about for the other solutions? What evidence do you have?
- Why was water gained by some cells but lost by other cells? (hint: you'll need the word osmosis in your discussion)
- Why was it so important to measure the mass of the potatoes before they were placed in the cups?
- Why was it so important to blot them dry before the mass was found at the end?

Part 2

- How did the plant leaf cells in the saltwater look compared to the cells in the regular water?
- What do you think happened to the plant leaf cells in the saltwater? (hint: you'll need the word osmosis in your discussion)
- What do you think would happen if you placed the plant leaf cells back into regular water for an extended time?

<u>Conclusion</u>: Claim, Evidence, Reasoning

Question: Why do you think the plants along the road in Northville, Up North were shriveling and dying even though the snow had melted and the temperatures had warmed up?

Claim *an **answer** to the question*

Evidence *summary of the data, including **measurements**, **calculations**, and **observations***

Reasoning *background knowledge and science that **supports the claim based on the evidence***

- Some words you'll use: osmosis, concentration, shrink or shrivel, swell, etc
- Think about: Why did some potato roots lose water while others gained water? Would the plants next to the heavily salted roads probably gain or lose water? Why? How would this affect the plants and their ability to live and grow?

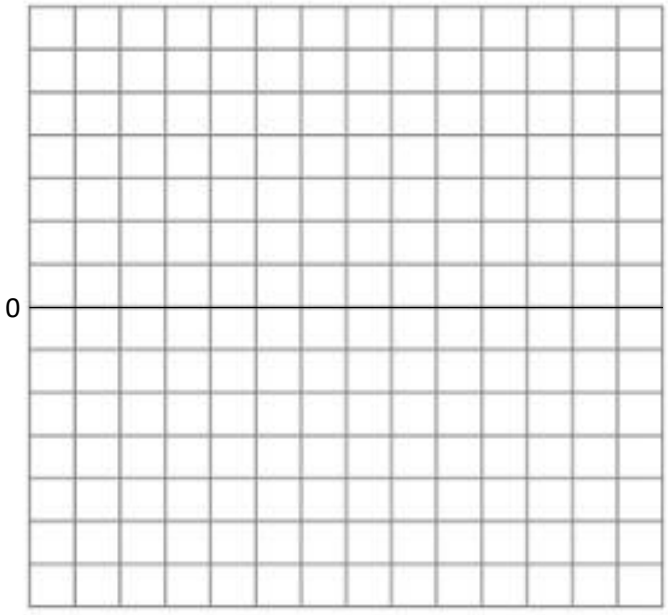
Name: _____ Date: _____ Period: _____

The Tragic Case of the Drowning Potatoes

Below is the class data average collected from the osmosis activity. USE A PENCIL!

% salt solution	Mass change (g)
0	0.6
5	0.1
15	-0.8
25	-1.0

Graph the data below. Be sure you label all axis, use variables, include a title, etc.



Answer the following:

1. Write a claim for your graph.

2. Why do plant cells lose water when surrounded by salt water?

3. At what %salt solution would the potato be in homeostasis/isotonic solution?

4. What type of tonic solution are the potatoes in that gained mass?

5. What type of tonic solution are the potatoes in that lost mass?