Part I: Lab Manual Questions

1.

Which substances were able to move through the dialysis tubing? How do you know? What was not able to move through the membrane? For the substances that moved through the membrane, which direction did they move? Was this with or against their concentration gradient?

The substances that were able to pass through the tubing were both the water with purple dye and Lugol's solution. The overall color of the solution when the substances moved through the tubing showed that this occurred. Both also moved from a high concentration to a lower concentration along their concentration gradient.

2.

What data do you have to support that this movement took place?

The data that is able to support the movement taking place is the change in color of the starch solution and the average absorbance rates recorded in the data tables. When the starch solution changed color, it meant that the cells were able to diffuse through the membrane.

3.

What substance(s) did not move through the membrane? Review your data and explain whether your data supports your answer.

Both the dyed water and the Lugol's solution were able to move through the membrane of the tubing. However, Lugol's solution saw a greater increase in absorption as time passed. The control group saw smaller absorbance changes than the solution, thus it was more difficult for the substance to pass through the dialysis tubing's membranes.

4.

Compare the movement of the substances to their molecular weight. Explain what may have been the limiting factor for the substance(s) that did not move through the dialysis tube.

The limiting factor for the substances that did not move through the tube must have been the size of the molecules. Larger molecules will have greater molecular weights, thus preventing them from passing through the tubing due to their larger size and weight. The iodine was small enough to pass through the membrane and be diffused.

5.

If the potato is placed in an isotonic solution, would it gain weight, lose weight, or have its weight remain the same? Why? Based on your graph and the trend line,

determine the molarity of the potato.
The potato would remain the same weight because in an isotonic solution, there is an equal number of solute concentrations between the cells and the environment. Thus, the
water inside and outside of the potato would remain in their original places as they have no need to exit nor enter the cells.

Part II: Lab Homework Assignment
Scatter Plot for Average Percent Changes in Potato Mass:
Figure 1:
The class average percent changes in potato mass.
The average mass of the potato
pieces appeared to decrease at every sucrose solution concentration. The equation generated
helps find the average percent change in mass at any sucrose solution. The unknown is demarcated by the heart shape

Discussion:
The purpose of this experiment was to observe diffusion and osmosis in living cells and artificial
systems such as dialysis tubing. During Part I, the potato pieces of the class's four groups
increased in mass when placed in the solutions dH2O and 0.2M sucrose solution. However, the
masses showed a decrease in the 0.4M sucrose solution for Groups 2 through 4, 0.6M sucrose,
0.8M sucrose, 1.0M sucrose, and the sucrose solution of unknown concentration. Thus, the
pieces increased and then decreased in mass. "Tonicity (ie, effective osmolarity) of a solution
refers to its property to cause osmotic fluid shifts into or out of cells suspended in it."
(Argyropoulos et al., 2016) The tonicities of each solution correlated with what occurred with the
potato cells because the dH2O and 0.2M sucrose solutions represented hypotonic solutions
because the cell contained more solutes than the environment. This would explain why the pieces
gained mass, since water flows into the cell when the solution is hypotonic. However, the 0.4M,

0.6M, 0.8M, and 1.0M sucrose solutions all represented hypertonic solutions because the cell
contained less solutes than the environment, thus water left the cell and the masses decreased.
The concentration of the unknown solution used in Part 1 was 0.83M, illustrated by the heart
shape present in Figure 1. This was determined by using the formula y = -27.774x + 9.5166 and
substituting the average percent change, which was -13.57324%, into y to then solve the
equation for x. The substances that were able to move across the membrane for the control and
experimental conditions were the water with the purple dye and the Lugol's solution. However,
the Lugol's solution was able to diffuse at a faster rate than the water. The processes of diffusion
and osmosis took place because though the substances did diffuse through the membrane, the
experimental bag's increase in mass suggests that water moved into the bag. Osmosis is "
the net
movement of water across a selectively permeable (semipermeable) membrane caused by water concentration difference." (Tzamaloukas et al., 2019). This is determined by examining the
absorbance levels found in the data tables and seeing that there was a more dramatic increase in
mass for the experimental bag compared to the control variable. The negative slope of the line in
Figure 1 rejects the null hypothesis which stated that molarity of different sucrose solutions
would not ultimately affect the weights of the potato pieces. Potential errors that may have
occurred could have been contaminating the tubes that contained the solutions when trying to
have the absorbance read and having potato pieces with different masses since this may have
altered the overalls absorbance values