**Instructions:** Read the paragraphs and watch the videos under the “Understanding Osmosis” section. Then, answer the questions under the “Checking for Understanding” section.

### **Understanding Osmosis**

**Osmosis and Tonicity**

The plasma membrane of the cell is made up of a phospholipid bilayer with membrane proteins embedded throughout. This structure of the plasma membrane is very important as it allows for it to be selectively permeable, which means it allows some things to pass through but not others. The membrane allows small nonpolar molecules such as oxygen, carbon dioxide, and small steroid hormones to pass through easily, whereas water soluble molecules and ions (charged particles) cannot pass freely through the membrane. Integral proteins may serve as transport channels for water soluble molecules and ions to pass through the membrane. Transporting substances across the plasma membrane may be categorized into passive processes and active processes. Active processes require energy from the cell, whereas passive processes use the energy from a concentration gradient and do not use cellular energy. One example of a passive transport process is osmosis, which is the movement of water across the membrane from where water is in a high concentration to where water is in a low concentration. During osmosis, water will move from the side of the membrane with less dissolved solute to the side with a higher solute (solid particle, i.e., s) concentration. When the relative concentrations of water to solute are equal on both sides of the membrane, the net movement of water ceases and the concentrations are said to be at a state of equilibrium.

If the inside of a cell and the extracellular fluid surrounding it are at equilibrium, the cell is said to be an isotonic environment. Isotonic means that both concentrations are equal on either side of the membrane. If a cell is placed in an environment with less dissolved solute in the extracellular fluid than inside of the cell, the environment is said to be hypotonic to the cell. Since water flows toward the higher solute concentration during osmosis, water will flow into the cell in a hypotonic environment and the cell will swell. If a cell is placed in an environment with more dissolved solute in the extracellular fluid than inside of the cell, that environment is said to be hypertonic to the cell. In a hypertonic environment, water will flow out of the cell and the cell will shrink.

Video links:

[Osmosis Background Video](https://youtu.be/Z0cgyuGdeWY)

### **Checking for Understanding**

Instructor Note: Consider the suggested questions found under the math section of the Assessment Questions document.

### **Experiment**

**Instructions**: Watch the video link below describing the experiment. Then write a summary of what is happening in the experiment.

[Osmosis Experiment Video](https://youtu.be/WIjJgJY_a7Y)

### **Excel Activity:**

* [How to Fix Wrong Axes on Graph](https://youtu.be/nvnn6_KD1zs)
* [P Value Test for Linear Correlation in Microsoft Excel](https://youtu.be/LyTSzAVwhxU)
* [Graphing Least-Squares Regression Lines in Microsoft Excel with Multiple Data Sets on One Graph](https://youtu.be/c5MOEL-WWQA)

### **Regression and Osmosis Activity:**

**Instructions**: Use the osmosis data set to answer the questions below.

Question 1: Identify the independent and dependent variable for the experiment. Explain your answer.

Question 2: Create a scatterplot for the data set for each bag in every beaker. Label the axes.

Question 3: Using what you know about osmosis, correctly fill in the blanks below.

1. Bag A in beaker 1 is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ( Isotonic/Hypertonic/Hypotonic) to the solution.

This means water will \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_( move into/out of/ neither) the bag.

1. Bag B in beaker 1 is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ( Isotonic/Hypertonic/Hypotonic) to the solution.

This means water will \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_( move into/out of/ neither) the bag.

1. Bag C in beaker 1 is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ( Isotonic/Hypertonic/Hypotonic) to the solution.

This means water will \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_( move into/out of/ neither) the bag.

1. Bag D in beaker 1 is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ( Isotonic/Hypertonic/Hypotonic) to the solution.

This means water will \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_( move into/out of/ neither) the bag.

1. Bag E in beaker 1 is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ( Isotonic/Hypertonic/Hypotonic) to the solution.

This means water will \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_( move into/out of/ neither) the bag.

1. Bag F in beaker 1 is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ( Isotonic/Hypertonic/Hypotonic) to the solution.

Question 4: Find the line of best fit for each bag in every beaker.

Question 5: Interpret the slope of the line of best fit using complete sentences.

Question 6: Interpret the y-intercept of the line of best fit using complete sentences.

Question 7: Would you expect the slope to be positive or negative for a bag that is hypertonic to the solution? Would you expect the slope to be positive or negative for a bag that is hypotonic to the solution?

Question 8: Would we use the line of best fit to make predictions for each bag in beaker 1? Explain your answer.

Question 9: Find the predicted weight of a bag at 65 minutes for each bag in beaker 1. Explain your steps. Round to 3 decimal places and include the units.

Question 10: Could we find the weight of a bag B in beaker 1 at 180 minutes using the same method used in Question 8? Explain your answer.

### **Summary, Reflection, and Peer Review**

**Instructions**: Complete the peer review and write a summary of what you learned from this activity. Give another real world example of where you predict based on linear correlations. If you use a source from the internet, cite your source.