Diffusion and Osmosis Worksheet

Below are semi-permeable bags filled with various concentrations of solutions placed in beakers with various concentrations of solutions. Use this information to help answer the questions below for each set-up.

- The solutions are prepared with distilled water.
- The semi-permeable membrane bag is permeable to glucose, a very small sugar molecule.
- The semi-permeable membrane bag is NOT permeable to sucrose, a larger sugar molecule.

For each set-up, you must:
1. Indicate whether the solution in the bag is isotonic, hypertonic, or hypotonic to the solution in the beaker.
2. Draw a blue arrow for the net movement of water by osmosis (do not draw any arrow if there would be no net movement of water).
3. Draw a green arrow for the net movement of solute by diffusion (do not draw any arrow if there would be no net movement of solute).
4. Explain why you drew the arrows you did in terms of the properties of diffusion, osmosis, and semi-permeable membranes. Be sure to include concentrations of solutions in your explanation.

The solution in the bag is __________ hypotonic __________ compared to the solution in the beaker

Explain your arrows:
There is a lower concentration of sucrose (0.1 M) in the bag than there is in the beaker (0.5 M). Therefore, there is a higher concentration of water in the bag. Water will diffuse through a semi-permeable membrane from an area of high water concentration to low water concentration, so the blue arrow shows water diffusing out of bag.

There is no green arrow because the sucrose molecule is too large to fit through the pores of the semi-permeable membrane bag. There would be no diffusion of sucrose.

The solution in the bag is __________ isotonic __________ compared to the solution in the beaker

Explain your arrows:
There are no arrows because isotonic solutions are already at equilibrium.
The solution in the bag is **hypertonic** compared to the solution in the beaker.

Explain your arrows:
There is a higher concentration of sucrose (1 M) in the bag than there is in the beaker (0.4 M). Therefore, there is a higher concentration of water in the beaker. Water will diffuse through a semi-permeable membrane from an area of high water concentration to low water concentration, so the blue arrow shows water diffusing into the bag.

There is no green arrow because the sucrose molecule is too large to fit through the pores of the semi-permeable membrane bag. There would be no diffusion of sucrose.

The solution in the bag is **isotonic** compared to the solution in the beaker.

Explain your arrows:
There are no arrows because isotonic solutions are already at equilibrium.

The solution in the bag is **hypotonic** compared to the solution in the beaker.

Explain your arrows:
There is a higher concentration of glucose (1 M) in the beaker than there is in the bag (0.9 M). Therefore, there is a higher concentration of water in the bag. Water will diffuse through a semi-permeable membrane from an area of high water concentration to low water concentration, so the blue arrow shows water diffusing out of the bag.

Glucose is small enough to fit through the pores of the bag. Glucose will diffuse through the semi-permeable membrane from an area of high glucose concentration to an area of low glucose concentration, so the green arrow shows glucose diffusing into the bag.

The solution in the bag is **hypertonic** compared to the solution in the beaker.

Explain your arrows:
There is a higher concentration of glucose (0.7 M) in the bag than there is in the beaker (0.1 M). Therefore, there is a higher concentration of water in the beaker. Water will diffuse through a semi-permeable membrane from an area of high water concentration to low water concentration, so the blue arrow shows water diffusing into the bag.

There is a higher concentration of glucose (0.7 M) in the bag than there is in the beaker (0.1 M). Glucose is small enough to fit through the pores of the bag. Glucose will diffuse through the semi-permeable membrane from an area of high glucose concentration to an area of low glucose concentration, so the green arrow shows glucose diffusing out of the bag.
The solution in the bag is **isotonic** compared to the solution in the beaker.

Explain your arrows:
There are no arrows because isotonic solutions are already at equilibrium.

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The solution in the bag is **hypotonic** compared to the solution in the beaker.

Explain your arrows:
There is a concentration of sucrose (0.8 M) in the beaker. There is no sucrose in the bag. Therefore, there is a higher concentration of water in the bag. Water will diffuse through a semi-permeable membrane from an area of high water concentration to low water concentration, so the blue arrow shows water diffusing out of bag.

There is no green arrow because the sucrose molecule is too large to fit through the pores of the semi-permeable membrane bag. There would be no diffusion of sucrose.

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The solution in the bag is **hypertonic** compared to the solution in the beaker.

Explain your arrows:
There is a concentration of glucose (1 M) in the bag. There is no glucose in the beaker. Glucose is small enough to fit through the pores of the semi-permeable membrane bag. Glucose will diffuse through the semi-permeable membrane from an area of high glucose concentration to an area of low glucose concentration, so the green arrow shows glucose diffusing out of bag.

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The solution in the bag is **hypertonic** compared to the solution in the beaker.

Explain your arrows:
There is a higher concentration of sucrose (1 M) in the beaker than there is in the bag (2 M). Therefore, there is a higher concentration of water in the beaker. Water will diffuse through a semi-permeable membrane from an area of high water concentration to low water concentration, so the blue arrow shows water diffusing into bag.

There is no green arrow because the sucrose molecule is too large to fit through the pores of the semi-permeable membrane bag. There would be no diffusion of sucrose.
The solution in the bag is ______ isotonic ________ compared to the solution in the beaker

Explain your arrows:
There are no arrows because isotonic solutions are already at equilibrium.

The solution in the bag is ______ hypotonic ________ compared to the solution in the beaker

Explain your arrows:
There is a higher concentration of glucose (0.2 M) in the beaker than there is in the bag (0.1 M). Therefore, there is a higher concentration of water in the bag. Water will diffuse through a semi-permeable membrane from an area of high water concentration to low water concentration, so the blue arrow shows water diffusing out of the bag.

There is a higher concentration of glucose (0.2 M) in the beaker than there is in the bag (0.1 M). Glucose is small enough to fit through the pores of the bag. Glucose will diffuse through the semi-permeable membrane from an area of high glucose concentration to an area of low glucose concentration, so the green arrow shows glucose diffusing into the bag.

Using the set-up to the left, explain how you would test your explanation. Make sure to include what you would use to produce quantitative data.

Quantitative data is numerical data; it’s a measurement of distance, mass, or volume.

To test my explanation to the left I could set up a similar experiment in the lab. I would fill a beaker or cup with distilled water. I would make a semi-permeable membrane bag from dialysis tubing and add 0.8M Sucrose until it was half full. I would remove the extra air from the bag so there is room for water to move into the bag. I would then mass the bag before putting it into the distilled water. After 24 hours I would remove the bag from the distilled water and mass it again. I would determine whether the bag gained or lost mass by subtraction. To show that sucrose did not leave the bag, I would have to do some sort of test on the distilled water that could indicate the presence of sucrose.

The solution in the bag is ______ hypertonic ________ compared to the solution in the beaker

Explain your arrows:
There is a concentration of sucrose (0.8 M) in the bag. There is no sucrose in the beaker. Therefore, there is a higher concentration of water in the bag. Water will diffuse through a semi-permeable membrane from an area of high water concentration to low water concentration, so the blue arrow shows water diffusing into bag.

There is no green arrow because the sucrose molecule is too large to fit through the pores of the semi-permeable membrane bag. There would be no diffusion of sucrose.