



Chapter 5 Project

A “Beary” Gummy Experiment

Project Goal + Timeline

In this project, you will be reviewing your knowledge of diffusion and osmosis by conducting a 24-hour gummy candy experiment. You’ll soak gummy bears in distilled water and in NaCl solutions with different concentrations overnight. You will record the mass of the gummy bears before and after the overnight soak to explore the relationship between a solution’s tonicity and the passive transport of water. This project can be completed individually or in a group over 24 hours. The estimated active work time is two hours.

Directions

Part 1: Pre-lab Questions

Answer these questions before you begin your experiment.

1. Gummy bears will soak overnight in three solutions: (1) distilled water, (2) a 0.25 M NaCl solution, and (3) a 1.0 M NaCl solution. Assume the gummy bears are semipermeable in that they can absorb water but not NaCl. Based on this assumption, how do you expect the size of the bears to change in distilled water and in the 1.0 M NaCl solution? Explain your reasoning by discussing how the net movement of water might differ in these treatments. Would this movement be best described as passive or active transport?
2. What if the gummy bears are fully permeable to both water and NaCl? How would you expect the size changes of the bears to differ from your prediction for Question 1?

Part 2: The Gummy Bear Osmosis Experiment

Step 1. Use a permanent marker to label the four spoons and the four clear cups: “control,” “distilled water,” “1.0 M NaCl,” and “0.25 M NaCl.” Label both the side and the bottom of the cup. (The bottom label allows you to read the label when looking down.)

Step 2. Prepare a 1.0 M NaCl solution by dissolving 14.6 g of NaCl in 250 mL of distilled water. Prepare a 0.25 M NaCl solution by dissolving 3.7 g of NaCl in 250 mL of distilled water. Pour each solution into the appropriately labeled cup. Pour 250 mL of distilled water into the cup labeled “distilled water.” The cup labeled “control” will remain empty.

Step 3. Select four gummy bears of the same color. Then, label the individual bears by writing directly on each bear with your fine-tipped permanent marker. (That way, when you remove bears from the solution to mass them, you won’t forget which bear goes with which solution.)

Step 4. Now examine Table 1. Fill in the initial date and time for T_0 (timepoint 0, the initial time) with the date and time you begin the experiment. Take the mass of each bear. Record each bear’s initial mass at the appropriate location in the table.

TABLE 1: Gummy Bear Mass (g) Over Time for Different Solutions**Gummy bear mass (g) versus solution concentration**

Solution	T ₀ (initial time) Date: _____ Time: _____	T ₁ Date: _____ Time: _____	T ₂ Date: _____ Time: _____	T ₃ (final time) Date: _____ Time: _____	Net change in mass (g)
1.0 M NaCl					
0.25 M NaCl					
distilled water					
control					

Step 5. Add each gummy bear to the appropriately labeled cup. Notice that the control bear will not go into a liquid. Instead, it goes in the empty cup labeled “control.”

Step 6. Begin completing Table 2 by writing brief descriptions of the initial appearance of each bear in its cup. Optional: Take a top-down picture of each cup for later reference.

TABLE 2: Gummy Bear Appearance Over Time for Different Solutions**Gummy bear appearance versus solution concentration**

Solution	T ₀ (initial time) Date: _____ Time: _____	T ₁ Date: _____ Time: _____	T ₂ Date: _____ Time: _____	T ₃ (final time) Date: _____ Time: _____
1.0 M NaCl				
0.25 M NaCl				
distilled water				
control				

Step 7. After 30 minutes, observe the four cups. Observe each bear’s appearance for T₁ (timepoint 1).

Step 8. Gently remove each bear with the appropriately labeled spoon and place it on a paper towel to drain. *Be careful not to press or squeeze the bears.*

Step 9. Update Table 1 and Table 2 with the correct date and time for T₁. Gently take the mass of each bear. Record the mass of all bears into Table 1. Describe changes in each bear’s appearance or texture in Table 2. If no changes in appearance are detectable, write “No change.” Return bears to their solutions.

Step 10. Over the next 23 hours, take two more measurements. At each measurement, remove and mass the bears. Record the mass in Table 1 and appearance in Table 2. The final measurement, at timepoint 3 (T₃), should occur approximately 24 hours after T₀. The measurement for timepoint 2 (T₂) can happen anytime between T₁ and T₃, but, if possible, aim for 3–8 hours after T₀.

Step 11. After taking your final measurement at T₃, determine the net change in mass for each gummy bear by subtracting the mass at T₀ from the mass at T₃. Record the net change in mass for each gummy bear in Table 1.

Part 3 : Post-lab Questions

Answer the following questions about your experiment.

1. Briefly summarize your results from each of the three solutions. Then, review your answers to the pre-lab questions. Do you think your results suggest the gummy bears are semipermeable (permeable to water but not NaCl) or fully permeable (permeable to both water and NaCl)?
2. Abigail is planning to cook a pot of beans. First, she'll soak her beans overnight. She adds salt to the soak water to improve the flavor of the beans. However, after a 12-hour soak, Abigail notices the beans have swelled very little. Refer to your experimental result to explain to Abigail what likely occurred; what could she do now?
3. Centuries ago, people observed that adding salt to a field of crops reduced plant growth immediately and in the following years. What effect might salty soil have on plants? Explain your answer using the term "hypertonic."
4. Based on your findings, what is most likely to happen to red blood cells placed in distilled water?
 - a. The red blood cells will swell and could potentially burst due to the movement of water into them.
 - b. The red blood cells will shrink and shrivel up due to the movement of water out of them.
 - c. The red blood cells will remain the same size since they are in clean water.
 - d. The red blood cells will shrink or shrivel up because they are in a hypertonic environment.

To submit this project, submit answers to the pre-lab and post-lab questions and the completed Tables 1 and 2.

Project Materials

- 4 gummy bears (same color)
- Approximately 20 g NaCl (table salt, not iodized)
- 4 clear plastic cups, about 250 mL
- 4 disposable spoons
- Distilled water (Don't substitute with tap or "spring" water.)
- Fine-tipped permanent marker
- Scale or balance

Student Checklist

- ☐ Answer pre-lab questions
- ☐ Complete experiment and fill in data for Table 1 and Table 2
- ☐ Answer post-lab questions