Prelab Information

**Purpose** Explore how materials move across a semipermeable membrane.

**Time** Approximately 45 minutes

**Question** What is the effect of the molecule size of a material on its ability to diffuse across a semipermeable membrane?

**Hypothesis** If molecules are small enough, then they will diffuse across a semipermeable membrane because they will be able to pass through its tiny openings.

**Summary** You will try to diffuse both glucose and sugar across dialysis tubing, a semipermeable membrane with similarities to the membrane around a cell.

**Variables** *Independent variable:* the molecule size of the material (Glucose is a smaller molecule than starch.)

*Dependent variable:* the ability to diffuse across a semipermeable membrane

Safety

 Always wear safety goggles and a lab coat when performing an experiment.

 Keep behavior in the lab purposeful. Use caution when working with chemicals.

 Check glassware, such as test tubes and beakers, for cracks and chips prior to use.

 Use the right tools, such as tongs, when handling hot objects.

 Report all accidents—no matter how big or small—to your teacher.

Lab Procedure

1. Gather Materials

 Droppers

 Stirring rod

 Seven test tubes

 Two 500 mL beakers

 Hot plate

 Distilled water

 Two lengths of dialysis tubing, each 15 cm long

 String

 Starch solution

 Lugol’s solution (starch indicator)

 Glucose solution

 Benedict’s solution (glucose indicator)

**Steps 2-4: Test Whether Starch Passes through the Semipermeable Membrane**

1. Verify Lugol’s Solution as an Indicator for the Presence of Starch

**a)** Label three test tubes “Water,” “Starch,” and “Glucose.” Add ten drops of water, ten drops of glucose solution, and ten drops of starch solution respectively.

**b)** Put ten drops of Lugol’s solution into each of the test tubes.

**c)** Gently swirl the contents of all three test tubes.

**d)** In your data table, record any color changes, which indicate that starch is present. (If the indicator solution works properly, only the test tube with the starch solution should show a change.) Keep these test tubes for reference during Step 5.

1. Prepare a “Membrane” for Testing Starch Solution

 **a)** Tie a knot in one end of a length of dialysis tubing.

**b)** Hold the tubing with the knotted end down. Carefully fill the tubing with starch solution so that the tube is half full.

**c)** Tie a knot in the top end of the tubing.

**d)** Rinse the tubing with water. (It is best to use distilled water, at least for the final rinse.)

1. Test for Diffusion of Starch through the Membrane

**a)** Fill a 250 mL beaker with 150 mL of distilled water. Add ten drops of Lugol’s solution to the

beaker, and mix with a stirring rod.

**b)** Place the tubing into the beaker. Observe the solution in the beaker and the dialysis tube;

record your observations in the data table.

**c)** Wait 15 minutes. Note the color of the solution in the beaker and the dialysis tube; record the results in the data table.

**d)** Did starch diffuse through the membrane? Record your answer and reason in the data table.

**Steps 5-7: Test Whether Glucose Passes through the Semipermeable Membrane**

1. Verify Benedict’s Solution as an Indicator for the Presence of Glucose

**a)** Label three test tubes “Water,” “Starch,” and “Glucose.” Add ten drops of water, ten drops of glucose solution, and ten drops of starch solution respectively.

**b)** Put ten drops of Benedict’s solution into each of the test tubes.

**c)** Place the test tubes in a water bath on the hot plate. Heat for five minutes.

**d)** In your data table, record any color changes, which indicate that glucose is present. If the indicator solution works properly, only the test tube with glucose solution should show a change. Keep these test tubes for reference during step 7.

1. Prepare a “Membrane” for Testing Glucose Solution

Repeat steps 3a through 3d exactly except with the glucose solution.

1. Test for Diffusion of Glucose through the Membrane

**a)** Fill a 250 mL beaker with 150 mL of distilled water. Add ten drops of Benedict’s solution to

the beaker and mix with a stirring rod.

**b)** Place the tubing into the beaker. Observe the solution in the beaker and the dialysis tube.

Record your observations in the data table.

**c)** Wait fifteen minutes. Transfer ten drops of the solution in the beaker to a test tube.

**d)** Place the test tube in a hot water bath, and wait for five minutes. Note the color of the solution in the test tube taken from the beaker. Record the results in the data table.

**e)** Did glucose diffuse through the membrane? Record your answer and reason in the data table.

1. Dispose of all materials and tools according to your teacher’s directions.

Data

Record your data either in your lab notebook or in the space below. For Data table 1 (Lugol’s test), mark a plus (+) if the color changes to blue and minus (-) if it does not change to blue. For Data table 1 (Benedict’s test), mark a plus (+) if the color changes to red and minus (-) if it does not change to red.

**Table 1: Indicator Tests**

|  |  |
| --- | --- |
| **Step 2: Color Change Due to Lugol’s Solution (starch indicator)** | **Step 5: Color Change Due to Benedict’s Solution (glucose indicator)** |
|  |  |
|  |  |
|  |  |

**Distilled Water**

**Starch Solution**

**Glucose Solution**

**Table 2: Diffusion Tests**

|  |  |
| --- | --- |
| **Step 4: Test for****Diffusion of Starch** | **Step 7: Test for****Diffusion of Glucose** |
| Initial color:Color after 15 minutes: | [Not observed] |
| Initial color:Color after 15 minutes: | Initial color:Color after 5 minutes boiling: |
| Y/N Reason: | Y/N Reason: |

**Color of Solution**

**in Dialysis Tube**

**Color of Solution in Beaker**

**Was there diffusion?**