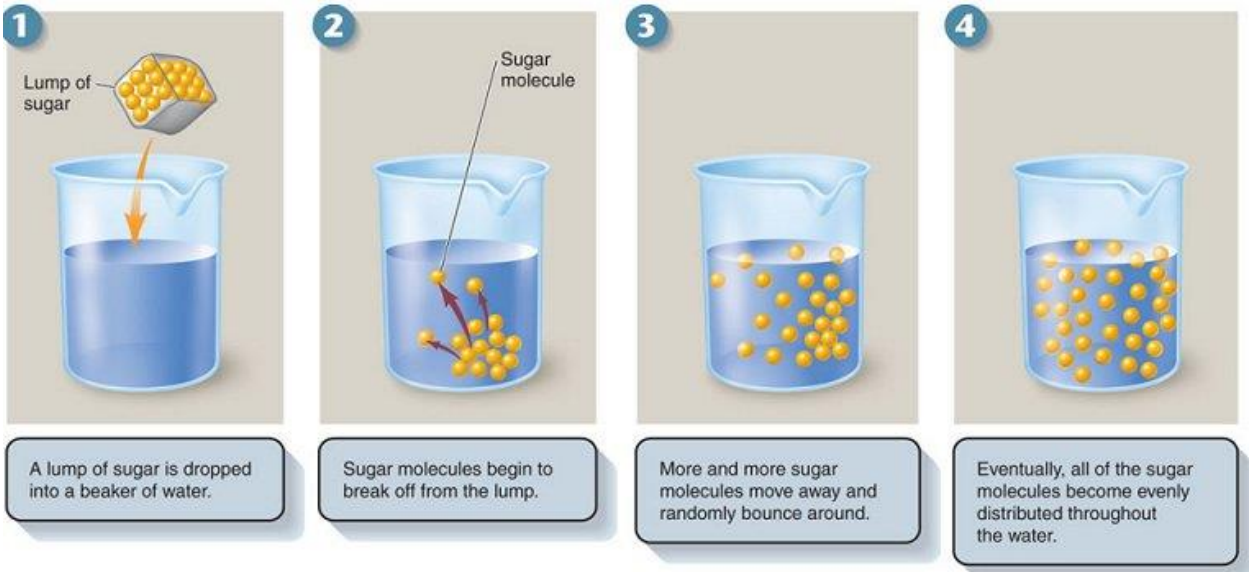
STATION ONE: DIFFUSION

The word ***concentration*** refers to how much stuff or mass is found in a given space or volume. An espresso coffee has more coffee particles than a regular cup of coffee; therefore the espresso is more concentrated. You can also say that a cup of coffee with three sugar cubes has a **higher concentration** of sugar then a second cup of coffee that has only one sugar cube added.

When the sugar cube was first added to the coffee, the sugar was concentrated or tightly packed into a sugar cube. However, the water in the coffee gradually dissolves the sugar cube causing the sugar cube to randomly spread out in the solution. The dissolved sugar molecules moved away from the cube where it was highly concentrated into the coffee liquid where it was less concentrated. This random movement of particles from an area of high concentration to an area of lesser concentration is called ***diffusion***. The uneven distribution of sugar particles is called a ***concentration gradient***. Normal diffusion goes with the gradient moving particles from high to low concentrations. Diffusion **stops** when the particles are spread out evenly. The particles are still in constant motion, but because there is no concentration gradient, the solution has reached ***equilibrium.***



<u>INVESTIGATION</u>:

1. Fill up a beaker with water.
2. Using 3 beakers ¾ filled with water, drop 1 drop of food coloring into each beaker at the same time and observe what happens.
3. Pour out the beaker of water into the sink, rinse beakers and return to tray.
4. Put your nose up to the balloon to see if you can smell anything.

Particles will pass through a membrane if they are small enough or if they are recognized as molecules that need to pass into or out of a cell.

STATION TWO: ACTIVE TRANSPORT

Investigation/Procedure:

1. Watch the video Active Transport on EDpuzzle.
2. Use the video and reading passage to answer the questions.

What happens when you are trying to get from one class to another class in a crowded hallway? Is it easier to move with the crowd or against the crowd? Have you ever been on a slide at a playground? Does it take more energy to climb the stairs to get to the top or to actually slide to the bottom? What does it mean to you to be ***"active?"*** When you are moving against something, or walking up stairs, you are actively using energy to get the task done.

Sometimes a cell needs to use energy to move molecules ***against*** the concentration gradient to where they are needed. This is like pushing against the crowd on Main Street. Molecules are moved from an area of low concentration to an area of high concentration. This is called **active transport**, because it takes ***energy*** to actively move molecules against the concentration gradient. The cell is able to create energy by breaking the high energy bond found within a molecule known as **A**denosine **T**ri**P**hospate (ATP)

Modeling Active Transport: Pick up the beaker of "molecules". The beaker represents a cell full of these molecules (having a high concentration). Tip the beaker and allow four or five of the molecules to fall out, once the beaker is tilted notice no energy is required for the molecules to move from a high concentration to a low concentration. This is passive transport.
Now set the beaker down on the table and put the molecules outside the beaker (where there is a lower concentration) back into the beaker (where there is a higher concentration). Does it take energy to move these molecules to the beaker? YES! This is active transport. Active transport uses energy to move molecules from a low concentration to a high concentration.

Energy is also required if the cell needs to take in or release large bulky materials. The molecules would be too large to pass through the cell membrane on their own. Let's look at two processes used in moving these kinds of large, bulky materials. In science, root words (prefixes and suffixes) are helpful in figuring out the meaning of words.

For example: The root word ***Endo-*** means "Into," ***Exo-*** means "Out of" and ***Cyto-*** means "Cell."

During the process of ***Endocytosis***, energy is used to move large, bulky materials *into the cell.* These molecules are engulfed by an enfolding cell membrane that surrounds and closes up around the large,

bulky materials. The cell enfolds and pinches off inside of the cell creating a **vacuole** or *"pocket of materials."*

During the process of ***Exocytosis***, energy is used to move large, bulky materials *out of the cell.* Materials can be broken down inside a vacuole in the cell. Materials that are not used by the cell are removed as wastes. The membrane of the vacuole fuses with and becomes part of the cell membrane. The vacuole then opens up to the outside of the cell and releases its content. This is how the cell can rid itself of cellular wastes and dump needed materials, such as hormones, into the blood stream.

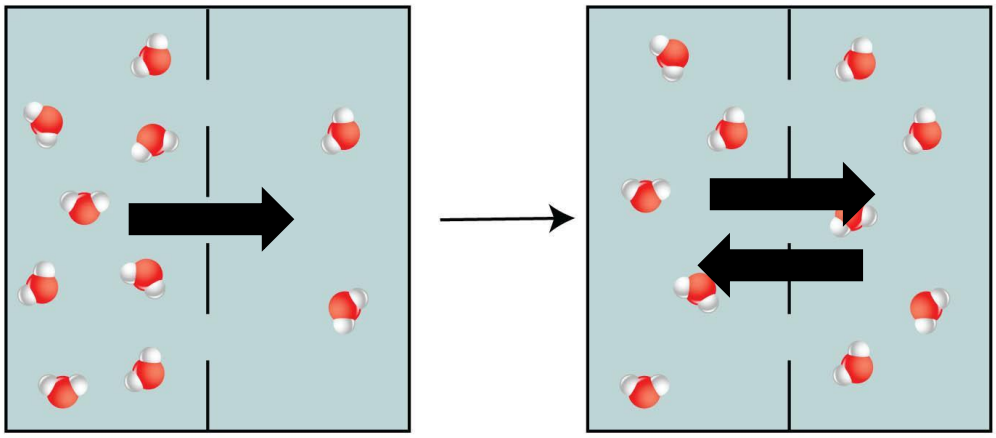
STATION THREE: OSMOSIS

Osmosis is a **specialized case of diffusion** that involves the **passive transport of water** across the cell/plasma membrane. In osmosis, water moves through a selectively permeable membrane from a region of higher concentration (more water) to a region of lower concentration (less water). I always remember it as **H_2O**smosis.

The cell membrane is selectively permeable which means it allows passage of certain types of molecules while restricting the movement of others. **Water** is allowed to pass freely, and without using energy, through the cell/plasma membrane usually through proteins. Therefore, osmosis is a form of **passive transport.**

If there was a membrane with twice as many water molecules on one side as there were on the other (and remember, water can move freely through the membrane), what do you think would happen to the water molecules? Yes, they would move toward the lower amount of water molecules.

The side with twice as many water molecules would move in one direction to the other side where the concentration was lower until eventually causing the concentration of water to be **equal** or **in equilibrium on both sides**. After that the **flow of water would then diffuse through the membrane in both directions to** maintain equilibrium.



Look at the raisin in the petri dish, the raisin in the distilled water and the raisin prior to becoming a raisin (the grape). Answer the questions on your paper.