OSMOSIS IN ONION CELLS

LESSON OVERVIEW:
For living organisms to survive, nutrients, water, and waste must be able to move into and out of the cell. This process maintains homeostasis. The movement of materials into and out of the cell is regulated by the membranes that surround both the organelles within the cell and the outer plasma membrane. The simplest way molecules move is through diffusion, which is when substances move from an area of high concentration to an area of low concentration. Diffusion does not require the expenditure of energy. Water also moves through membranes by diffusion in a process called osmosis. Water will move from an area of high concentration to an area of low concentration.

ESSENTIAL QUESTION:
How do cells maintain homeostasis?

TOPICAL ESSENTIAL QUESTION:
How does solute concentration affect osmosis in cells?
LESSON OBJECTIVES:

Students will be able to:
1. Observe the effect of different solutes on diffusion in onion cells.
2. Explain hypertonic, hypotonic and isotonic in terms of cellular environment.
3. Model the effects of solutes on diffusion in onion cells.

STANDARDS:

MS-LS1-2
Students who demonstrate understanding will be able to: Develop and use a model to describe the function of a cell as a whole and the ways parts of cells contribute to the function.

HS-LS1-2
Students who demonstrate understanding will be able to: Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

HS-LS1-3
Students who demonstrate understanding will be able to: Plan and conduct an investigation to provide evidence of the importance of maintaining homeostasis in living organisms.

Science and Engineering Practices:
1. Asking questions
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations and designing solutions
7. Engaging in scientific argument from evidence
8. Obtaining, evaluating and communicating information

Crosscutting Concepts:
1. Patterns
2. Cause and Effect: Mechanisms and explanations
3. Scale, Proportion and Quantity
4. Systems and System Models
5. Energy and Matter: Flows, cycles and conservation
6. Structure and Function
7. Stability and Change

KEY VOCABULARY:

Diffusion
Root hair
Homeostasis
Solute
Hypertonic
Aqueous
Isotonic
Selectively permeable
Concentration Gradient
Osmosis
Hypotonic

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SAFETY PRECAUTIONS:

- Do not eat or drink in the laboratory.
- Wear safety glasses, lab coat and gloves when performing the experiment.
- Scalpels are extremely sharp; caution is advised when using.
  - Hold the scalpel as you would a pencil.
  - Cut with a downward motion, but never push down very hard to make a cut.
  - Watch the placement of your specimen-holding hand. Do not cut toward your holding hand.
  - Do not use for anything other than the intended task.
- If sodium polyacrylate comes in contact with skin, wash thoroughly with water.
- Use caution with glass slides and cover slips.

NOTE TO THE TEACHER:

- Prepare a 10% NaCl solution prior to class by dissolving 10 g of NaCl in 100 mL of distilled or deionized water. Each group will need 5 mL.
- A petri dish works well for the shallow container of tap water.
- Onion slices can be cut up to 15 minutes prior to use.

LAB BACKGROUND INFORMATION:

NOTE: This is background information for the teacher to assist in facilitating learning and will be explained to the students after the Explore section.

For living organisms to survive, nutrients, water, and waste must be able to move into and out of the cell. This process maintains homeostasis. The movement of materials into and out of the cell is regulated by the membranes that surround both the organelles within the cell and the outer plasma membrane. These membranes are selectively permeable, meaning that they allow only certain materials into and out of the cell. The cells live in an aqueous or high in water content environment. Dissolved within the water are solutes (salts and organic molecules) needed by the cell to function. The simplest way molecules move is through diffusion, which is when substances move from an area of high concentration to an area of low concentration. Diffusion does not require the expenditure of energy. An example of diffusion in daily life is the process of brewing tea. As the tea leaves soak in the water, they release tannins from the area they are most concentrated (in the leaves) into the area where they are least concentrated (the water). Over time, the tannins will spread throughout the entire cup of tea. This process occurs through the tea bag, a membrane, and doesn’t require any energy to occur.
Water also moves through membranes by diffusion in a process called **osmosis**. Water will move from an area of high concentration to an area of low concentration. This difference in concentrations across a space, such as a membrane, or in different locations is a **concentration gradient**. In plant cells that have walls, osmosis is affected by the solute concentration and by the resistance of water to move in the cell by the cell wall. This resistance is called turgor pressure and is what helps keep the plant stems rigid enough to stand. When discussing the way solutions separate by selective permeability, the terms isotonic, hypertonic and hypotonic are used. An **isotonic** solution is one in which the concentration of solutes is even on both sides of the membrane. A **hypertonic** solution is one in which the concentration of solutes is greater outside of the cell, causing water to move from inside to outside of the cell. A **hypotonic** solution is one in which the concentration of solutes is greater inside the cell than outside, causing water to move from the environment into the cell.

**Concentration gradients** are important in allowing the movement of substances into and out of cells. In a normal environment, the roots of the plant live in an aqueous environment, one in which the minerals from the soil are dissolved in water. The plant must absorb these minerals to carry out its life functions. Roots have specialized structures called **root hairs**, which are responsible for absorbing water. When the root hairs are hypertonic to the surrounding soil water, they have a lower water concentration, causing the water and any dissolved mineral solutes to move from the soil into the root hair cells. Once the water is absorbed by the root hairs, the water moves from cell to cell by osmosis along a concentration gradient; each cell is hypertonic to the one before it, drawing the water through the cells into the center of the root where it enters the xylem and can be carried up to the rest of the plant by transpiration.

**ENGAGE:**

Present a video or GIF of a wilting and recovering plant. Many examples can be found online through Youtube by searching “turgor pressure” or “wilting plants time lapse.”

- GIF of wilting plant: giphy.com/gifs/plant-drought-house-l0O9ywqDmsf2nNY10/
- GIF of turgor pressure in action: giphy.com/gifs/water-timelapse-SzdmxXacGD18A
- Video of turgor pressure in action: www.youtube.com/watch?v=YLQg_ykcxg0
DEMONSTRATIONS OF DIFFUSION:

1. Effect of Concentration Demonstration
Before adding a drop of food color into a beaker of water, ask students what they think will happen. Add the food color to the glass and observe what happens. Ask students to explain what they see. (Diffusion – the molecules of food dye are in constant motion and are colliding with the water molecules. Since the dye molecules are more concentrated than the water, they move to areas of lower concentration until the solution reaches equilibrium.)

2. Effect of Temperature Demonstration
Have a clear beaker of cold water and a clear beaker of hot water on a table where students can see. Do not tell students that there is a difference in temperature. Add a tea bag to both beakers and have students watch. Ask students to explain what is happening. Why is one diffusing faster than the other? (Temperature affects the speed of the molecules, causing diffusion of the concentrate to increase or decrease.)

3. Sodium Polyacrylate
Part 1:
Show students a super-absorbent diaper, a glass of water and a pitcher of water. Ask students how many glasses of water they think the diaper will hold. Have one student hold the diaper open and slowly pour glasses of water into the entire length of the diaper until it will not hold any additional liquid. (It should hold seven to 10 glasses of water). Ask students why the diaper holds so much water.
Place a dry diaper into a large plastic bag and cut open the diaper. Shake out the contents of the diaper (pad and powder) into the bottom of the bag, then remove the rest of the diaper. Slowly add water to the bag a little at a time, seal the bag, and squish the bag between each addition of water. Have students explain what is happening to the powder from the diaper. How does this relate to diffusion?

Teacher Explanation: The powder is sodium polyacrylate which can absorb 500 to 800 times its weight in pure water. It is made of long molecular chains that connect in a type of network. Inside this network are sodium ions. When the water is added to the powder, the concentration of sodium inside the network is higher than outside so the water will rush into the network, forming a gel. The network of sodium polyacrylate will continue to swell until it reaches capacity.

Part 2:
Add 30 grams, or 2 tablespoons, of salt to the bag containing the gel. Massage the salt throughout the gel. Ask students to observe what happens.

**TEACHER EXPLANATION:** When the salt is added, it changes the concentration of the solution to higher outside the gel. Water will move from an area of low sodium ion concentration to an area of high sodium ion concentration and thus will move out of the sodium polyacrylate network into the bag. The diaper will normally not hold as much urine as pure water because urine contains dissolved salts which change the concentration of sodium ions.

**EXPLORE:**
1. Using the scalpel, carefully slice away the purple layer of cells from the outermost layer of the red onion. This should be only the thin purple layer. From this layer, trim to get a piece that is the size of the box to the right. The slice should be very thin so that you have only one layer of tissue.
2. Place the onion tissue layer on a dry microscope slide with the shiny side facing up.
3. Place the slide on the stage, and scan the onion tissue under low power to find the darkest purple area on the tissue.
4. Raise the objective power to medium and focus the view, using the coarse adjustment knob.
5. On Table 1, draw a picture of what one cell looks like and label the observable cell structures.
6. Return the microscope to the lowest objective, lower the stage and remove the slide.
7. Make a wet mount by using the pipette to place two to three drops of salt water solution on the onion tissue, then place a cover slip on top.
8. Return the wet mount slide to the microscope. Scan the onion tissue on low power to observe any changes. Once you have found an area to view, raise the objective power to medium and observe the cells for three minutes.
9. After three minutes, draw an image of what the cell looks like, label the observable structures, and answer the questions on Table 1.
10. Return the microscope to the lowest objective, lower the stage and remove the slide.
11. Place the entire slide into a shallow dish of tap water to rinse the salt water off the slide, cover slip and onion tissue. Gently rotate the dish a few times to agitate the slide.
12. Very gently, remove the cover slip and onion tissue from the slide. Dry the slide and cover slip with a paper towel. Gently blot the onion tissue dry.

13. Make a wet mount of the onion tissue using a clean pipette, and add two to three drops of distilled water onto the onion tissue before placing the cover slip on.

14. Place the wet mount slide on the stage, and scan the tissue under low power. Observe any changes. Find an area where the changes are clearly visible and raise the objective power to medium. Observe the tissue for two to three minutes.

15. On Table 1, sketch an image of how the cell looks and answer the questions associated with it.

Table 1. Onion Cell Osmosis

<table>
<thead>
<tr>
<th>SKETCH</th>
<th>OBSERVATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry Mount Cell Image:</td>
<td>Describe what you observed.</td>
</tr>
<tr>
<td><img src="image1.jpg" alt="Dry Mount Image" /></td>
<td>Students should be able to observe individual cells within the onion tissue. On low power, they can identify the cell wall and cytoplasm. On high power, they should also be able to observe the nucleus.</td>
</tr>
<tr>
<td>NaCl Wet Mount Cell Image:</td>
<td>Describe the changes that you observed when the salt solution was added to the onion tissue.</td>
</tr>
<tr>
<td><img src="image2.jpg" alt="NaCl Wet Image" /></td>
<td>When the salt water is added to the onion tissue, over time students will notice that the cytoplasm pulls away from the cell wall as a result of water leaving the onion cell where it was more highly concentrated onto the slide where it was less concentrated.</td>
</tr>
<tr>
<td>Distilled Water Wet Mount Cell Image:</td>
<td>Describe the changes that you observed when the distilled water was added to the onion tissue.</td>
</tr>
<tr>
<td><img src="image3.jpg" alt="Distilled Water Wet Image" /></td>
<td>Over the course of several minutes, students should observe that the cytoplasm expands to once again fill the cell as water from the slide (higher concentration) begins to move into the onion cell (lower concentration).</td>
</tr>
</tbody>
</table>

**EXPLAIN: (SEE LAB BACKGROUND)**

The Lab Background information from the Teacher Guide is repeated in the Explain section of the Student Guide. Below is additional information to help aid explanations.
ELABORATE:

Optional Extension Activity: Osmosis in Carrots

Materials (per group):
• 200 mL 3% NaCl solution
• 200 mL 5% NaCl solution
• 200 mL 7.5% NaCl solution
• 200 mL 10% NaCl solution
• 200 mL Tap water
• 200 mL Distilled water

• 6 Baby carrots
• Electronic balance
• 6 - 250 mL Beakers
• Paper towel
• Forceps

Procedure:
Day 1
1. Label beakers 3% NaCl, 5% NaCl, 7.5% NaCl, 10% NaCl, tap water and distilled water.
2. Fill each beaker with 200 mL of the appropriate solution.
3. Assign one carrot to each treatment.
4. Make an initial observation of the carrot (color, texture, firmness).
5. Using the electronic balance, record the mass of each carrot in Table 2.
6. Place the appropriate carrot in the corresponding beaker.
7. Make a prediction about what will happen to the mass of each carrot overnight in Table 2.
8. Place the beakers where your teacher instructs.

Day 2
1. Remove the carrot from the 5% salt beaker using forceps. Do not stab or poke the carrot. Use a paper towel to pat the carrot dry, measure the mass, and record in Table 3. Record observations of carrot (color, texture, firmness).
2. Repeat Step 1 for each treatment.
3. Complete calculation for treatments in Table 3.
4. Graph the results of Table 3.
5. Dispose of beaker solutions in the sink with running water. Throw carrots in the trash.
### Table 2. Observations and Predictions

<table>
<thead>
<tr>
<th>Pretreatment observation</th>
<th>3% NaCl</th>
<th>5% NaCl</th>
<th>7.5% NaCl</th>
<th>10% NaCl</th>
<th>Tap Water</th>
<th>Distilled Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prediction</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Posttreatment Observation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table 3. Mass of Carrots

<table>
<thead>
<tr>
<th>Pretreatment Mass</th>
<th>3% NaCl</th>
<th>5% NaCl</th>
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<th>Tap Water</th>
<th>Distilled Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posttreatment Mass</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre and Post Mass Difference</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>% change (- or +)</td>
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</tr>
</tbody>
</table>

This investigation can also be done using various concentrations of sucrose solutions, and students can calculate water potential for each treatment.
EVALUATE:

1. In your own words, explain diffusion. Provide an example of diffusion that occurs in daily life.
   Diffusion is the movement of solutes from an area of high concentration to an area of low concentration.
   Making tea, spraying air freshener, spraying perfume, food dye in a mixture, etc.

2. In the dry mount slide, what environment was the onion tissue in: hypertonic, hypotonic or isotonic?

3. When the salt solution was added to the onion cells, was the concentration of water greater inside or outside of the cell? Explain your answer using your observations from this lab.
   The concentration of water was greater outside of the cell. The water moved from inside the cell to outside the cell, moving from an area of high concentration to an area of low. This was observed by the way the vacuole pulled away from the cell wall and appeared shriveled.

4. In the salt solution, what environment was this cell in: hypertonic, hypotonic or isotonic?

5. When the distilled water was added to the onion cells, was the concentration of water greater inside or outside of the cell? Explain your answer using your observations from this lab.
   The concentration of water was greater inside the cell than outside when distilled water was added.
   This was observed by the fact that the vacuole filled with water and expanded to fill the cell once more.

6. In the distilled water solution, what environment was this cell in: hypertonic, hypotonic or isotonic?

7. Using your understanding of diffusion and osmosis, explain why a plant wilts and is able to recover as seen in the Engage video.
   Wilting occurs when a plant does not get enough water. As a result, the cell loses water to the cellular environment as the concentration gradient lowers. As the cell loses water, the vacuole exerts less pressure on the cell wall, causing the cell wall to lose rigidity and become soft. The more cells that this occurs to, the greater the effect is on the entire plant.

8. Grass often dies near roads covered in salt to remove ice. Using what you have learned in this experiment, why do you think the grass dies?
   In the presence of dissolved salts in the water, the plant cells become hypertonic and will die if left in that condition because the cells will plasmolyze.

9. Over time, land that is irrigated or overfertilized will have minerals build up and form salts in the soil. What do you predict will happen over time to the farmer’s crops if this process continues? Please explain your reasoning, and provide evidence from the lab to support your reasoning.
   Over time, the productivity of the crops will decrease. As salts build up in the soils, it will eventually cause water to move from plant tissues to into the soils where water is less concentrated. This will lead to a loss of crop productivity and eventually, unless remediated, will create an environment in which plants cannot grow due to high salinity.
10. Draw a model depicting the events of this lab on onion cells. Be sure to include all three events: dry mount slide, salt solution slide, and distilled water slide and use proper terminology.

11. What do you think would happen to an animal cell placed into a pure water solution? Explain your reasoning.
   
   Animal cells do not have a cell wall, so if they absorb too much water, they will lyse.

12. How is this lab activity similar to the sodium polyacrylate demonstration?
   
   Both activities demonstrate diffusion, the movement of solutes from areas of high concentration to areas of low concentration.

Noble Research Institute would like to thank the following people for their contributions to this lesson:

- Quentin Biddy
- Janie Herriott
- Susie Edens
- Fiona McAlister
- Kay Gamble
LESSON OVERVIEW:
For living organisms to survive, nutrients, water, and waste must be able to move into and out of the cell. This process maintains homeostasis. The movement of materials into and out of the cell is regulated by the membranes that surround both the organelles within the cell and the outer plasma membrane. The simplest way molecules move is through diffusion, which is when substances move from an area of high concentration to an area of low concentration. Diffusion does not require the expenditure of energy. Water also moves through membranes by diffusion in a process called osmosis. Water will move from an area of high concentration to an area of low concentration.

ESSENTIAL QUESTION:
How do cells maintain homeostasis?

TOPICAL ESSENTIAL QUESTION:
How does solute concentration affect osmosis in cells?
LESSON OBJECTIVES:
You will be able to:
1. Observe the effect of different solutes on diffusion in onion cells.
2. Explain hypertonic, hypotonic and isotonic in terms of cellular environment.
3. Model the effects of solutes on diffusion in onion cells.

KEY VOCABULARY:
<table>
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<th>Diffusion</th>
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SAFETY PRECAUTIONS:
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• Wear safety glasses, lab coat and gloves when performing the experiment.
• Scalpels are extremely sharp; caution is advised when using.
  o Hold the scalpel as you would a pencil.
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  o Watch the placement of your specimen-holding hand. Do not cut toward your holding hand.
  o Do not use for anything other than the intended task.
• If sodium polyacrylate comes in contact with skin, wash thoroughly with water.
• Use caution with glass slides and cover slips.

ENGAGE:
Observe the demonstrations and answer the questions below:
1. What happens to the food coloring when dropped into the beaker of water?

2. Why does the tea diffuse at different rates?
3. What allows the diaper to hold so much water?

4. Why does adding salt to the diaper contents release the water?

EXPLORE:

1. Using the scalpel, carefully slice away the purple layer of cells from the outermost layer of the red onion. This should be only the thin purple layer. From this layer, trim to get a piece that is the size of the box to the right. The slice should be very thin so that you have only one layer of tissue.

2. Place the onion tissue layer on a dry microscope slide with the shiny side facing up.

3. Place the slide on the stage, and scan the onion tissue under low power to find the darkest purple area on the tissue.

4. Raise the objective power to medium and focus the view, using the coarse adjustment knob.

5. On Table 1, draw a picture of what one cell looks like and label the observable cell structures.

6. Return the microscope to the lowest objective, lower the stage and remove the slide.

7. Make a wet mount by using the pipette to place two to three drops of salt water solution on the onion tissue, then place a cover slip on top.

8. Return the wet mount slide to the microscope. Scan the onion tissue on low power to observe any changes. Once you have found an area to view, raise the objective power to medium and observe the cells for three minutes.

9. After three minutes, draw an image of what the cell looks like, label the observable structures, and answer the questions on Table 1.

10. Return the microscope to the lowest objective, lower the stage and remove the slide.

11. Place the entire slide into a shallow dish of tap water to rinse the salt water off the slide, cover slip and onion tissue. Gently rotate the dish a few times to agitate the slide.

12. Very gently, remove the cover slip and onion tissue from the slide. Dry the slide and cover slip with a paper towel. Gently blot the onion tissue dry.

13. Make a wet mount of the onion tissue using a clean pipette, and add two to three drops of distilled water onto the onion tissue before placing the cover slip on.

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EXPLAIN:

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Water also moves through membranes by diffusion in a process called osmosis. Water will move from an area of high concentration to an area of low concentration. This difference in concentrations across a space, such as a membrane, or in different locations is a concentration gradient. In plant cells that have walls, osmosis is affected by the solute concentration and by the resistance of water to move in the cell by the cell wall. This resistance is called turgor pressure and is what helps keep the plant stems rigid enough to stand. When discussing the way solutions separate by selective permeability, the terms isotonic, hypertonic and hypotonic are used. An isotonic solution is one in which the concentration of solutes is even on both sides of the membrane. A hypertonic solution is one in which the concentration of solutes is greater outside of the cell, causing water to move from inside to outside of the cell. A hypotonic solution is one in which the concentration of solutes is greater inside the cell than outside, causing water to move from the environment into the cell.

Concentration gradients are important in allowing the movement of substances into and out of cells. In a normal environment, the roots of the plant live in an aqueous environment, one in which the minerals from the soil are dissolved in water. The plant must absorb these minerals to carry out its life functions. Roots have specialized structures called root hairs, which are responsible for absorbing water. When the root hairs are hypertonic to the surrounding soil water, they have a lower water concentration, causing the water and any dissolved mineral solutes to move from the soil into the root hair cells. Once the water is absorbed by the root hairs, the water moves from cell to cell by osmosis along a concentration gradient; each cell is hypertonic to the one before it, drawing the water through the cells into the center of the root where it enters the xylem and can be carried up to the rest of the plant by transpiration.
ELABORATE:

Osmosis in Carrots

Materials (per group):
- 200 mL 3% NaCl solution
- 200 mL 5% NaCl solution
- 200 mL 7.5% NaCl solution
- 200 mL 10% NaCl solution
- 200 mL Tap water
- 200 mL Distilled water
- 6 Baby carrots
- Electronic balance
- 6 - 250 mL Beakers
- Paper towel
- Forceps

Procedure:

Day 1
1. Label beakers 3% NaCl, 5% NaCl, 7.5% NaCl, 10% NaCl, tap water and distilled water.
2. Fill each beaker with 200 mL of the appropriate solution.
3. Assign one carrot to each treatment.
4. Make an initial observation of the carrot (color, texture, firmness).
5. Using the electronic balance, record the mass of each carrot in Table 2.
6. Place the appropriate carrot in the corresponding beaker.
7. Make a prediction about what will happen to the mass of each carrot overnight in Table 2.
8. Place the beakers where your teacher instructs.

Day 2
1. Remove the carrot from the 5% salt beaker using forceps. Do not stab or poke the carrot. Use a paper towel to pat the carrot dry, measure the mass, and record in Table 3. Record observations of carrot (color, texture, firmness).
2. Repeat Step 1 for each treatment.
3. Complete calculation for treatments in Table 3.
4. Graph the results of Table 3.
5. Dispose of beaker solutions in the sink with running water. Throw carrots in the trash.
### Table 2. Observations and Predictions

| Pretreatment observation | | | | | | |
| Prediction | | | | | | |
| Posttreatment Observation | | | | | | |

### Table 3. Mass of Carrots

| Pretreatment Mass | | | | | | |
| Posttreatment Mass | | | | | | |
| Pre and Post Mass Difference | | | | | | |
| % change (- or +) | | | | | | |

This investigation can also be done using various concentrations of sucrose solutions, and students can calculate water potential for each treatment.
EVALUATE:

Name: _________________________________________________

1. In your own words, explain diffusion. Provide an example of diffusion that occurs in daily life.

2. In the dry mount slide, what environment was the onion tissue in: hypertonic, hypotonic or isotonic?

3. When the salt solution was added to the onion cells, was the concentration of water greater inside or outside of the cell? Explain your answer using your observations from this lab.

4. In the salt solution, what environment was this cell in: hypertonic, hypotonic or isotonic?

5. When the distilled water was added to the onion cells, was the concentration of water greater inside or outside of the cell? Explain your answer using your observations from this lab.

6. In the distilled water solution, what environment was this cell in: hypertonic, hypotonic or isotonic?
7. Using your understanding of diffusion and osmosis, explain why a plant wilts and is able to recover as seen in the Engage video.

______________________________________________________________________________

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8. Grass often dies near roads covered in salt to remove ice. Using what you have learned in this experiment, why do you think the grass dies?

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9. Over time, land that is irrigated or overfertilized will have minerals build up and form salts in the soil. What do you predict will happen over time to the farmer’s crops if this process continues? Please explain your reasoning, and provide evidence from the lab to support your reasoning.

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10. Draw a model depicting the events of this lab on onion cells. Be sure to include all three events: dry mount slide, salt solution slide, and distilled water slide and use proper terminology.

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11. What do you think would happen to an animal cell placed into a pure water solution? Explain your reasoning.

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______________________________________________________________________________

12. How is this lab activity similar to the sodium polyacrylate demonstration?

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