OSMOSIS AND PLASMOLYSIS

Name ______________________________

Sec ____ Date ______________

Introduction

Cell membranes are permeable to water but much less so to sodium chloride (NaCl or table salt). Thus, water can freely diffuse into or out of a cell, but sodium chloride cannot because the cell membrane is semipermeable. Diffusion of water across a semipermeable membrane is called osmosis.

In this investigation, you will

(a) quantify the effect of the concentration of sodium chloride on the mass of potato slices.

(b) graph your results

(c) in writing, summarize your findings and infer a possible explanation.

Materials (per pair of students)

potato	5% sodium chloride solution
razor blade or knife	10% sodium chloride solution
plastic cups -- 4	15% sodium chloride solution
balance	distilled water
graph paper	glass marking pencil or labels

Procedure

Cut a potato into at least 12 slices. Each slice should be about 1 cm thick and small enough to fit into the plastic cups. Determine the mass of the potato pieces in stacks of three. Record the mass of each stack of three potato slices in Table 1. Put a stack of potato slices into each of four cups numbered from 1 to 4. To cup 1, add enough distilled water to completely cover the slices of potato. Cover the slices in cup 2 with 5% NaCl solution, in cup 3 with 10% NaCl solution, and in cup 4 with 15% NaCl solution. Let the cups stand for at least one hour.

Remove the potato pieces from the cups. Quickly blot the slices with a paper towel and determine the mass of each stack. Record the mass of each stack after soaking in Table 1. In rows 3 and 4 of the table, indicate the amount of change in mass of each stack. Calculate the percent change by using the formula:

$$\frac{\text{Amount of increase or decrease}}{\text{Mass before}} \times 100 = \%\ \text{change}$$

Observe the appearance of each slice of potato. Record a brief description of the potatoes in the space below.

Table 1. Change in Mass of Potato Slices After Soaking in Various Concentrations of Sodium Chloride

	Cup 1 (0% NaCl)	Cup 2 (5% NaCl)	Cup 3 (10% NaCl)	Cup 4 (15% NaCl)
Mass before				
Mass after				
Amount of increase (+) or decrease (-)				
Percent change (+ or -)				

Following the rules of graphing presented in BS 118, graph the data in Table 1. On a separate sheet of paper, write a summary of the results of this investigation and a plausible explanation for these results. (*Hint*: Focus on the water, not the salt. A 15% NaCl solution is 85% water, whereas a 0% NaCl solution is 100% water. Reread the information in the introduction.)

GRAPHING RULES - BS 118

The general rules for making all graphs are the same. They are:

1. Choosing a title -- a brief description including manipulated, responding, and important controlled variables.

2. Selecting the proper axes for the variables (histograms may be an exception):

   a. Manipulated variable -- placed on the horizontal axis (independent)

   b. Responding variable -- placed on the vertical axis (dependent)

3. Labeling the axes -- give variable tested or measured.

4. Showing the unit of the variable -- place under or beside label.

5. Choosing the scales for the axes:

   a. Both need not be the same, e.g., one could be in 5s but the other in 100s.

   b. Should be evenly divided. Use 1, 2, 5, 10, 100, etc. (not 3, 4, 7, 8, 9,) because the graph paper being used is based on the decimal (base 10) system.

   c. Should start at zero. May show break in axis for clarity.

   d. Should be selected so graph covers at least one-fourth page.

6. Plotting the data points -- sometimes data need to be rounded.

7. Drawing of the bars or points (and best fit line).

Adapted from: Gabel, Dorothy. (1984). Introductory science skills. Prospect Heights, IL: Waveland Press.

Graphing Data Information Sheet

1. **Use graph paper for greater accuracy in plotting the data points.** Most of the graphs you see reproduced in publications do not show the grid of graph paper, however you can be sure that the first draft of the graph was drawn on graph paper. Later if you want to transfer the data to non-graph paper it is an easy job to trace from the graph paper.

2. **Use a ruler.** When you draw in the axes and the lines of a line graph or the bars of a bar graph use a straight-edge. Unless you are a very good and steady artist it is very difficult to free-hand a straight line.

3. **Use a good sense of proportionality.** For example, do not make the ordinate (vertical Y axis) 5 cm long and the abscissa (horizontal X axis) 50 cm long. This distorts your results.

4. **Make good use of space on the sheet of graph paper.** Do not use only a quarter of the sheet of graph paper to draw your graph.

5. **Draw in the axes.** Do not rely upon the margin of the graph paper as your axes.

6. **Label the axes.** The labels should clearly indicate what values are plotted and be sure to include the appropriate units. (biomass per plant, grams, etc.).

7. **The dependent variable is plotted on the ordinate and the independent variable is plotted on the abscissa.** The ordinate is the vertical Y axis and the abscissa is the horizontal X axis. The independent variable is what you manipulated and the dependent variable "depends" on the values of the independent variable.

8. ☆ **Use equal divisions along the axes.** An equal space should be given equal numerical values. (5,10,15 vs. 5, 7, 20, 24).

9. **Include a title.** A descriptive title is an important part of any graph.

10. **Decide whether you have "continuous" or "categorical" data.** Continuous data are best presented by line graphs and categorical data are best presented by bar graphs. Continuous data can assume an infinite range of numerical values (temperature, distance, weight, etc.). Categorical data fall into discrete categories (sex, blood type, etc.).

11. **Do not "smooth" the curves.** Connect the dots for your true data points and do not guess or interpolate a hypothetical curve unless you have done the appropriate statistical calculations.

12. **Be neat.** A very neat, clean, well-done graph leaves a good impression.