

DIFFUSION/OSMOSIS INVESTIGATION SET UP

Semi-permeable Membrane Activity

Teacher Note: Starch will turn dark blue/black when it comes in contact with iodine. *Wait to tell students this until after they have completed the activity.* They may be able to figure it out for themselves with some probing questions.

Lab Safety

The iodine solution can be an irritant if it comes in contact with skin or eyes. Be sure that students wear disposable gloves and goggles. It will also stain fabric, so make sure students are aware of this in advance. Have students wear lab aprons/coats if they are available.

Materials

- Ruler
- Digital scale
- Gloves and goggles
- Deionized or distilled water (*Do not use tap water!*)
- Dialysis tubing
- String
- Starch (cornstarch or potato starch)
- Glucose (powdered)
- Iodine (as iodine/potassium iodide, e.g., Lugol's Iodine)
- Transfer pipettes
- Spoon/stirring rod
- Beakers (250 mL, 500mL)
- Graduated cylinder
- Small container (e.g., paper/Dixie cups, specimen cup, small beaker)
- Glucose test strips

Teacher Prep

1. Cut 15cm lengths of dialysis tubing, one (1) per student group plus a few extras for inevitable tears or leaks. Soak for at least 15 minutes in distilled water.
2. **Starch solution (2%):** Dissolve 2g of starch into 100mL of boiling distilled water.
3. **Glucose solution (30%):** Dissolve 30g of glucose into 100mL of distilled water.
4. Combine starch and glucose solutions together in a single beaker. Mix well.
5. Add 5-10mL of the mixture into small cups/beakers/etc., one per student group.

Student Instructions

1. Add 100mL of distilled water to a beaker.
2. Use a glucose test strip to check for the presence of glucose in the beaker. (**Teacher Note: The strip is used here because once iodine is added to the water, it will stain the test strip.**)
3. Add 1mL of the iodine to the beaker and stir well. (**Teacher Note: Decide in advance how you will distribute this to students without contamination; e.g., enough bottles for each student group, pre-measured, bottle passed around, etc.**)

4. Use a glucose test strip to confirm the presence of glucose in this glucose/starch solution your teacher has provided.
5. Get a piece of wet dialysis tubing. Tie off one end with a piece of string. Be sure to knot it tightly so that it does not leak. **(Teacher Note: Decide in advance how you will distribute this to students. If time is a concern, this step could be prepped for students in advance.)**
6. Use a pipette to fill the tube up halfway with the glucose/starch solution. **(Teacher Note: If students struggle to open the tubing to add the solution, have them put the clean tubing back into distilled water for a few minutes and try again.)**
7. Leaving some air space in the tube, tie off the other end with a piece of string to create a "cell." Be sure to knot it tightly so that it does not leak.
8. Rinse off the cell, lightly pat it dry, and weigh it.
9. Put the cell into the beaker of iodine solution and wait for 15 minutes.
10. After 15 minutes, record any visible changes you observe in the cell and in the solution.
11. Remove the cell from the iodine solution, lightly pat it dry, and weigh it.
12. In a separate small container add 1mL of the iodine solution and 9 mL of distilled water. Stir well. **(Teacher Note: A dilution is used here to reduce test strip staining due to iodine. Since students are only looking for presence/absence of glucose, the concentration details are not important for this activity.)**
13. Use a glucose test strip to check for the presence of glucose in the iodine solution

Dialysis Experiment

Lab Safety

None of the materials used in this lab present safety concerns. However, students should still wear gloves and goggles as a standard safety practice.

Materials

- Ruler
- Digital scale
- Gloves and goggles
- Deionized or distilled water (*Do not use tap water!*)
- Dialysis tubing
- String
- Glucose (powdered)
- Transfer pipettes
- Spoon/stirring rod
- Beakers (250 mL, 500 mL)
- Graduated cylinder
- Glucose test strips

Teacher Prep

1. Cut 15cm lengths of dialysis tubing, five (5) per student group plus a few extras for inevitable tears or leaks. Soak for at least 15 minutes in distilled water.
2. Make a 10% glucose solution (100 mg/L) in distilled water. Each student group should get 50 mL of the solution.

Student Instructions

1. Fill beakers with 100 mL of distilled water. Label one “control” and the other “0% glucose.”
2. Fill 3 more beakers, each with 100 mL of distilled water. Label each of them with the concentrations of glucose you decided to use. **(Teacher Note: The most common glucose testing strips are only sensitive enough to measure concentrations of 1, 3, 10, and 30 mg/mL, so keep this in mind if you are letting students select their own experimental concentrations.)**
3. Measure the appropriate amount of glucose powder for each concentration and add it to the appropriate beakers. Stir until the glucose is dissolved.
4. Use a glucose test strip to measure the amount of glucose in each beaker. Follow the timing directions exactly. If you check the strip too soon or wait too long, the measurement will not be accurate. **(Teacher Note: If left to sit long enough, the glucose test strips will saturate and all of them will turn to the darkest color regardless of actual concentration in the solution. In some cases, this can occur in as little as five minutes.)**

5. Get 5 pieces of wet dialysis tubing. Tie off one end of each one with a piece of string. Be sure to knot them tightly so that they do not leak. **(Teacher Note: Decide in advance how you will distribute this to students. If time is a concern, this step could be prepped for students in advance.)**
6. Add approximately 10 mL of distilled water to one tube for your control.
7. Leaving some air space in the tube, tie off the other end of with a piece of string to create a “cell.” Be sure to knot it tightly so that it does not leak.
8. Add approximately 10 mL of the 10% glucose solution your teacher made to the next tube. **(Teacher Note: Decide in advance how you will distribute the solution.)**
9. Leaving some air space in the tube, tie off the other end of with a piece of string to create a “cell.” Be sure to knot it tightly so that it does not leak.
10. Rinse off each cell, lightly pat it dry, and weigh it.
11. Repeat steps 8-10 for the remaining cells.
12. Put each cell into a beaker and wait for 15-20 minutes. Be sure your cell with only distilled water inside goes in your control beaker.
13. After 15-20 minutes, rinse off a cell, lightly pat it dry, and weigh it.
14. Use a glucose test strip to measure the amount of glucose in the beaker. **(Teacher Note: With the limited sensitivity of the glucose testing strips, it is unlikely that the glucose in the beaker will show a measurable change in concentration. Have students measure it anyway to confirm the presence of glucose in the water before and after the experiment.)**
15. Repeat steps 13-14 for the remaining cells and beakers.