Name: _____ Period: _____ Date: _____

Gummy Bears and Osmosis

1. Background: Yesterday, we set up three gummy bear treatments. One was kept dry. A second was placed in water. A third was placed in 10% sucrose solution.

2. Collecting Data

A. Visual Observations: (Note: you'll have to observe another group's bear to see all three treatments). How do the three gummy bears look different? Indicate which one was in which liquid.

_____

_____

_____

B. Numerical Data. Carefully pour off all water before weighing. Zero the scale each time.

	A	B	C	D
	Individual data (mass in grams)	**Total class data for gummies (mass in grams)**	**# of gummies**	**Average class data (Total mass/# gummies)**
Dry Gummy Bear				
Gummy Bear in 10% sucrose solution				
Gummy Bear in tap water				

Class data for our gummy bear lab

DRY		**10% sucrose**		**Tap water**

C. Using the concept of *diffusion*, can you explain what happened?

_____

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3. Osmosis

A. What is osmosis?	The diffusion of water.
B. How does water diffuse?	• Water diffuses just like everything else, from more concentrated (more H_2O molecules) to less concentrated (fewer H_2O molecules).
C. Review: Solutions, solvents, and solutes	• In a solution, the liquid that does the dissolving is the *solvent*. • The most common solvent on earth is water • The thing that gets dissolved is the *solute*.

4. Checking Understanding: a) If you mix up some powdered lemonade, the water is the _____, and the lemonade mix is the _____. In a cola drink, the sugar is the _____, and the water is the _____.

b) All molecules diffuse from _____ concentration to _____ concentration.

KEY POINT: **Understanding osmosis is always about *comparing* two solutions separated by a membrane.**

5. Important terms: Hypertonic & Hypotonic

A. What is a <u>hyper</u>tonic solution?	• A solution that has a **higher** concentration of solute than the solution on the other side of the membrane. • Think: *less water, more solute.*
B. What is a <u>hypo</u>tonic solution?	• A solution that has a **lower** concentration of solute than the solution on the other side of the membrane. • Think: *more water, less solute.*

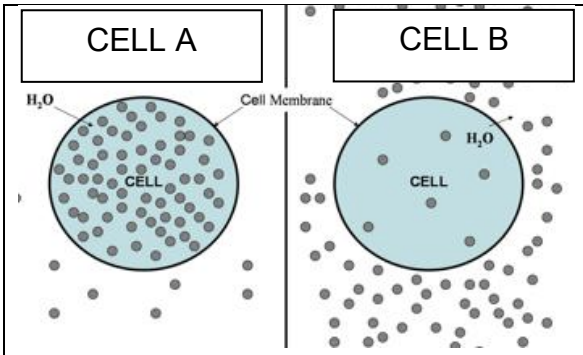
6. Practice. In all problems, *the two solutions have the same volume.* Use *hypertonic* or *hypotonic* as your answers.

1. Solution A has 10 drops of food coloring. Solution B is pure water. Solution A is _____ to solution B. Solution B is _____ to solution A.
2. Solution X has 3 drops of ink. Solution Y has 8 drops of ink. Solution X is _____ to solution Y. Solution Y is _____ to solution X.
3. I've made a solution with sugar dissolved in water. If I want to make the solution more hypotonic, I add more _____. If I want to make the solution more _____, I add more sugar.
4. Solution K is 90% water, 10% solute. Solution L is 100% water. Solution K is _____ to solution L. Solution L is _____ to solution K.

7. Back to our gummy bears

a. When we put our gummy bears into water, the gummy bear was _____ to the water outside of it.
b. You can also say, the water was _____ to the gummy bear.
c. Because of that, the water flowed from the _____ into the _____, causing it to expand and gain mass.
d. The gummy bear in the 10% sucrose solution was in a _____ hypotonic environment than the gummy bear in pure water. As a result, the gummy bear gained _____ mass than the gummy bear in pure water.

8. Use the terms **hypotonic** and **hypertonic** to describe what's happening in side A and side B. The dots represent SOLUTE.



a. Cell A is _____ to the surrounding solution.
b. The solution outside CELL A is _____ to the solution inside the cell.
c. As a result, water will flow._____ CELL A.
d. Cell B is _____ to the surrounding solution.
e. The solution outside CELL B is _____ to the solution inside the cell.
f. As a result, water will flow _____ CELL B.

9. The most important idea: Water always flows from _____ to _____.

10. PULLING IT ALL TOGETHER: What happened in our gummy bear lab? Explain a) how we set up the lab, b) the change in mass in the gummy bears, and 3) why this occurred. Use the terms *hypotonic* and/or *hypertonic* in your response.

Language frames.	Your response
• We set up the lab as follows: • we observed that • This occurred because… • Consequently • As a result…	_____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____

11. More Checking understanding:

a. The diffusion of water is called _____.

b. The side of a membrane where the solution is more concentrated is the _____ side.

c. The side of a membrane where the solution is less concentrated is the _____ side.

12. Reinforcement: In terms of osmosis, how does water flow across membranes? _____

_____

13. Isotonic Solutions

What is an isotonic solution?	• A solution that has the same concentration of solute as the solution on the other side of the membrane. • Think: equal concentration of water on both sides • Result: no *overall* movement of solute or solvent (though molecules are moving back and forth)

14. More Checking Understanding

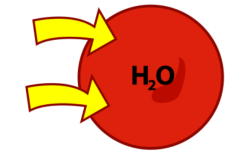
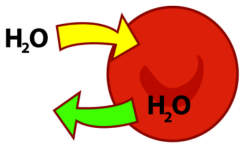
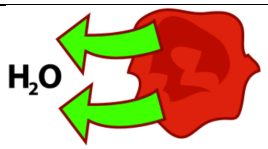
1. Osmosis is the _____ of water.
2. Two solutions are separated by a membrane. The side that has more solute dissolved in it is the _____ side.
3. Solution A is 94 % water, 6% solutes. Solution B is 80% water, 20% solutions. Solution A is _____ to solution B.
4. If two solutions are both 45% water, we'd say that they were _____ to one another.

15. ***Use arrows*** to show the direction of water movement into or out of each cell (which is 98% water). The % of water outside the cell is listed below the cell. Examine each diagram, and then complete the table.

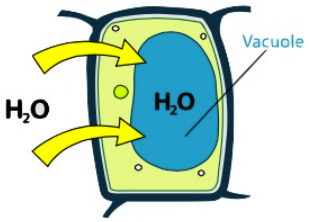
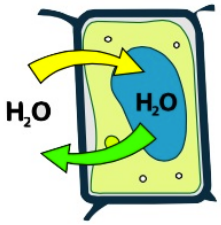
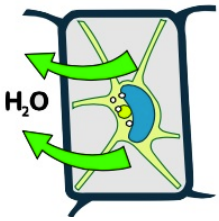
		
The cell is _____ to its environment.	The cell is _____ to its environment.	The cell is _____ to its environment.
The outside solution is _____ to the cell.	The outside solution is _____ to the cell.	The outside solution is _____ to the cell.
Water will flow _____ the cell.	Water will flow _____ and _____ the cell and its environment at the _____ rate.	Water will flow _____ the cell.

16. More applications

A. A red blood cell is placed in a solution. The first picture shows the cell expanding. The second shows it remaining the same. The third shows it shriveling up. Was the solution isotonic, hypotonic, or hypertonic?

		
_____ ***solution***	_____ ***solution***	_____ ***solution***
The cell must have been _____ to its environment because water is flowing…	*The cell must have been _____ to its environment because water water is flowing…*	*The cell must have been _____ to its environment because water water is flowing…*

B. A plant cell, with a cell wall, is placed in a solution. The first picture shows the cell expanding. The second shows it remaining the same. The third shows it shriveling up. Was the solution isotonic, hypotonic, or hypertonic?

		
_____ ***solution***	_____ ***solution***	_____ ***solution***
The cell must have been _____ to its environment because water water is flowing…	*The cell must have been _____ to its environment because water water is flowing…*	*The cell must have been _____ to its environment because water is flowing…*

C. Think about it: Why didn't the plant cell burst?

_____

_____

17. Yet more checking for understanding

a. isotonic b. hypertonic c. hypotonic

a)	_____ Solution with a lower solute concentration than the one on the other side of the membrane.
b)	_____ Solution in which the solute concentration is the same as the other side of the membrane
c)	_____ Condition plant cells require so that they don't wilt.
d)	_____ Condition that animal cells require so that they don't shrink or burst.
e)	_____ This solution will cause red blood cells to burst
f)	_____ In this solution, a plant cell wilts as it loses water..
g)	_____ A solution with a higher solute concentration than the one on the other side of the membrane.
h)	_____ A solution with a higher concentration of water than the one on the other side of the membrane.
i)	_____ A solution with a higher concentration of dissolved materials than the one on the other side of the membrane.

TEACHER'S GUIDE

1) Set up
a) Get a class set of beakers or cups.
b) Make a solution of 10% sucrose
c) Have water available.

2) The day before the analysis, each lab group does the following
a) In the first cup, one gummy bear gets taped to the outside the cup. The cup is filled with water. The second gummy bear gets placed in the water.
b) In the second cup, A gummy bear gets taped to the outside of the cup. The cup is filled with 10% sucrose solution. Another gummy bear is placed inside the 10% sucrose.
c) Let these sit overnight.

3) The gummy bear in water will gain a huge amount of mass and volume. I have the students weigh individually, and then we record the total mass of all the gummies (dry, in water, in 10% sucrose) and average them. That's what we graph.

4) For the underlying science, it's all explained in my Osmosis Music Video: www.sciencemusicvideos.com/osmosis.

5)Target language performance for 1# 10
What happened in our gummy bear lab? Explain a) how we set up the lab, b) the change in mass in the gummy bears, and 3) explain why this occurred. Use the terms *hypotonic* and/or *hypertonic* in your response.

In our gummy bear lab, we placed gummy bears in two solutions. One was pure water, and one was 10% sucrose. After 24 hours, **we observed that** the gummy bear in pure water gained the most mass. The gummy bear in 10% sucrose gained less mass, and the dry gummy bear stayed the same.
Why did this happen? The gummy bear in pure water was in an extremely hypotonic environment. **Consequently**, water flowed from the hypotonic water to the hypertonic gummy bear, **causing it to** gain mass as it took up water. The 10% sucrose solution was also hypotonic to the gummy bear, but less so. **As a result**, less water flowed into the gummy bear, and it gained less mass.