

Names: _____ Date: _____

Student Exploration: Osmosis

Prior Knowledge Questions

1. What is the question you will be answering by using this Gizmo?

2. What is the difference between a **solvent** and a **solute**? Give an example of each.

Gizmo Warm-up

The *Osmosis* Gizmo™ shows a cell (red square) in a solution of purple **solute** particles dissolved in green **solvent** particles (water). Press **Play** and observe.

1. Which particles can pass through the cell membrane? _____

2. Which particles cannot pass through the cell membrane? _____

3. **Osmosis** is the **diffusion** of water molecules across the cell membrane. Explain how this simulation shows the process of osmosis.

Experimentation

- For each of the next 3 pages, you will perform experiments to answer questions about osmosis. For each page:
 - A. Read the question
 - B. Use the Gizmo to run an experiment
 - C. Record data on the data table
 - D. Answer all questions based on your data and observations.
- Always collaborate:
 - 1 person writes while the other uses the computer.
 - Switch at least every page.
- If you need assistance, ask a neighboring group for help before asking the teacher.

Question: How do solute concentrations affect the movement of water across the cell membrane?

1. Observe:

- i. Use the **Solute outside** slider to change the concentration of **solute** particles outside the cell.
- ii. Test several different concentrations for about 30 seconds each.
- iii. In each case, focus on how the **solvent** particles change inside and outside the cell. Record your data in the chart below.

Solute outside	Initial cell volume	Initial solvent particles	Final solvent particles	Overall change (increased or decreased)
	50%	Inside	Inside	Inside
		Outside	Outside	Outside
	50%	Inside	Inside	Inside
		Outside	Outside	Outside
	50%	Inside	Inside	Inside
		Outside	Outside	Outside
	50%	Inside	Inside	Inside
		Outside	Outside	Outside

A. When does solute outside the cell cause water (**solvent**) to move into (increase inside) the cell?

B. When does solute outside the cell cause water to move out of (decrease inside) the cell?

2. Summarize: In what direction does water always move during osmosis? (Hint: Water is moving toward something.) _____

3. In this experiment, identify the

i. Independent variable: _____

ii. Dependent variable: _____

iii. Constant (1) _____

4. Observe: Replay the simulation and wait until the numbers are not changing very much. What do you notice about the solute concentrations inside and outside of the cell?

This situation is called **equilibrium**.

5. Observe: What do you notice about the particle motion across the membrane after the solute concentrations have equalized? Do they stop moving across the membrane?

This situation is called **dynamic equilibrium**.

Question: How do solute concentrations affect the size of a cell?

1. Observe:

- i. Use the **Solute outside** slider to change the concentration of solute particles outside the cell.
- ii. Test several different concentrations for about 30 seconds each.
- iii. In each case, focus on whether the cell gets bigger or smaller (Switch to the BAR CHART tab). Record your data in the chart below.

Solute outside	Initial cell volume	Final cell volume	Overall Change (increased or decreased)
	50%		
	50%		
	50%		
	50%		

A. When does solute outside the cell cause the cell get larger?

B. When does solute outside the cell cause the cell get smaller?

2. In this experiment, identify the

- i. Independent variable: _____
- ii. Dependent variable: _____
- iii. Constant (1) _____

3. Summarize: You have observed examples of **osmosis**—the **diffusion** of a solvent (such as water) across a semipermeable membrane. Summarize what you have observed by filling in the blanks in the following paragraph:

A. During osmosis, water (solvent) moves away from an area of _____ solute concentration and toward an area of _____ solute concentration.

B. When there is a higher concentration of solute particles inside the cell, most water particles will move _____ the cell and the cell will _____.

C. When there is a higher concentration of solute particles outside the cell, most water particles will move _____ the cell and the cell will _____.

Extra Credit

Question: How do solvent concentrations affect the movement of water (solvent) particles across the membrane?

1. Observe: Set the **Solute outside** to 5. Test several different **Initial cell volumes** in order to change the initial amounts of **Solvent** inside and outside the cell. In each case, focus on how the **Solvent** particles change over time. Record your data in the chart below.

Solute outside	Initial cell volume	Initial solvent particles	Final solvent particles	Overall change (increased or decreased)
5		Inside	Inside	Inside
		Outside	Outside	Outside
5		Inside	Inside	Inside
		Outside	Outside	Outside
5		Inside	Inside	Inside
		Outside	Outside	Outside
5		Inside	Inside	Inside
		Outside	Outside	Outside

A. In what direction do solvent particles move when they are initially higher inside the cell? _____

B. In what direction do solvent particles move when they are initially lower inside the cell? _____

C. Recall that a **concentration gradient** is a difference in concentrations between two areas. During osmosis, does water move *down* its concentration gradient (from high to low concentrations) or *up* its concentration gradient (from low to high)?

D. Does this suggest osmosis is a form of **passive transport** or **active transport**? Explain.

4. In this experiment, identify the

iv. Independent variable: _____

v. Dependent variable: _____

vi. Constant (1) _____