SECTION

3.4 Diffusion and Osmosis

Teacher Notes and Answers

SECTION 4

Instant Replay

1. Hypertonic solution: Plus sign should be inside the cell; minus sign should be outside the cell. Hypotonic solution: Plus sign should be outside the cell; minus sign should be inside the cell.
2. Yes, the molecules diffuse through a protein from an area of higher concentration to an area of lower concentration.

Vocabulary Check

1. diffusion, osmosis
2. facilitated diffusion
3. concentration gradient

The Big Picture

4. It enables materials to pass into and out of the cell without requiring the cell to use energy.
5. Not all materials can diffuse across the membrane. Facilitated diffusion enables a cell to obtain or get rid of substances that could not otherwise cross the membrane.
6. The cell has a higher solute concentration compared to a hypotonic solution, and it therefore has a lower water concentration. The water diffuses from the higher water concentration, outside the cell, to the lower water concentration, inside the cell.

SECTION

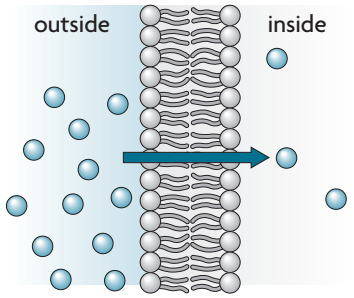
3.4 Diffusion and Osmosis

TEKS 4B, 9A

KEY CONCEPT Materials move across membranes because of concentration differences.

Diffusion and osmosis are types of passive transport.

Cells are constantly taking in and sending out substances. But cells do not have to use energy to move all those molecules. **Passive transport** is the movement (transport) of molecules without a cell using energy (passive).



Passive transport is the movement of molecules across the membrane from areas of higher concentration to areas of lower concentration. It does not require energy input from the cell.

Concentration

Concentration is the amount of molecules of one type in an area. If there are few molecules, the area has a low concentration. If there are many molecules, the area has a high concentration. Concentration can vary from one region to another. A **concentration gradient** is the difference in the concentration of a substance from one location to another. Molecules move from one place to another because of this difference in concentration.

Diffusion is the movement of molecules from a place of higher concentration to a place of lower concentration. When molecules diffuse, they are described as moving down their concentration gradient*. The diffusion of molecules across the cell membrane is a type of passive transport. It happens because of the natural motion of particles. Diffusion does not need energy from a cell.

The diffusion of water molecules is called **osmosis.** The process of osmosis is exactly the same as diffusion but refers only to water molecules. Water molecules diffuse across a membrane from a place of higher water concentration to a place of lower water concentration.

Solutions

If you dissolve salt in water, you have made a solution. The more salt you put in the water, the higher the concentration of salt becomes, and the lower the concentration of water becomes. The salt is the solute, and the water is the solvent.

Cells are usually surrounded by fluid. The type of solution that a cell is in can have a big effect on the cell. There are three types of solutions: isotonic, hypotonic, and hypertonic. These terms are comparisons. They compare the concentration of one solution to the concentration of another solution.

* ACADEMIC VOCABULARY

gradient a slope or incline; the change in a quantity per unit distance

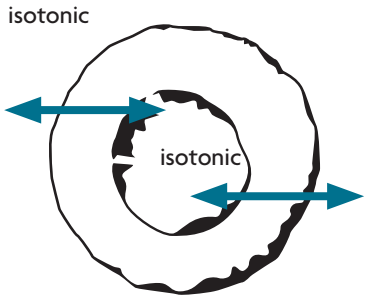
- A solution is **isotonic** to a cell if it has the same concentration of solutes that the cell has. *Iso-* means "equal." In an isotonic solution, water moves into and out of a cell at equal rates. As a result, cell size remains constant.
- A solution is **hypertonic** if it has a higher concentration of solutes than a cell. *Hyper-* means "more." This means the cell has a higher concentration of water than the surrounding fluid. As a result, water diffuses out of the cell, and the cell shrivels.
- A solution is **hypotonic** if it has a lower concentration of solutes than a cell. *Hypo-* means "less." This means the cell has a lower concentration of water than the surrounding fluid. As a result, water diffuses into the cell, and the cell grows larger.

Notice how water moves from the area of higher water concentration to the area of lower water concentration in two of the pictures below.

EFFECTS OF OSMOSIS

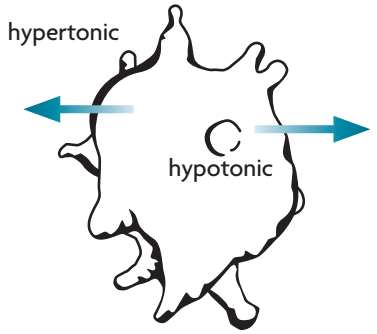
Osmosis is the diffusion of water across a semipermeable membrane from an area of higher water concentration to an area of lower water concentration.

1 ISOTONIC SOLUTION



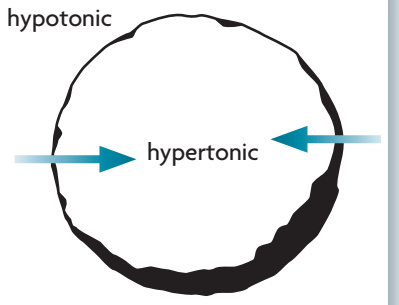
A solution is isotonic to a cell if it has the same concentration of solutes as the cell. Equal amounts of water enter and exit the cell, so its size stays constant.

2 HYPERTONIC SOLUTION



A hypertonic solution has more solute than a cell. Overall, more water exits a cell that is in a hypertonic solution, causing the cell to shrivel or even die.

3 HYPOTONIC SOLUTION



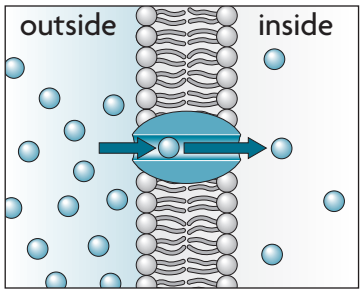
A hypotonic solution has less solute than a cell. Overall, more water enters a cell that is in a hypotonic solution, causing the cell to expand or even burst.

INSTANT REPLAY

In each picture above, mark a plus (+) where the water concentration is higher, and a minus (−) where it is lower.

Some molecules diffuse through selective transport proteins.

If some molecules can't diffuse through the cell membrane by themselves, they can get help. Transport proteins give them a ride through the membrane. This process is called **facilitated diffusion.** The word *facilitate* means "to make easier." Different transport proteins make it easier for certain molecules to get through the cell membrane without a cell using energy. Facilitated diffusion is another type of passive transport.



Facilitated diffusion enables molecules that cannot directly cross the phospholipid bilayer to diffuse through transport proteins in the membrane.

INSTANT REPLAY

In facilitated diffusion, do molecules move down their concentration gradient? Explain. _____

_____

_____

3.4 Vocabulary Check

passive transport	isotonic
concentration gradient	hypertonic
diffusion	hypotonic
osmosis	facilitated diffusion

Mark It Up

Go back and highlight each sentence that has a vocabulary word in **bold.**

1. Which two words mean nearly the same thing? _____

_____

2. Which word includes a "helper?" _____
3. Which word describes a slope? _____

3.4 The Big Picture

4. How does passive transport benefit a cell? _____

_____

5. Why do cells need facilitated diffusion? _____

_____

6. Why does a cell swell in a hypotonic solution? _____

_____

_____