WHAT IS THE FUNCTION OF THE CELL MEMBRANE?
1. **DIFFUSION:** The movement of molecules from an area of **high** concentration to an area of **lower** concentration.
Why do molecules move from high concentration to low concentration?
• All molecules are always in motion.
**Concentration Gradient**: The difference between the 2 concentrations of molecules.

**Larger Gradient**
Molecules move DOWN the concentration gradient.
Diffusion

high concentration

low concentration
• Molecules bump into each other as they move.
• Eventually, the molecules will be evenly spread out.
• **Equilibrium:** When there is an even concentration of molecules.

**DIFFUSION STOPS WHEN EQUILIBRIUM IS REACHED.**
In which direction will these molecules diffuse?

high concentration \[\rightarrow\] low concentration

Selectively Permeable Membrane
In which cell is diffusion occurring?
What will happen?
2. Facilitated diffusion

- Movement of molecules from high concentration to lower concentration with the help of cell membrane protein molecules.
3. **Osmosis**: The diffusion of water from **high** water concentration to **low** water concentration.
- Hypertonic: Having a **higher solute** concentration.
  - (But a *lower* water concentration)

- Hypotonic: Having a **lower solute** concentration.
  - But a *higher* water concentration.
Solution is hypertonic.
Water will leak out.
Solution is hypotonic. Water will rush in.
Isotonic: Same concentration.
Osmosis

• Water will rush towards the area that has more solute (salt, starch, etc.) in order to dilute it.
Water diffuses towards salt.

Swell

Shrink
Salt will dehydrate and kill a slug.
Less water

Fresh Water
More water
Active Transport

• The cell uses energy (ATP) in order to move molecules from \underline{low} concentration to \underline{high} concentration.
• **Active Transport** - but requires energy!!!!
Endocytosis and Exocytosis

(a) Endocytosis

(b) Exocytosis

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Active Transport
In which direction will the molecules move?
In which direction will the molecules move?

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In which direction will the molecules move?
In which direction will the molecules move?
Diffusion and Osmosis do not require energy from the cell.

- They occur **naturally** due to Brownian motion.
Selectively Permeable Membrane

Starch Molecule

Water Molecule
Lysis: Cell bursts.
In Fresh Water

- Animal cell may pop.
- Plant cell will just swell up.
Osmosis

• Water will rush towards the area that has more solute (salt, starch, etc.) in order to dilute it.
In Salt Water

• **Animal** cell will shrivel.

• **Plant cell wall** maintains its shape.

• The cell **membrane** and its **insides** will shrivel.
2 Ways to Look at it:

1. **80% Water**
   - 100% Water

2. **20% Salt**
   - Solute
   - All Water
OSMOSIS: Which Way?

20% Water

80% Water
OSMOSIS: Which Way?

50% Water

50% Salt
OSMOSIS: Which Way?

70% Water

Salt

40% Salt
Passive or Active?
Passive or Active?
Passive or Active?
Passive or Active?
Which process requires energy from the cell and which does not?

Fresh Water

Contractile Vacuole

OSMOSIS
Fresh Water Paramecium

(a) A contractile vacuole fills with fluid that enters from a system of canals radiating throughout the cytoplasm.

(b) When full, the vacuole and canals contract, expelling fluid from the cell.
Membrane Proteins

A. Some membrane proteins help communicate with other cells.

B. Other proteins do active transport.
PASSIVE TRANSPORT

No energy
ACTIVE TRANSPORT

Requires energy
Passive Transport

- Requires no energy
- High to Low
  - Diffusion
  - Osmosis
  - Facilitated diffusion
- Equilibrium is reached.

Active Transport

- Requires energy (ATP)
- Low to High
  - Pumps
  - Contractile Vacuole
- Equilibrium is **NOT** reached.
Practice problems
Passive or Active?

- You soak a cell in iodine but the cell never fills with iodine.
Passive or Active?

- You soak a cell in methylene blue and eventually it becomes fully blue.
The biologist added a 10% salt solution to the slide and observed the cell as shown in diagram $B$.

The change in appearance of the cell resulted from......

1. more salt moving out of the cell than into the cell
2. more salt moving into the cell than out of the cell
3. more water moving into the cell than out of the cell
4. more water moving out of the cell than into the cell
1. Draw the molecules in the empty beakers to show where they will be when they reach equilibrium.

A.

Semi-Permeable Membrane

B.
Quiz Today!

• Diffusion is the movement of molecules from a _______________________.
• What is an indicator?
• Which molecules are small enough to pass through a cell membrane?
  
  starch             sugar               protein amino acid
  acid             fat                 fatty acid
2. Diffusion is the movement of molecules from a __________________________ to a __________________________.

3. What determines if a molecule will be able to pass through a membrane? ____________________________________________________________

4. True or False: In order for molecules to move through a membrane, it has to be alive. (Circle one) ______________________________________________________

5. Why do your foods need to be digested?
   _________________________________________________________________
   _________________________________________________________________
The diagram below represents a plant cell in tap water as seen with a compound light microscope.

Which diagram best represents the appearance of the cell after it has been placed in a 15% salt solution for two minutes?
If frog eggs taken from a freshwater pond are placed in a saltwater aquarium, what will most likely happen?

(1) Water will leave the eggs.
(2) Salt will leave the eggs.
(3) Water will neither enter nor leave the eggs.
(4) The eggs will burst.
What will happen?

- **Tube A**
- **Glass tube**
- **Tube B**
- **Tubing**
- **10 mL of distilled water**
- **10 mL of water containing 5% starch**
- **Dialysis membrane**
10 mL of water containing 5% starch

Dialysis membrane

10 mL of distilled water
Which statement best explains why the liquid in tube A will rise over a period of time?

(1) The starch concentrations are equal on both sides of the membrane.
(2) The water will pass from a region of lower starch concentration to one of higher starch concentration.
(3) Water and starch volumes are the same in both tubes A and B.
(4) The fluids in both tubes A and B will change from a higher temperature to a lower temperature.
*Elodea* is a plant that lives in freshwater. The diagram below represents one *Elodea* leaf cell in its normal freshwater environment.

![Elodea cell in freshwater](image)

Predict how the contents of the *Elodea* cell would change if the cell was placed in saltwater for several minutes by completing the diagram, “*Elodea* cell in saltwater” below. Label the location of the cell membrane. [2]

![Cell Membrane](image)
Damage to which structure will most directly disrupt water balance within a single-celled organism?

(1) ribosome  (2) cell membrane  (3) nucleus  (4) chloroplast
The diagram below shows the relative concentration of molecules inside and outside of a cell.

![Diagram of cell with different molecules]

<table>
<thead>
<tr>
<th>Key</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diamond (♦) = Protein</td>
</tr>
<tr>
<td>Square (□) = Oxygen</td>
</tr>
<tr>
<td>Star (★) = Glucose</td>
</tr>
<tr>
<td>Circle (●) = Carbon dioxide</td>
</tr>
</tbody>
</table>

Which statement best describes the general direction of diffusion across the membrane of this cell?

1. Glucose would diffuse into the cell.
2. Protein would diffuse out of the cell.
3. Carbon dioxide would diffuse out of the cell.
4. Oxygen would diffuse into the cell.
Which observation would most likely be made 24 hours later?

1. The contents of the model cell have changed color.
2. The diameter of the model cell has increased.
3. The model cell has become smaller.
4. The amount of distilled water in the beaker has increased.
Does diffusion require energy from this cell?
Since cyanide is a poison that limits a cell's ability to manufacture ATP, a cell containing cyanide is least likely to carry on the process of…..

1. passive transport
2. active transport
3. diffusion
Passive or Active?

- A red blood cell maintains a higher concentration of Potassium inside its cell than outside.
Passive or Active?

- You soak a cell in iodine but the cell never fills with iodine.
Passive or Active?

- You soak a cell in methylene blue and eventually it becomes fully blue.
Passive or Active?

• Equilibrium is reached.
Passive or Active?

- The cell stays out of equilibrium.
Passive or Active?

• ATP is used.
Passive or Active?

• No energy is needed.
Which process is best represented in this diagram?

1. active transport
2. diffusion
With the passage of time, some molecules move from **area B to area A**. This movement is the result of the process of:

1. active transport
2. diffusion
ATP is being used to move the molecules out of which cell(s)?

1. cell A, only
2. cell B, only
3. both cell A and cell B
4. neither cell A nor cell B
Which process is directly responsible for the net movement of K+ and Mg++ into the cell?

1. diffusion
2. active transport
Which row represents **Diffusion**?  
(Passive Transport)

<table>
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<tr>
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<th>Movement of Molecule X</th>
<th>Use of ATP</th>
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<tbody>
<tr>
<td>(1)</td>
<td>high concentration → low concentration</td>
<td>used</td>
</tr>
<tr>
<td>(2)</td>
<td>high concentration → low concentration</td>
<td><strong>not used</strong></td>
</tr>
<tr>
<td>(3)</td>
<td>low concentration → high concentration</td>
<td>used</td>
</tr>
<tr>
<td>(4)</td>
<td>low concentration → high concentration</td>
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Which row represents **ACTIVE TRANSPORT**?

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6. Susie put amino acids and protein in a dialysis bag (artificial membrane). Then she put the bag into a beaker of water that has sugar in it. After 24 hours, where can each of these molecules be found?

Sugar
_____inside the bag  _____outside the bag
Amino Acids
_____inside the bag  _____outside the bag
Protein
_____inside the bag  _____outside the bag
The diagram below shows the relative concentration of molecules inside and outside of a cell.

Which statement best describes the general direction of diffusion across the membrane of this cell?

1. Glucose would diffuse into the cell.
2. Protein would diffuse out of the cell.
3. Carbon dioxide would diffuse out of the cell.
4. Oxygen would diffuse into the cell.