Osmosis Simulator

Name: _____   **Period:** _____   **Date:** _____

> Open **peebedu.com** and navigate to **Osmosis Simulator**. Click the **Dive Into Osmosis!** button to begin. Read the introduction popup, which describes the three types of solutions — hypotonic, isotonic, and hypertonic — and how each affects cell volume.

Part 1 — Model Evaluation (MAPP Framework)

Scientific models are simplified representations of complex biological phenomena. Use the MAPP framework below to evaluate the Osmosis Simulator as a scientific model.

M — Mode

What type of model is the Osmosis Simulator? Describe how this computational simulation represents the process of osmosis. In your answer, identify at least three specific simulation elements and explain what each one is designed to show about water movement across membranes.

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A — Accuracy

(a) Identify two things this simulation represents **accurately** about osmosis and tonicity. For each, name the specific simulation feature and explain what biological concept it demonstrates.

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(b) Identify two things this simulation **oversimplifies or leaves out** about osmosis and cellular water balance. Consider what you cannot observe in the simulation that would be important for a complete understanding of how real cells regulate their water content.

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P — Purpose

What is the learning goal of this simulation? Explain how the Osmosis Simulator is designed to help you understand how external solute concentrations create hypotonic, isotonic, and hypertonic conditions that drive water movement across cell membranes. In your answer, connect at least one specific simulation feature to a biological consequence of osmotic imbalance in cells.

P — Permanency

Could this model change with new scientific evidence? Describe one way that new discoveries might change or improve a simulation like the Osmosis Simulator. Explain why scientific models, including computational simulations, are revised as new evidence becomes available.

Small-Group Discussion

With your group, discuss the following:

- What are the strengths of this simulation as a model for osmosis?
- What are its limitations?
- If you could add one feature to improve this simulation, what would it be and why?
- How does the simulation help you connect the direction of water movement to the relative solute concentrations inside and outside the cell?

Part 2 — NGSS Questions

1.

*Simulation Task: Set the Solute Concentration slider to **50** and observe the red blood cell. Note the Concentration Label, the Cell Mass reading, and the direction of water particle movement across the membrane.*

Describe what happens to water movement across the cell membrane when the solute concentration outside the cell equals the solute concentration inside. Explain why the cell stays the same size even though water molecules are still moving in both directions.

HS-LS1-3

2.

*Simulation Task: Move the Solute Concentration slider from **50** down to **10**. Watch the blue water particles, the cell size, and the Cell Mass display as the environment becomes hypotonic. Record the Cell Mass at slider values of 50 and 10.*

Explain why the red blood cell swells when placed in a solution with a lower solute concentration than its interior. In your answer, describe the direction of net water movement and how this relates to the difference in solute concentration on each side of the membrane.

HS-LS1-3

3.

Describe how the red blood cell changes when placed in a solution with a higher solute concentration than its interior. Explain why water leaves the cell under these conditions and how this causes the cell to shrink and develop a wrinkled appearance.

HS-LS1-3

4.

Predict what would happen to the red blood cell if you left the slider at 0 (pure water) for an extended time. Explain why a cell without a rigid outer wall is at risk of bursting in this environment, and describe how the concentration difference drives this outcome.

HS-LS1-3

5.

Explain why returning a shrunken cell to an isotonic environment allows it to regain its normal shape and mass. Describe how the change in the surrounding solute concentration reverses the direction of net water movement across the membrane.

HS-LS1-3

6.

*Simulation Task: Observe the cell at slider values of **10, 50**, and **90**. At each setting, note the cell size, the direction of blue water particle movement, and the positions of the green solute particles inside and outside the cell.*

In the box below, draw three side-by-side diagrams of a red blood cell in a hypotonic solution, an isotonic solution, and a hypertonic solution. For each diagram, use arrows to show the net direction of water movement and label the relative solute concentration inside and outside the cell.

Draw your diagrams here.

HS-LS1-3

7.

*Simulation Task: Move the slider to **0** and observe the extreme swelling, then move to **100** and observe the extreme shrinkage. Think about what would happen to many cells in a tissue or organ experiencing these conditions.*

Red blood cells are one of many specialized cell types that must maintain proper water balance to function. Explain how widespread osmotic damage to red blood cells could disrupt the ability of the circulatory system to deliver oxygen throughout the body. Describe why maintaining the correct fluid environment around cells is essential for the functioning of a multicellular organism.

HS-LS1-2