Cell Transport

Diffusion, Osmosis, Facilitated Diffusion, and Active Transport

**Use pgs 182-189 in your textbook to help you with this handout. You may want to read through these pages and look at the diagrams as you move through this handout.**

***Vocabulary: Match the term to the correct definition.***

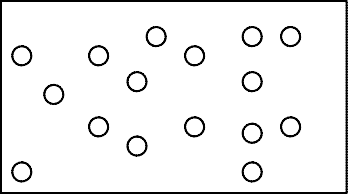
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| 1. \_\_\_\_\_\_ Passive transport | 1. The amount of solute in a given volume of solution |
| 1. \_\_\_\_\_\_ Diffusion | 1. Movement of molecules from high concentration to low concentration with the help of a protein channel in the membrane |
| 1. \_\_\_\_\_\_ Osmosis | 1. Substance that is dissolved in a solvent to create a solution |
| 1. \_\_\_\_\_\_ Facilitated Diffusion | 1. The movement of water from an area of high [water] to low [water] (or from low [solute] to high [solute] ) |
| 1. \_\_\_\_\_\_ Active Transport | 1. This type of cell movement occurs without the use of energy; includes processes such as diffusion, osmosis, and facilitated diffusion |
| 1. \_\_\_\_\_\_ Endocytosis | 1. When the concentration of two solutions is the same |
| 1. \_\_\_\_\_\_ Exocytosis | 1. The movement of molecules from an area of high concentration to an area of low concentration |
| 1. \_\_\_\_\_\_ Equilibrium | 1. When the concentration is the same throughout |
| 1. \_\_\_\_\_\_ Concentration | 1. Process by which a cell can take material into itself by infoldings of the membrane |
| 1. \_\_\_\_\_\_ Solute | 1. The solution with the lower [solute] |
| 1. \_\_\_\_\_\_ Solvent | 1. Substance that dissolves a solute to form a solution |
| 1. \_\_\_\_\_\_ Isotonic | 1. The solution with the higher [solute] |
| 1. \_\_\_\_\_\_ Hypertonic | 1. The movement of molecules against the concentration gradient (from low to high concentration) and requires energy (ATP) |
| 1. \_\_\_\_\_\_ Hypotonic | 1. Process through which a cell gets rid of materials (i.e. waste) |

***The Cell Membrane***

1. All cells are surrounded by a thin, flexible barrier known as the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. The cell membrane \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ what enters and leaves the cell and also provides \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ for the cell. Most cell membranes are made up of a double-layered sheet called a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ because it contains two layers of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Besides lipids, cell membranes also contain \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ molecules and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ molecules which are attached to the proteins. Some of the proteins play a huge role in cell transport because they form \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ that help move material across the membrane.
2. Draw and label a cell membrane in the space below. Be sure to label which side of the membrane is outside the cell and which is inside the cell. You will also need to color your membrane using this key: hydrophilic lipid heads – yellow, hydrophobic tails – brown, proteins – red, carbohydrate chains – blue

***Diffusion***

1. Particles are constantly \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, colliding with each other and spreading out randomly. As a result, particles tend to move from an area of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ concentration to an area of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ concentration through a process known as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. When the concentration is the same throughout, the system has reached \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Because diffusion depends on random particle movements, substances can diffuse across the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ without using any \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. When equilibrium is reached, the particles continue to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in both directions across the membrane. This process does not use any energy and is considered \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ transport.
2. Use arrows to indicate the direction of diffusion in each case: is a molecule that can pass through the cell membrane. is the cell membrane.

A) B)

***Osmosis***

1. Only some substances can cross or diffuse through the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. If a substance has the ability to diffuse through the membrane it is said to be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, whereas a membrane that does not allow substances to cross through (due to size, polarity, charge, etc) is said to be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Most membranes are selectively permeable which means \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
2. *How does osmosis work?* A selectively permeable membrane is permeable to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, but is not permeable to molecules such as sugar. This means that water can cross the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, while \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ cannot. As a result, there is a movement of water from the area of high [water] to low [water]. Water will tend to move across the membrane until \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is reached. At that point, the concentration of water and sugar will be the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ on both sides of the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. When this happens, both solutions are said to be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, which means \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Before the experiment began, one solution contained a higher [sugar] and therefore was considered to be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. The other solution contained a lower [sugar] and therefore was considered to be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
3. *Osmotic Pressure:* Study Figure 7-16 on pg 186. Answer the questions below.
   1. What happens to the size of a cell when it is placed in a hypertonic solution? Why?
   2. What happens to the size of a cell when it is placed in a hypotonic solution? Why?
   3. What happens to the size of a cell when it is placed in an isotonic solution? Why?
4. Complete the table by checking the correct column(s) for each statement.

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| **Statement** | **Isotonic Solution** | **Hypotonic Solution** | **Hypertonic Solution** |
| Causes a cell to swell |  |  |  |
| Doesn’t change the shape of a cell |  |  |  |
| Causes osmosis to occur |  |  |  |
| Causes a cell to shrink |  |  |  |

1. For each situation below, draw arrows to indicate the net movement of **water** into or out of the cell. After drawing the arrows, fill in the blanks with the appropriate answers.

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| --- | --- | --- |
| 5% sugar  1% sugar   1. Water will flow \_\_\_\_\_\_\_\_\_\_\_\_\_ (into the cell, out of the cell, in both directions) 2. The cell will \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (shrink, burst, stay the same) | 1% sugar  3% sugar   1. Water will flow \_\_\_\_\_\_\_\_\_\_\_\_\_ (into the cell, out of the cell, in both directions) 2. The cell will \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (shrink, burst, stay the same) | 1% sugar  1% sugar   1. Water will flow \_\_\_\_\_\_\_\_\_\_\_\_\_ (into the cell, out of the cell, in both directions) 2. The cell will \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (shrink, burst, stay the same) |

1. You have just bought a tropical fish for your freshwater aquarium. Unfortunately, you do not realize it is a saltwater fish. Using your knowledge of osmosis, explain why this fish will not survive in your aquarium.
2. You have a freshwater aquarium that contains 5 fish. You accidently spill an entire container of salt into the aquarium making saltwater with a concentration of 3%. Using your knowledge of osmosis, explain why these fish will not survive in your aquarium.

***Facilitated Diffusion***

1. Some molecules, such as sugars, are too large to pass through the cell membrane on their own. However, they are still able to move from one side of the membrane to the other. How does this happen? The cell membranes have \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ that make it possible for these larger molecules to pass through. The cell membrane protein is said to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ , or help, the diffusion of these larger molecules. Because of these protein channels, we call this type of diffusion \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ diffusion. Facilitated diffusion is a type of diffusion so that means movement occurs only if there is a higher concentration one side of the membrane than the other side. Molecules will move from a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ concentration to a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ concentration. This process requires no \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ as it is a type of passive transport.

***Active Transport***

1. Sometimes cells need to move materials against the concentration \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. This is accomplished by a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. This process requires the use of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
2. *Molecular Transport:* Small molecules and ions are carried across membranes by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in the membrane that act like \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Some ions involved in this type of active transport are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Changes in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ shape seem to play an important role in this pumping process.
3. *Endocytosis and Exocytosis:* Larger molecules may be transported by movements of the cell \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is the process of bringing material into the cell. This is done by creating infolds of the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. The infolding of the membrane forms a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ within the cytoplasm. The two types of endocytosis are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Phagocytosis means “\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_” and used to take in food. Pinocytosis occurs when cells take in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ from the surrounding environment. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is the process through which a cell gets rid of material (wastes).

***Putting It All Together***

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| 1. **Plant cell after being over-watered**   http://upload.wikimedia.org/wikipedia/commons/2/21/Rhoeo_Discolor_epidermis.jpg | * 1. Water rushes into the plant cell’s vacuole. What process is this? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_   2. Is this passive or active transport? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_   3. What causes osmosis to occur? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_   4. Is the plant cell in a hypertonic, hypotonic, or isotonic solution? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_   5. What could happen to the cell if water continues to move into it? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| 1. **Plant cell after not being watered lately (more water inside the cell than out)**   [http://upload.wikimedia.org/wikipedia/commons/thumb/0/01/Rhoeo_Discolor_-_Plasmolysis.jpg/180px-Rhoeo_Discolor_-_Plasmolysis.jpg](http://en.wikipedia.org/wiki/Image:Rhoeo_Discolor_-_Plasmolysis.jpg) | * 1. Which way will the water go? Into the cell, or out of the cell? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_   2. What process is taking place? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_   3. Is the plant cell in a hypertonic, hypotonic, or isotonic solution? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_   4. What could happen to the cell if water continues to move out of it? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| 1. **An amoeba engulfs a particle of food**   [Amoeba Feeding](http://www.biology-resources.com/drawing-amoeba-breathing.html) | * 1. Does this require energy? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_   2. Is this active or passive transport? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_   3. What process is this? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| 1. **An amoeba expels waste**   [http://tbn0.google.com/images?q=tbn:VIaqRe3GhrOUtM:http://www.pitt.edu/~biohome/Dept/Img/graphics/diabetes2.jpg](http://www.pitt.edu/~biohome/Dept/Img/graphics/diabetes2.jpg) | * 1. Does this require energy? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_   2. Is this active or passive transport? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_   3. What process is this? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |