

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.

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.

(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.

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 – Free Response Questions

Conceptual Analysis

Question 1 – Osmotic Water Movement in Hypotonic Environments

*Simulation Task: Move the Solute Concentration slider to **10** and observe the red blood cell. Note the direction of water particle movement, the label that appears, and the Cell Mass reading. Then move the slider to **50** and compare. Record the Cell Mass at each setting.*

(A) (1 pt) **Describe** how the relative solute concentrations inside and outside a cell determine whether the external environment is hypotonic, isotonic, or hypertonic.

(B) (1 pt) **Explain** why a red blood cell placed in a hypotonic solution gains water and swells.

(C) (1 pt) **Predict** what would happen to the Cell Mass reading and the appearance of the red blood cell if you moved the slider to 0 (pure water with no external solute) and left it there.

(D) (1 pt) **Justify** your prediction by explaining how the concentration gradient between the cell interior and the external environment drives the net movement of water by osmosis.

Analyze Model / Visual Representation

Question 2 – Osmoregulation and Cell Survival

*Simulation Task: Set the Solute Concentration slider to **90** and observe the cell's response. Note the direction of water particle movement and the Cell Mass value. Then move the slider to **50** (isotonic) and observe how the cell recovers. Finally, move the slider to **10** and compare all three conditions.*

(A) (1 pt) **Describe** how osmoregulation maintains water balance and allows organisms to control their internal solute composition.

(B) (1 pt) **Explain** the relationship between the constant movement of water molecules across membranes and the maintenance of growth and homeostasis, even when a cell is in an isotonic environment.

(C) (1 pt) **Represent** the process of osmosis in all three tonicity conditions.

Draw your diagrams here.

(D) (1 pt) **Explain** how disruption of osmoregulation in kidney cells could lead to a failure to maintain homeostasis at the organism level.

EK 2.7.B.1, EK 2.7.B.2