

# Membrane Transport Lab

In today's lab you will investigate the behavior of cell membranes and the movement of molecules across membranes.

Scientific Method Connection: Observation of diffusion and osmosis. Asking questions and making predictions about the movement of fluids and solutes across membranes.

## Activity 1: Diffusion & Cell Size

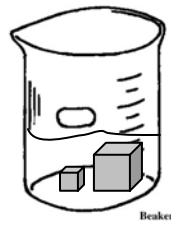
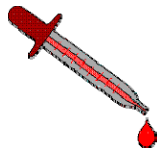
**Question:** How does cell size affect diffusion of solutes into and out of cells? Is there a maximum cell size? Why?

**Your hypothesis:** \_\_\_\_\_

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### Methods:

1. Obtain one small beaker and one large and one small potato cube.
2. Place the potato squares in the beaker and fill it with just enough water to cover the large cube.
3. Put two or three **full droppers** (not drops) of iodine in the beaker. The water should turn dark yellow or brownish.



4. Leave the beaker aside at your lab bench for at least **1 hour** while you answer the following questions and complete Activity Two.

**Questions:**

1. What kind of molecules are in the potato cells?
2. What kinds of molecules are in the beaker?
3. Of all the molecules listed above, which do you think could cross a semi-permeable membrane? Think about what you know of the structures of the molecules...
4. Based on your answers above, make a prediction about what you expect the results to be.

5. After at least **1 hour** remove the cubes and cut each one in half.
6. Draw a diagram of the results below.
7. Measure the full diameter of each cube and then measure the distance of diffusion of iodine into the cube. Calculate the percentage of diffusion into the cubes.

Small Cube (cell) width=	mm
Diffusion % =	

Large Cube (cell) width=	mm
Diffusion % =	

**Iodine can be used as a marker for starch because it turns black when it comes into contact with starch.**

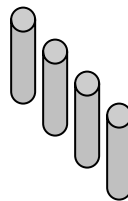
1. When you cut the cubes in half what did you find?
2. Why do you think living things are composed of many small cells instead of a few large cells?

### **Activity 2: Osmosis**

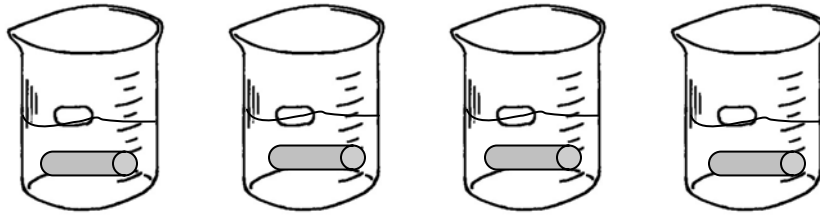
**Problem: How does exposure to sodium chloride solutions affect the weight of a potato? Remember, the potato is made of living cells, which are naturally about 0.85% NaCl.**

#### **Methods:**

1. Obtain 4 beakers and label them **0%, 1%, 3% & 5% NaCl** (sodium chloride).
2. Put ~100ml of the appropriate solution in each beaker.
3. Obtain 4 potato cylinders. Rinse them quickly in tap water and dry them with a paper towel. Weigh each one and record the starting weights in your data table.  
*Note: Keep track of which cylinder goes into each beaker.*



4. Place each cylinder in one of the beakers of solution. Still keeping track of which one is in each beaker.



5. After 15 minutes, remove the cylinders from the beakers. Dry them off quickly and weigh each one before placing it back in the cylinder. **AGAIN, BE SURE YOU KEEP TRACK OF WHICH CYLINDER CAME FROM EACH BEAKER AND PUT IT BACK IN THE CORRECT BEAKER.**

**Questions:**

1. What kinds of molecules are in the potato cells?
2. What kinds of molecules are in the beakers?
3. Which of the above molecules can diffuse through a semi-permeable membrane?
4. The concentration of saline inside of plant cells is about 0.85%. Which solution is hypertonic?
5. Which solution is isotonic?
6. Which solution is hypotonic?
7. What do you expect will happen to the potato cells when they are placed in each solution?

Write a hypothesis statement for each.

- a. Hypertonic:
- b. Isotonic:
- c. Hypotonic:

6. Repeat the weighing procedure at 15-minute intervals and record the data in your data table.

**Data Table One: Weight (in grams) of potato cylinders over time.**

Solution	Starting Weight	15 minutes	30 minutes	45 minutes
0% NaCl				
1% NaCl				
3% NaCl				
5% NaCl				

Because the potato cylinders were not the same exact weight at the beginning, it is more useful to compare their weight change as a percent. In order to calculate the percent weight change, use the following equation:

$$\% \text{ weight change} = \left( \frac{\text{weight at time } x - \text{starting weight}}{\text{starting weight}} \right) \times 100$$

Complete this calculation for each cylinder at each time interval and record the data below.

**Data Table Two: Percent weight change of potato cylinders over time.**

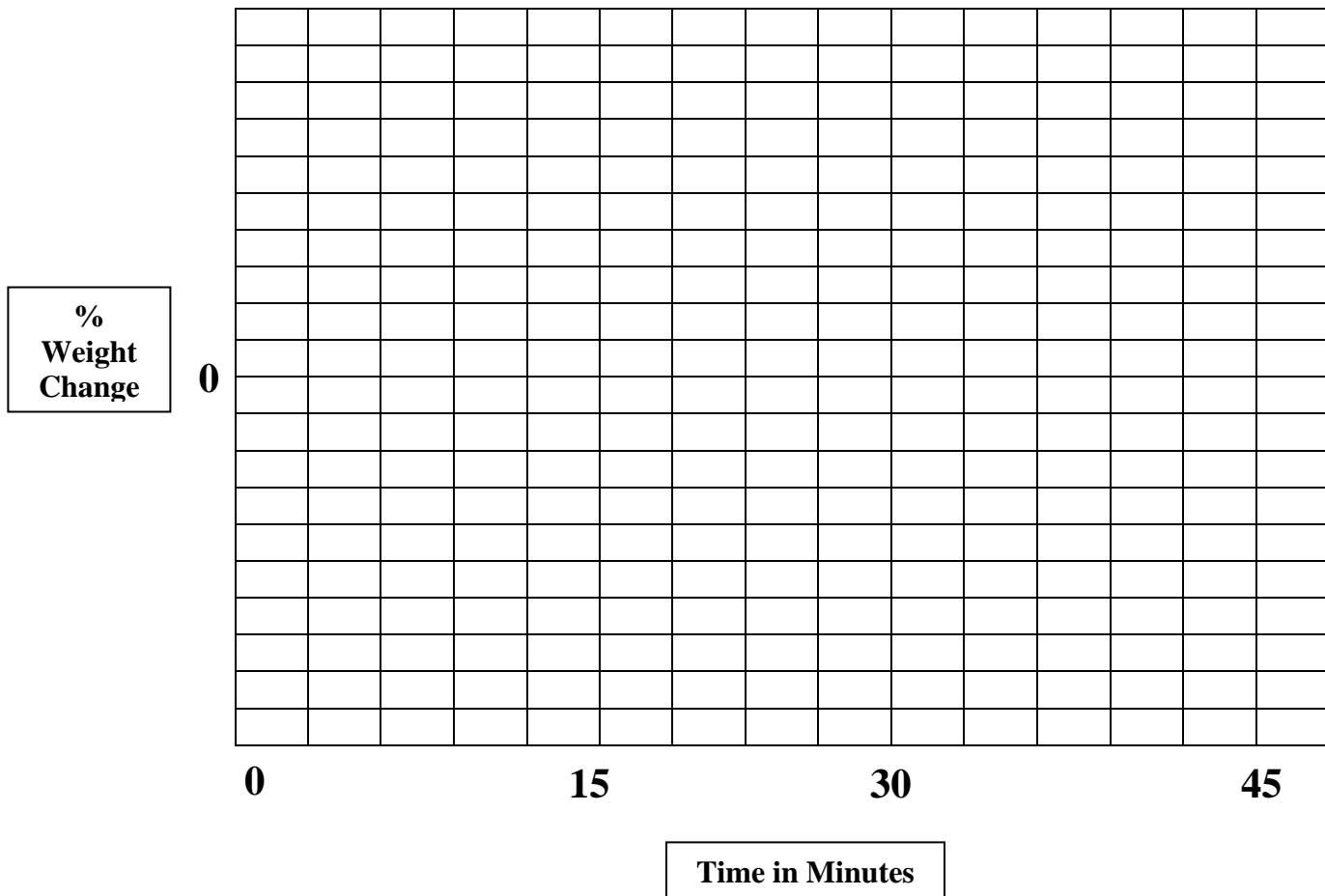
Solution	0 minutes	15 minutes	30 minutes	45 minutes
0% NaCl				
1% NaCl				
3% NaCl				
5% NaCl				

As you know, tables are an easy and efficient way to organize your data. They do not, however, allow you to see trends in data easily and graphically. For this reason, it is often better to **graph** your data using a bar graph or a line graph. The type of graph you choose will depend on what type of trend you are trying to show.

For data that show trends over **time**, line graphs are usually best. Construct a line graph below using the space provided and then answer the questions about your

findings. It should include four curves (one for each cylinder). *Tip: Use a different color pencil for each cylinder.*

**WEIGHT CHANGE OVER TIME OF POTATO CYLINDERS**  
**IN VARIOUS CONCENTRATIONS OF NaCl**



**Results:**

1. Did any of the cylinders gain weight? If so, which one(s)?
2. What kind of molecules made them gain weight? How?
3. Did any of the cylinders lose weight? How did that occur?
4. Were your hypotheses correct? Why or why not?