

OSMOSIS

PLAN:

AIM

To investigate the effects of different solutions on plant cells.

EQUIPMENT

- Potato
- Boiling Tube (5)
- Cork Borer
- Water (50cm)
- Ruler
- Scale
- Salt Solution
- Clamp Stand

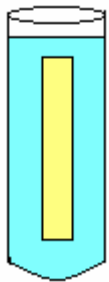
STEP BY STEP

1. Cut a potato chip out of a potato with a cork borer. Measure the length (in mm) and the mass (in grams) of the chip.
2. Place the chip into a boiling tube containing 10 cm of water. Leave the chip in the boiling tube for 25~30 minutes.
3. After 25~30 minutes remove the chip and measure the length (in mm) and the mass (in grams).
4. Place these results in a table and then plot a graph.
5. I will complete steps 1~4 again four times, but instead of water I will use 25%, 50%, 75% & 100% salt solution. I will then take a percentage of

the length and mass because in my preliminary work I found out that cutting the chip to the same weight was virtually impossible so I am going to complete my experiment get the results, and when I have my results I will take an average width and length.

6. Then I will produce a graph and compare the results.

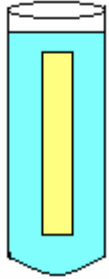
DIAGRAM



100% water



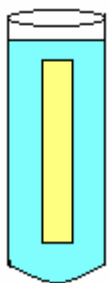
75% water, 25% salt solution



50% water, 50% salt solution



25% water, 75% salt solution



100% salt solution

FAIR TEST

- I will make this a fair test by making sure I leave each chip in its solution for exactly the same amount of time.
- I will also make this a fair test by taking a percentage of the mass because in my preliminary work I found out that it is not possible to make each chip weigh the same.
- I will also make sure I use the same size equipment i.e. cork borers and boiling tubes.

RELIABILITY

- I will make this experiment reliable by making sure the chips are left in the solutions for 25~30 minutes because in my preliminary work I found out that this was a good amount of time.
- I will also make this experiment reliable by repeating it and taking down the results three times.

SAFETY

- I will make sure this experiment is safe by tying back my scarf.
- I will also make sure this experiment is safe by using the cork borer correctly and safely.

PREDICTION

I predict that the potato chip that will be placed in water will expand. This is because the mass and length will increase. This will happen because there is a higher concentration of water outside the chip so water particles will diffuse into the chip due to the process of osmosis, causing the chip to become turgid.

I know this because in my preliminary work I placed a potato chip in 100% water and it expanded and became turgid e.g. the chip before the

experiment weighed:4.34 grams and the length before the experiment was 5.6 centimetres. The chip after the experiment weighed:4.25 grams and the length after the experiment was 5.8 centimetres. This showed there was an increase in weight by 0.22 grams and there was an increase in length of 0.2 centimetres.

I predict that the chip placed in 75% water and 25% salt solution will expand. This is because the mass and length will increase. This will happen because there is a higher concentration of water outside the chip so water particles will diffuse into the chip due to the process of osmosis, causing the chip to become turgid.

I know this because in my preliminary work I found out that in 100% water the chip expanded so I am sure that in 75% it will as well. This is because the salt solution is very diluted and so there should be a less concentration of water inside the chip.

I predict that the chip placed in 50% water and 50% salt solution will expand because the concentration of water outside the chip than in is higher.

I know this because water particles diffuse from an area high concentration to an area of low concentration due to the process of osmosis.

I predict that the chip placed in 25% water and 75% salt solution will neither expand nor contract because the concentration of water inside the chip is equal to the concentration of water outside the chip. I know this because the lower the amount of salt solution the higher the mass of the chip will be. So I think that because the concentration of water is low but not that low then there will be the same amount of concentration of

water inside. This is the stage we call incipient plasmolysis.

I predict that the chip placed in 100% salt solution will contract. This is because the mass and length will decrease. This will happen because there is a higher concentration of water inside the chip so water particles will diffuse out of the chip due to the process of osmosis, causing the chip to become flaccid.

I know this because in my preliminary work I placed a potato chip in 100% water and it expanded and became turgid, so this means that the chip that will be placed in 100% salt solution will decrease in length and weight.

RESULTS

(Chip 1 = 100% water, chip 2 = 75% water and 25% salt solution, chip 3 = 50% water and 50% salt solution, chip 4 = 25% water and 75% salt solution and chip 5 = 100% salt solution.)

Experiment 1

	1	2	3	4	5
Length before	40mm	40mm	40mm	40mm	39mm
Mass before	3.03g	3.06g	3.03g	3.05g	3.10g
Length after	41mm	39mm	40mm	37mm	38mm
Mass after	3.38g	2.85g	2.80g	2.74g	2.61g

Experiment 2

	1	2	3	4	5
Length before	40mm	40mm	40mm	39mm	40mm
Length after	3.00g	3.10g	3.01g	2082g	3.13g
Mass before	40mm	41mm	39mm	37mm	38mm
Mass after	3.09g	2061g	2.33g	2.17g	2.39g

Experiment 3

	1	2	3	4	5
Length before	40mm	39mm	40mm	40mm	40mm
Length after	2.97g	2.96g	3.02g	3.05g	3.09g
Mass before	40mm	38mm	39mm	38mm	38mm
Mass after	3.13g	2.42g	2.34g	2.33g	2.38g

ANALYSIS

I used a calculation to find out the percentage of the mass and length because it made the results more easier to plot on a graph.

The length/mass before minus the length/mass after (if the length/mass after has increased then you do the length/mass after minus the length/mass before and if it had decreased then you do the length/mass before minus the length/mass after). Then the answer to that divided by the length before and then multiplied by 100. If the length/mass after is higher than the length/mass before then the answer is positive, if it is lower the answer is negative.

e.g. $41 - 40 = 1$

1 divided by 40 = 0.025

0.025 multiplied by 100 = -2.5

Because the length after was higher then the answer is positive.

These are the results for the percentages of my mass and length.

Experiment 1

	Length	Mass
1	2.50	11.55
2	-2.50	-21.00
3	0.00	-7.59
4	-7.50	-31.00
5	-2.56	-49.00

Experiment 2

	Length	Mass
1	0.00	9.00
2	2.50	-49.00
3	-2.50	-68.00
4	-5.13	-65.00
5	-5.00	-74.00

Experiment 3

	Length	Mass
1	0.00	-5.39
2	-2.56	-18.24
3	-2.50	-22.52
4	-5.00	-23.61
5	-5.00	-22.98

Using the answers that I obtained I needed to take the averages of the three experiments so that I could plot the graph, but I thought I would only do experiments 1 and 2 because experiment 3 had lower numbers than the other 2 and I thought the other two were similar.

So I added the lengths for chip 1 in both experiments and divided by two.

E.g. $2.50 + 0.00 = 2.50$

Divide 2.50 by 2 = 1.25

This is now the average and the number I will plot on my graph for 100% water (chip 1).

Average lengths

1	1.25
2	0.00
3	-1.25
4	-6.32
5	-3.78

Average mass

1	10.28
2	-35.00
3	-37.80
4	-48.00
5	-61.50

With these averages I plotted my graph.

My graph showed me that when any amount of salt solution was added to the boiling tube the length and mass of the chip decreased, and became flaccid. This showed me that water was diffusing out of the chip due to the process of osmosis, this is when water diffuses from an area of high concentration to an area of low concentration through a semi-permeable membrane. It also showed me that the potato chip must have a higher than 75% of water because when 75% of water was added and 25% of salt

solution was added then water diffused out of the chip.

My graph also shows me that the incipient plasmolysis stage was way below 25% of salt solution, but because my concentrations were too far apart (25%) I can not be precise in saying at which point it actually is.

There were two anomalies, one in each graph. The anomaly in the graph showing the percentage increase of length was when 75% of salt solution was added, I think this was because we measured out the volume of water and salt solution wrongly and so it was not a fair test.

Also the anomaly in the graph showing the percentage increase in mass was at 25%, I think this was because we mixed up the amount of salt solution we needed to add and so this also was not a fair test.

Also we did not use the results from experiment 3 because that was not a fair test, this is because we used to measuring cylinders to be quicker and I measured out 3 of the solutions and my partner measured out two, but then we realised that our cylinders were not the same so when we re-measured the solution (once the salt solution and water were added together) we found out that they were not 30cm altogether which they were supposed to be. This showed that our experiment was not fair but we carried on.

EVALUATION

In my results I found out that the incipient plasmolysis stage was at a lower point than 25% of salt solution. This showed that my prediction was wrong, I predicted that the incipient plasmolysis stage would be when 75% salt solution was added but this was wrong. Also I predicted that chip placed in 75% water and 25% salt solution would expand but it never, it became flaccid and water diffused out of the chip due to the process of osmosis. I also predicted that the chip placed in 50% water and 50% salt solution would expand and become turgid but it did not, it contracted and became flaccid.

The only bit of my prediction that did come true was when I predicted that when no solution was added to the boiling tube then the chip will expand and it did, I knew this from my preliminary work as well.

I do not think that my results are accurate enough make a firm enough conclusion because it was not a fair test and also that the percentages were too far apart so I could not get a specific percentage of when the incipient plasmolysis stage was.

I would use results from other people's experiments or get some results from the internet to make it more accurate and I would also weigh and measure the chip in more frequent intervals if I had to do this experiment again.

