

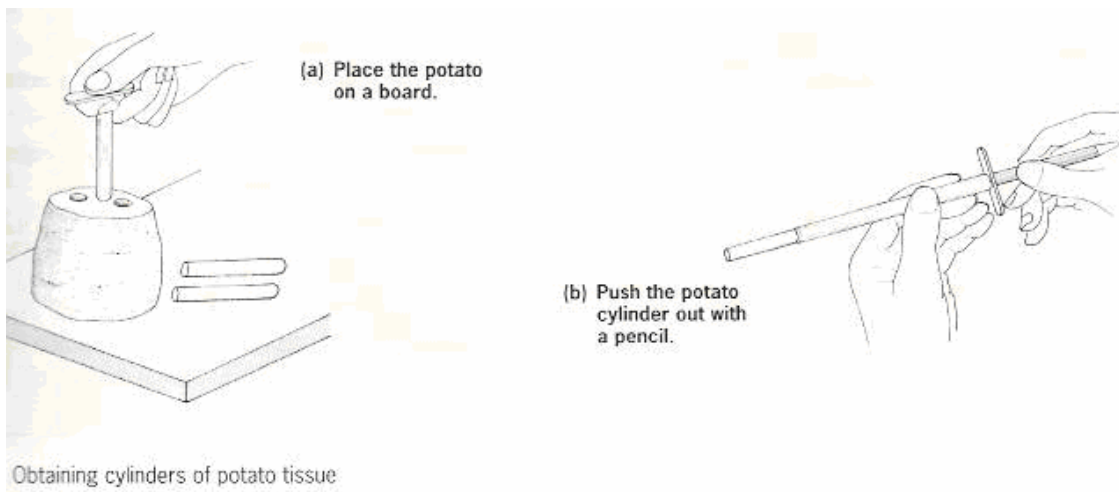
# Biology Coursework : Osmosis

## Plan

I will be investigating the effects of different concentration of sugar solution will have on potato tissue. I will be doing an experiment to identify the effects of different concentrations of sugar solution on potato tissue different concentration of sugar solution a healthy potato to obtain the potato tissue and laboratory equipment. I will be analysing the results from the experiment to clearly see if there is a trend thus an effect. Then I shall do a conclusion concluding and summarising the information and my analysis to see if there is an overall effect. After, I will evaluate my means of obtaining the results (experiment).

First, I am planning to collect all the equipment needed for my experiment:

- test tubes,
- potato corer,
- 3 potatoes,
- knife,
- 30cm ruler,
- a litre of 2 molar, sugar solutions,
- measuring cylinders
- timer
- 6 large beakers
- 150 ml of distilled water
- 1 board
- 1 pencil/pen
- 2 sheets of paper
- 1 electronic weighing scale



Then I will construct a table to show my results. Like the one shown on the next page. I will then carry out checks to make sure my results are accurate by making the experiment fair.

### *Method*

I will collect all the equipment needed for this experiment. I am going to place a potato on a board. I am going to use a potato corer to core out a potato tissue. I will measure the size and cut it to 50mm each (5cm). I will also weigh the potato pieces after they have been cut and record the data onto my table. Repeat this procedure five more times to have six potato tissues. I am cutting the potato to 50mm using a knife. Then using my 2 molar sugar solution I will produce 5 different concentrations of sugar solution by splitting it into parts and add a certain amount of distilled water to produce, sugar solutions with concentrations: 0.125 molar, 0.25 molar, 0.5 molar, 1 molar and 2 molar. After setting up beakers and test tubes, I will place the potato chips inside the test-tubes I am pouring the different concentrations of sugar solution into each of its own test tube. After, I have poured the different concentrations of sugar solution into each of its own test tube, take them out of the test tube, and clean them gently with paper towels. I am going to record the length of the potato chips after 24 hours. I am going to record the data obtained on a table after 24 hours. I will also, after this step, measure the weight of the potato chips, in their corresponding order. Then I will again, collect this data on to the table I have planned. I will repeat this 2 more times.

### *Safety precautions and fair test*

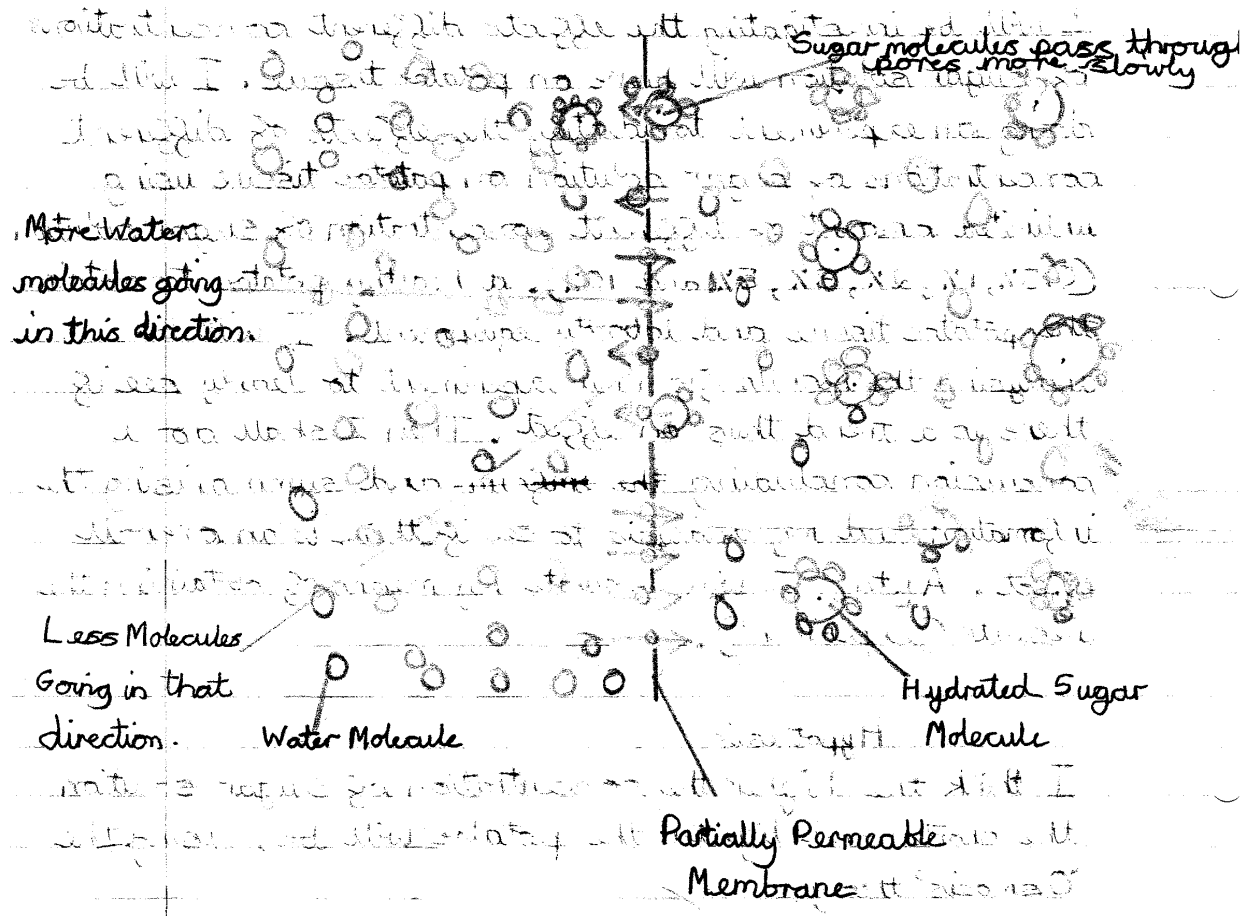
I am going to try to make my experiment fair as possible through many measures. To make my experiment fairer I will make sure, when I put the potato pieces inside the test tubes that they are all 50mm long. In addition, they are taken out of the test tube in the same order they went in. I will also label all the test tubes and clearly indicate what molar solutions there are. Also, the same volume of (50ml) of sugar solution will go in each test tube regardless of sugar concentration. I will wear goggles during the active part of the experiment to protect my eyes. I will cut and core the potato on a board. I will be more careful not to cut anything or myself. I will put the different test tubes containing the sugar solutions and potato chips into beakers with water. This will help keep a steady temperature throughout the experiments as water influenced environment will be less affected by sudden temperature changes. I will use the same size borer and pencil similar to that in figure 1. When the experiments are done, I will place the potato chip on paper towel to absorb excess sugar solution and then measure it. The experiment will last then 24 hours, as I do not want any bacteria to spread or damage the semi-permeable membrane. I am taking these precautions to make my results more accurate as well. All the sugar solution will have only originally contained distilled water, as I do not want and active uptake. The potato chips will always be 50 mm long before they go in and the same volume of sugar solution will be used but the concentration will vary. The experiment itself will be conducted on a normal mild day. I will also wear clear goggles to avoid the sugar solution or any other utensils being exposed to our eyes. I will conduct the experiment 3 times, as this will ensure results that are more reliable and establish a clear trend.

*Method (cont.) and results*

I will then, pour the different concentrations of sugar solution into each test-tube and place a cored potato tissue and measure it and weigh it using a ruler and a scale and record the data results on the table. I will leave it there for less than 24 hours. I will take out the potato tissue, measure it, weigh it using a ruler and a scale, and record the results on to the table. I will then compare the results on the table and then put or show the results on a graph I will plot the points above the osmotic point if the trend or change is positive and vice-versa for negative (under osmotic point). I will then see and identify the trends more easily from the graphs.

*Preliminary work*

I already know that osmosis is a process when a substance (usually solutes) like sugar or salt dissolves in water, the solute attracts some water molecules, and they cannot move around thus decreasing the concentration of water molecules(look at fig 3 to understand). If there is a partially permeable membrane containing pure water, and that membrane is surrounded by solution with high water potential the water the pure water would diffuse into the solution as the water molecules diffuse faster into pores of the membrane, as they are smaller than sugar solution molecules. The sugar solution will diffuse more slowly as they are bigger and take more time (thus less sugar molecules diffusing) as the pores are not big enough. This osmosis (this is the same for vice-versa).



In my case, the potato tissue cell (semi-permeable) has cell sap (very dilute sugar and chemical solution) inside its vacuole. It also has cell sap and reserved chemicals. The potato cell also has cell walls that control turgor of the potato cell. If there is higher percentage of sugar solution, which has a lower water potential, then plasmolysis, will take place. (See fig 2.) This means that the water diffuses out of the vacuole into the sugar solution and the vacuole gets smaller. Thus, the cell wall and cell membrane will collapse or shrink as there is no pressure being exerted on the membrane or the walls or there is less pressure. However, again using the osmosis theory. when there is higher water potential in the sugar solution outside than the vacuole inside the potato solution than the water molecules from the sugar solution will diffuse into the potato, and make it more turgid as there is more pressure being exerted on the cell membrane and cell wall as the vacuole will be bigger with more water molecules. This means that where plasmolysis has taken place and the sugar solution has a higher water potential solution the potato tissue will be even shorter and lighter, as in the solution there will be less water molecules moving freely and these are the water molecules which diffuse thus meaning that there will be less water molecules diffusing into potato cell membrane! Moreover, the water molecules in potato (majority) will diffuse out make even less turgid. I know a potato cell will be more turgid when there is more water as vacuole and cell membrane can expand as it is confined by the cell wall so it exerts pressure on it thus makes it more strong and turgid.

*Prediction*

Using this background information, I can make firm predictions using the osmosis theory primarily. I think, using different concentration I will get varied results. The potato cell, which has been, distilled water or lower concentrations of water will make the potato chip longer and more turgid. When potato chip is put in the higher concentrations of sugar solutions, plasmolysis will take place and the potato chip will generally become more flabby, soft, and flaccid. All concentrations will be measured in molar, all liquids will be measured in cm<sup>3</sup>, and the length will be measured in millimetres (mm), temperature, and degrees centigrade. Since the vacuoles in the potato cells contain much more water, the potato chips in general will be heavier if the sugar solution has lower concentration. However, if the sugar solution is higher than the potato chip then the potato chip will be lighter, as the potato cells will have loss mass through losing water through plasmolysis.

Using preliminary work, which I have done, will have improved my work greatly as in past experiments using a potato chip I have contaminated the solutions and distilled water with tap water, which contained minerals, and ions that could have altered the results through active uptake. Also my preliminary results may have been more inaccurate as only carried out the experiment once and in this experiment I will repeat it 3 times to improve its accuracy. I had also left it longer than 24 hours where the work of the enzymes and other chemicals (fed by ions and minerals in tap water) may have altered the structure of the cell membrane thus affect osmosis directly. In addition, in that experiment I had also measured the variables for mass and this was more likely to produce anomalies as weight of extra water would have got on the scale if the potato chips hadn't been cleaned properly. In this experiment, I had included the variable, mass, this is because in preliminary experiments concerning osmosis, just keeping length, and analysing that variable in detail would not give me results that are more accurate. So by including mass as a variable, it will confirm the trend suggested by length as they both support each other, as length increases with water in vacuoles, the water should add mass in itself in the vacuole.