

Osmosis with Potato Slices

Last Updated: July 2022

GOAL: To demonstrate the concept of osmosis using potatoes and fruit.

TN STATE STANDARDS: 7.LS1.2 Conduct an investigation to demonstrate how the cell membrane maintains homeostasis through the process of passive transport.

This lesson was adapted from Vanderbilt Student Volunteers for Science. Additional information about the lesson may be found at <https://studentorg.vanderbilt.edu/vsvs/>.

Lesson Outline:

- I. Demonstration of diffusion with vanilla and a balloon
- II. Osmosis with potato slices in distilled and salt water
- III. Illustration Using a Superabsorbent Polymer
- IV. Demonstration with fruits and vegetables
- V. Examples of Osmosis in Beans and Fruits

Materials in Kit:

- 5 balloons
- 1 bottle vanilla
- 5 pipettes
- 16 16 oz. clear cups
- 32 5 oz translucent cups, marked at 30 mL
- 16 plates
- 1 container of sodium polyacrylate
- 32 teaspoons
- 16 containers of salt (students will share)
- 16 250mL bottles of distilled water
- 1 funnel
- 1 gal. extra DI water (if you have more than 3 classes, you'll need to refill the bottles)
- 1 Ziploc bag containing 16 small petri dishes and lids labeled "#1 - Water"
- 1 Ziploc bag containing 16 small petri dishes and lids labeled "#2 - Salt"
- 1 jar of toothpicks
- 1 binder with documentation and activity sheet
- assorted dried fruits/beans

Materials to be provided by STF:

- Potatoes (one per class should be plenty; red skins work best)
- Materials for slicing spuds in the classroom

Prepare ahead of time:

- Start some of each dried fruit soaking in water the night before.
- If potatoes must be sliced ahead of time (not recommended), store in a 1% salt solution.

I. Vanilla Demonstration

- Pipette some vanilla into the balloon, blow it up and tie it.
- Pass the balloon around and have the students smell it.
- Ask them if they can smell the vanilla. If they can, it's due to diffusion of vanilla through the balloon.

II. Experiment: Osmosis in Potatoes

Distribute the following materials to each pair:

- 1 Potato Activity Sheet
- 1 250mL bottle of distilled water
- 2 5 oz. cups, marked to 30 mL
- 1 container of salt
- 1 spoon
- 1 petri dish and lid labeled “#1 – Water”
- 1 petri dish and lid labeled “#2 – Salt”
- 1 plate with 2 rectangles of potato on a sheet of paper towel.

Have each group do the following:

- Pour distilled water into the two small cups, to the 30 mL mark.
- Place the 2 petri dishes on the appropriate sections of the Potato Activity Sheet.
- Tell the students to very carefully feel how rigid or floppy the potatoes are. (Warn them to NOT break them.)
- Petri dish #1 / Distilled Water
- Trace one of the pieces of potato on the first section of the Potato Activity Sheet.
- Place it in the bottom of the petri dish that is next to its tracing.
- Pour distilled water from one of the cups into this petri dish #1, so that the potato slice is completely covered and place the lid over the petri dish.
- Petri dish #2 / Salt Water
- Make the salty water by putting 1 tsp. of salt into the other 5 oz. cup and stirring until it is dissolved (it will not matter if there is some solid remaining).
- Trace the other piece of potato on the second section of the Potato Activity Sheet.
- Place it in the bottom of the petri dish #2, which is next to its tracing.
- Pour the salt solution into this petri dish #2, so that potato slice is submerged and place the lids over the petri dish.
- Record the Start Time at the top of the page.
- Leave the experiment undisturbed while you do the next activity.

III. Observing Osmosis with a Superabsorbent Polymer

Give each pair the following:

- Large (16 oz.) cup containing 1 tsp. sodium polyacrylate crystals
- 5 oz. cold tap water (reuse 5 oz. cup from previous experiment)
- spoon

Have each pair do the following:

- Pour the water into the cup with the crystals and stir with a spoon.
- Observe that all the water is absorbed (forms a gel) immediately. This is osmosis - the water moved into the white powder.
- Use the spoon to remove about 2 tsps. of gel and put it back into the 5 oz. cup.
- Add a pinch of salt to the 5 oz. cup and observe water diffuse out of the gel.
- Add a little more salt or give the gel a swirl to speed things along.

IV. Examples of Osmosis in Beans and Fruits

- While the potatoes continue to soak, show students the difference between the dried beans, fruit, etc., and those that have been soaking overnight.
- Explain to them that water was absorbed through osmosis. In the case of the rhubarb, the absorbed water causes pressure (called turgor pressure) inside the cells, so that some cells burst open and curl.

V. Checking the Potatoes

After 25 minutes, have each pair do the following:

- Remove the first potato slice from the distilled water and very gently blot it on a paper towel.
- Place the potato slice on the original drawing and compare. Fit the potato to one short end of the trace (rather than a long end) and note changes in the length.
- Notice how the potato feels (can it be bent?).
- Remove the slice from the salt solution, blot gently, and compare to original tracing. Again, notice how the potato feels.
- Students should observe the following:
 - The potato slice in the distilled water is longer (and larger), indicating that more water molecules went into the potato than came out, because there was a higher concentration of salt water outside of the potato. The potato is also stiffer.
 - The potato slice in the salt solution is shorter (and smaller), indicating that more water molecules came out of the potato than went in, because there was a higher concentration of water inside the potato. This potato is very limp.

OBSERVATION SHEET

Start time: _____

<p style="text-align: center;">Potato Tracing #1</p>	<p style="text-align: center;">Petri Dish #1 (add distilled water)</p>
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How has the potato changed its size?

How does it feel different?

<p style="text-align: center;">Potato Tracing #2</p>	<p style="text-align: center;">Petri Dish #2 (add salt solution)</p>
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How has the potato changed its size?

How does it feel different?