

Name: _____ Period: _____ Date: _____

Open peebedu.com and navigate to **Membrane Explorer**. Click the **Explore the Membrane!** button to begin. Read the introduction popup, which categorizes molecules by their ability to cross the phospholipid bilayer: small nonpolar molecules freely cross, small polar molecules have limited passage, and ions and large polar molecules need channels.

Free Response Questions

Question 1 – Conceptual Analysis

Simulation Task: *In the Membrane Permeability Explorer, click **Add O₂** three times and **Add Na⁺** three times to place molecules in the extracellular space. Click **Run** and observe which molecules cross the bilayer and which do not. Note the concentration readouts for both O₂ and Na⁺ on each side of the membrane.*

(A) (1 pt) **Describe** the property of the interior of the phospholipid bilayer that determines which molecules can pass through the membrane without assistance.

(B) (1 pt) **Explain** why O₂ molecules reach equal concentrations on both sides of the membrane while Na⁺ ions remain concentrated on one side, even though both molecule types are present at high concentration in the extracellular space.

(C) (1 pt) **Predict** how the resting membrane potential of a neuron would change if a mutation caused its Na⁺ channel proteins to remain permanently open, allowing Na⁺ ions to flow freely across the membrane down their concentration gradient.

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

Question 2 — Analyze Model / Visual Representation

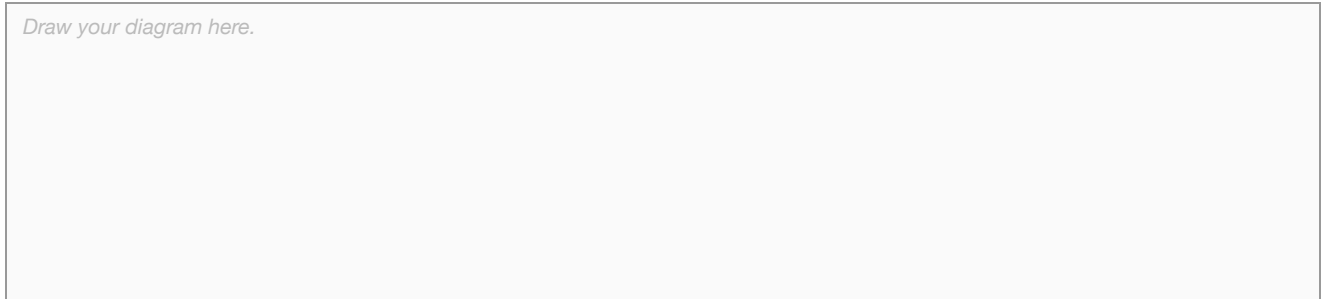
Simulation Task: Click **Reset** to clear all molecules. Then click **Add Water** five times and **Add Glucose** five times. Click **Run** and observe both molecule types for 15 seconds without adding any channels. Then click **Aquaporin (Water)** and **Glucose Channel** and observe the changes in transport rate and concentration readouts.

(A) (1 pt) **Describe** how the molecular composition of the membrane interior creates a barrier that prevents certain categories of molecules from crossing.

(B) (1 pt) **Explain** why water crosses the membrane slowly in small amounts without a transport protein, while glucose of similar polarity does not cross at all without one.

(C) (1 pt) **Represent** the selective permeability of the plasma membrane by drawing a labeled cross-section of the phospholipid bilayer showing a small nonpolar molecule passing through, a large polar molecule being blocked, and a channel protein allowing the large polar molecule to cross.

Draw your diagram here.



(D) (1 pt) **Explain** how a population of organisms migrating from a warm environment to a cold one could experience a change in allele frequencies for genes affecting membrane composition over many generations.

2.3.A.1, 2.4.A.2, 2.4.A.3