

Name: _____ Period: _____ Date: _____

Open [peebedu.com](https://www.peebedu.com) and navigate to **Contractile**. Click the **Start Game** button to begin. Read the introduction popup, which describes how to control your single-celled organism, the three osmotic zones (hypotonic, isotonic, hypertonic), and how the contractile vacuole expels excess water to prevent lysis.

Free Response Questions

Question 1 – Conceptual Analysis

Simulation Task: *In the Contractile game, navigate your cell into the light blue (hypotonic) zone and observe the water level bar as it rises. Before the water level reaches 100%, press C to activate the contractile vacuole and note the change in both the water level and energy bars. Then move into the dark blue (hypertonic) zone and observe what happens to the water level.*

(A) (1 pt) **Describe** the function of the membrane-bound organelle that freshwater protists use to regulate their internal water content.

(B) (1 pt) **Explain** why a freshwater protist continuously gains water even though its membrane is selectively permeable, and why the cell would lyse without a mechanism to expel excess water.

(C) (1 pt) **Predict** what would happen to a freshwater protist if a chemical inhibitor blocked the function of its contractile vacuole while the organism remained in a hypotonic environment.

(D) (1 pt) **Justify** your prediction.

Question 2 — Analyze Model / Visual Representation

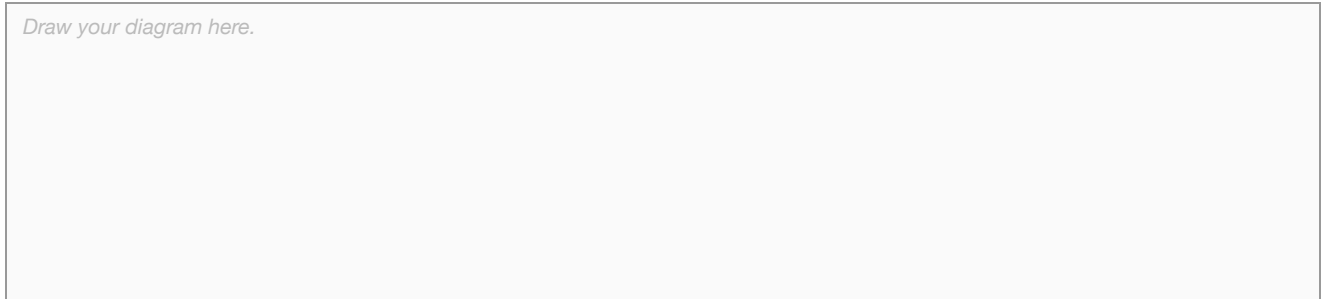
Simulation Task: Play the Contractile game and navigate your cell through all three zones: light blue (hypotonic), medium blue (isotonic), and dark blue (hypertonic). For each zone, observe the zone indicator label and note whether the water level bar increases, stays stable, or decreases. Record the zone color, its tonicity label, and the direction of water movement.

(A) (1 pt) **Describe** how the relative solute concentration of the external environment compared to a cell's interior determines whether the cell gains water, loses water, or remains stable.

(B) (1 pt) **Explain** why a cell placed in a hypertonic environment shrinks while the same cell placed in a hypotonic environment swells, even though water can move freely across the membrane in both cases.

(C) (1 pt) **Represent** the movement of water across a cell membrane by drawing three labeled diagrams showing a cell in a hypotonic, isotonic, and hypertonic solution, using arrows to indicate the net direction of water movement and showing the resulting change in cell size.

Draw your diagram here.



(D) (1 pt) **Explain** how variation in contractile vacuole pumping efficiency among freshwater protists could lead to differences in survival if the salinity of their environment decreased.

2.7.A.1, EK 2.1.A.7