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concentration of
solutes is

[Science](#), [Biology](#)



Today we are going to be learning about passive transport. Passive Transport is when substances diffuse across the plasma membrane.

Specifically in passive transport, we are going to do a lab all based on osmosis. Osmosis is when a substance crosses a semipermeable membrane in order to balance the concentrations of another substance. Water moves from areas of high concentration to areas of low concentration. In biology, this is usually when a solvent such as water flows into or out of a cell depending on the concentration of a solute such as salt. Osmosis deals with two parts of a chemical solution, the solvents and the solutes. A solution is when a solute dissolves in a solvent. There are three types of solutions that cells can be in: isotonic, hypotonic, and hypertonic.

An isotonic solution is when the concentration of solutes is the same both inside and outside of the cell. An example of an isotonic solution would be a cell having the same concentration of salt inside as well as in the surrounding fluid. In this situation, there is no net movement of solvent meaning there is no water entering or exiting the cell membrane. A hypotonic solution is one in which the concentration of solutes is higher inside the cell than outside of it. In this situation, more solvent will enter the cell than leave it to balance out the concentration of solute. A hypertonic solution is one where the concentration of solutes is greater outside the cell than inside it. In this type of solution, more solvent will exit the cell than enter it to lower the concentration of solute outside the cell.

Osmosis affects plant and animal cells differently because they each tolerate a different concentrations of water. Hypotonic solutions are ideal for plant

cells, while isotonic solutions are ideal for animal cells. Shown below are diagrams that show osmosis in action in a red blood cell with isotonic, hypotonic, and hypertonic solutions. In this lab we are going to explore osmosis through various activities. We will be doing an activity with eggs, cucumbers, as well as gummy bears to watch osmosis in action. We will be experimenting with isotonic, hypotonic, and hypertonic solutions. Pre-lab Activity – The Solutions The following pictures shows cells of different concentrations placed in beakers with different concentrations. Draw an arrow indicating the direction the solution will flow and draw an arrow with “W” (for water) to indicate where the water will flow.

Label the diagrams as isotonic, hypotonic, hypertonic. *The first one is done for you* Activity #1 – The Dissolving Egg Purpose: The purpose of this lab is to watch a chemical reaction take place between the shell of a chicken egg and vinegar. Once the protective shell is off, it allows us to watch how osmosis takes place in a single celled animal.

The purpose of this activity is to show a visual, hands on activity of how osmosis takes place as well as watching a chemical reaction happen. Hypothesis: If an egg without a shell is placed in a hypertonic solution, then the weight of the egg will _____. If an egg without a shell is placed in a isotonic solution, then the weight of the egg will _____. If an egg without a shell is placed in a hypotonic solution, then the weight of the egg will _____. Materials: 3 eggs – Slotted spoon 3 large mason jars– Measuring cup 3 butter knives – Measuring spoons White vinegar (3 cups)– Sticky notes and marker Distilled water (2 cups)– Scale Light corn

syrup (1¼ cups) Procedure: Place one egg in each glass. Pour in enough vinegar to cover each egg.

Bubbles will start to form around the egg, and it'll float up. To keep it submerged, put a butter knife in the glass to hold it down. Put the three glasses in the refrigerator and allow to sit for 24 hours. Gently holding the egg in the glass, pour out the old vinegar. Replace with fresh vinegar, and let sit in the refrigerator for another 24 hours. Repeat this process until the shells are fully dissolved and only the membrane remains. This should take about 2-3 days.

Gently remove the eggs using the slotted spoon and rinse with tap water in the sink. Gently put the eggs on the scale and record their weight in the table below in grams (starting weight) Prepare three different sugar-water solutions as follows, labeling with sticky notes: *Refer to introduction if you forget the meaning of isotonic, hypotonic, and hypertonic* Glass 1: Label “hypertonic” ? Pour in one cup of corn syrup. Glass 2: Label “isotonic” ? Add 1 ½ tablespoons corn syrup to the one cup measuring cup, and fill the remainder with distilled water. Pour into glass and stir.

Glass 3: Label “hypotonic” ? Pour in one cup of distilled water. Gently put one shell-less egg in each of the glasses, and let sit in the refrigerator for another 24 hours. Remove the glasses from the refrigerator, and gently put the eggs on a plate. Weigh each of the eggs and record their weight in grams (ending weight). Egg Weights: Solution Starting Weight (g) Ending Weight (g) Hypertonic Isotonic Hypotonic Questions: What happened to the size of the egg in the hypertonic solution? Did water flow in, out, or stay the

same in the egg in the hypertonic solution? What happened to the size of the egg in the isotonic solution? Did water flow in, out, or stay the same in the egg in the isotonic solution? What happened to the size of the egg in the hypotonic solution? Did water flow in, out, or stay the same in the egg in the hypotonic solution? Activity #2 - Cucumber Experiment Purpose: Do different liquids affect what will and will not enter a cucumber? The purpose of this lab is to see how cucumbers react in different solutions. By using your knowledge of isotonic, hypotonic, and hypertonic solutions, we will observe what happens to a cucumber when it is left in certain liquids. Will the cucumber grow, shrink, or stay the same? It is up to you to determine this in the experiment.

Hypothesis: If a cucumber is left in distilled water, then the cucumber's mass will _____, while the cucumbers thickness will _____. If a cucumber is left in salt water, then the cucumber's mass will _____, while the cucumbers thickness will _____. If a cucumber is left in vinegar, then the cucumber's mass will _____, while the cucumbers thickness will _____.

Materials: Peeled cucumbers- Sticky notes & pen Salt - 3

beakers Sugar - Scale Vinegar- Ruler Distilled water - Measuring

cup/spoons Procedure: Cut three slices of cucumber, evenly Measure the

cucumbers height and mass, and record the data in the charts below Pour

250mL of distilled water into a beaker and label it " Beaker #1" Pour 250mL

of water into a beaker and label it " Beaker #2" Add 2 tablespoons of salt to

beaker #2, stir until dissolved Pour 250mL of vinegar into a beaker and label

it " Beaker #3" Add a cucumber slice to each beaker After 1 hour of soaking,

remove the cucumbers from the liquid and record the mass and height

(measure at the middle) of each cucumber, and record the data in the charts below. After 1 day of soaking, remove the cucumbers from the liquid and record the mass and height of each cucumber, and record the data in the charts below. After the data is collected, create a bar graph in the given space showing the difference in initial and final mass, as well as difference in initial and final thickness. Observations: Fill out the tables using the directions in the procedure.

Distilled Water (Beaker #1)	Mass	Thickness (height)	Initial Measurements	1 Hour Later	1 Day Later
Salt Water (Beaker #2)	Mass	Thickness (height)	Initial Measurements	1 Hour Later	1 Day Later
Vinegar (Beaker #3)	Mass	Thickness (height)	Initial Measurements	1 Hour Later	1 Day Later

Bar Graph: Using the initial and final mass of the cucumbers from the various liquids, complete the graph below* Don't forget to label the graph! Questions About Mass: Which liquid caused the greatest change in mass of the cucumber? Which cucumber, if any, got heavier? Which cucumber, if any, got lighter?

Bar Graph: Using the initial and final thickness (height) of the cucumbers from the various liquids, complete the graph below* Don't forget to label! Questions About Thickness: Did any of the cucumbers stay the same thickness (height)? Which cucumber shrunk the most?

Activity #3 - Gummy Bears! Purpose: Based on what we now know about osmosis, what will happen to a gummy bear when placed in various solutions? If the outside of the gummy bear acts as the "membrane", which solutions will act as isotonic, hypotonic, and hypertonic? It is up to you to find out what will happen to the size of the gummy bears when placed in different solutions. Hypothesis: If a gummy bear is put in a salt solution, then the size of the gummy bear will _____. If a gummy bear

is put in a sugar solution, then the size of the gummy bear will _____. If a gummy bear is put in a baking soda solution, then the size of the gummy bear will _____.

Materials: 3 mason jars- Sugar Gummy bears- Water Baking soda- Scale Salt- Measuring cups Procedure: Pick 3 different colored gummy bears and take the weight for each and fill it out in the chart below Label the three mason jars with " salt solution", " sugar solution", " baking soda solution" Fill each mason jar with 50 ml of water and add 1 tablespoon of salt, sugar, and baking soda to the respective container Add one gummy bear to each container and let them sit overnight The next day, carefully remove the gummy bears and weigh each one and record the results in the chart

Gummy Bear in Solution	Start Weight (g)	End Weight (g)
Salt Solution		
Sugar Solution		
Baking Soda Solution		

Procedure (continued): 6. Once you have calculated the weights of your gummy bears, record your results on the class chart and fill in the class chart below:

Salt Solution	Start Weight (g)	Salt Solution End Weight (g)	Sugar Solution	Start Weight (g)	Sugar Solution End Weight (g)	Baking Soda Solution	Start Weight (g)	Baking Soda Solution End Weight (g)

7. Once the class data is collected, find the average for the start weight and end weight in each type of solution

Salt Solution	Start Weight Average (g)	Salt Solution End Weight Average (g)	Sugar Solution	Start Weight Average (g)	Sugar Solution End Weight Average (g)	Baking Soda Solution	Start Weight Average (g)	Baking Soda Solution End Weight Average (g)

8. Using the data from question 7, use the graph below to make a bar graph to plot the average start and end weights of the class results. Once you have drawn the class averages, make

a line on each bar as to where your data falls on the graph. * Don't forget to label! When drawing the bar graphs, use two different color pencils to distinguish between start weight and end weight Questions: In which solution did the gummy bear get the biggest? In which solution did the gummy bear get the smallest? Did the gummy bear stay the same size in any of the solutions? When the gummy bear got bigger or smaller, did it lose its shape? By looking at the graph, how does your gummy bear data compare with the class average data? AppendixItem Price Location 3 eggs \$2. 99/dozenAmazon Slotted spoon\$5. 99Amazon 3 large mason jars\$4. 48 Amazon Measuring cup \$7. 99Amazon 3 butter knives\$8. 95 Amazon Measuring spoons\$5. 97Amazon White vinegar \$3. 02Amazon Sticky notes\$4. 04 Amazon Marker\$6. 67Amazon Distilled water \$1. 89 Amazon Scale\$9. 99 Amazon Light corn syrup\$4. 88 Amazon Cucumbers \$1. 07Amazon Salt \$0. 89Amazon 3 beakers\$7. 97Amazon Sugar \$2. 89 Amazon Ruler \$1. 48Amazon Gummy Bears \$3. 85Amazon Baking Soda \$0. 87 Amazon