

## 7.3 & 7.4 Cell transport and Homeostasis

### Lesson Summary

**Passive Transport** The movement of materials across the cell membrane without using cellular energy is called passive transport.

- ▶ **Diffusion** is the process by which particles move from an area of high concentration to an area of lower concentration.
- ▶ **Facilitated diffusion** is the process by which molecules that cannot directly diffuse across the membrane pass through special protein channels.
- ▶ **Osmosis** is the facilitated diffusion of water through a selectively permeable membrane.
  - **Aquaporins** are water channel proteins that allow water to pass through cell membranes.
  - Two adjacent solutions are **isotonic** if they have the same concentrations of solute.
  - **Hypertonic** solutions have a higher concentration of solute compared to another solution.
  - **Hypotonic** solutions have a lower concentration of solute compared to another solution.
- ▶ **Osmotic pressure** is the force caused by the net movement of water by osmosis.

**Active Transport** The movement of materials against a concentration difference is called active transport. Active transport requires energy.

- ▶ Transport proteins that act like pumps use energy to move small molecules and ions across cell membranes.
- ▶ The bulk transport of large molecules and clumps of materials into and out of cells occurs by movements of the cell membrane, which require energy.

**The Cell as an Organism** Sometimes a single cell is an organism. Single-celled organisms must be able to carry out all the functions necessary for life.

- ▶ Unicellular organisms maintain **homeostasis**, relatively constant internal conditions, by growing, responding to the environment, transforming energy, and reproducing.
- ▶ Unicellular organisms include both prokaryotes and eukaryotes.
- ▶ Unicellular organisms play many important roles in their environments.

**Multicellular Life** Cells of multicellular organisms are interdependent and specialized.

- ▶ The cells of multicellular organisms become specialized for particular tasks and communicate with one another to maintain homeostasis.
- ▶ Specialized cells in multicellular organisms are organized into groups.
  - A **tissue** is a group of similar cells that performs a particular function.
  - An **organ** is a group of tissues working together to perform an essential task.
  - An **organ system** is a group of organs that work together to perform a specific function.

- ▶ The cells of multicellular organisms communicate with one another by means of chemical signals that are passed from one cell to another.
  - Certain cells form connections, or cellular junctions, to neighboring cells. Some of these junctions hold cells together firmly.
  - Other cells allow small molecules carrying chemical signals to pass directly from one cell to the next.
  - To respond to a chemical signal, a cell must have a **receptor** to which the signaling molecule can bind.

## Passive Transport

For Questions 1–4, write the letter of the correct answer on the line at the left.

- \_\_\_\_\_ 1. Which of the following must be true for diffusion to occur?
- A. Molecules or particles must have different sizes.
  - B. Special protein channels must always be available.
  - C. There must be areas of different concentrations.
  - D. Energy must be available.
- \_\_\_\_\_ 2. Which term refers to the condition that exists when *no* net change in concentration results from diffusion?
- A. concentration
  - B. equilibrium
  - C. osmosis
  - D. randomness
- \_\_\_\_\_ 3. Air has a higher concentration of oxygen molecules than does the cytoplasm of your lung cells. Where in your lungs will there be a net increase of oxygen?
- A. in the air breathed in
  - B. in the air breathed out
  - C. outside of the lung cells
  - D. inside of the lung cells
- \_\_\_\_\_ 4. Which of the following statements tells how facilitated diffusion differs from simple diffusion?
- A. Particles move through cell membranes without the use of energy by cells.
  - B. Particles tend to move from high concentration to lower concentration.
  - C. Particles move within channel proteins that pass through cell membranes.
  - D. Particles tend to move more slowly than they would be expected to move.

For Questions 5–7, match the situation with the result. Write the letter of the correct answer on the line at the left.

### Situation

### Result

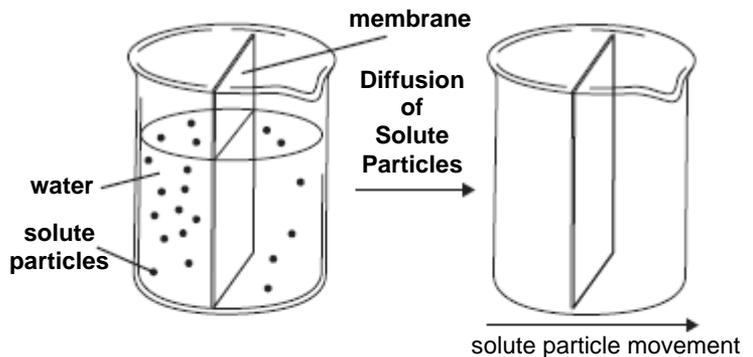
- |          |                                     |                                    |
|----------|-------------------------------------|------------------------------------|
| _____ 5. | Cells are in an isotonic solution.  | <b>A.</b> The cells lose water.    |
| _____ 6. | Cells are in a hypertonic solution. | <b>B.</b> The cells gain water.    |
| _____ 7. | Cells are in a hypotonic solution.  | <b>C.</b> The cells stay the same. |

**Compare/Contrast Table** Use a compare/contrast table when you want to see the similarities and differences between two or more objects or processes. Select words or phrases from the box to complete the table comparing passive and active transport.

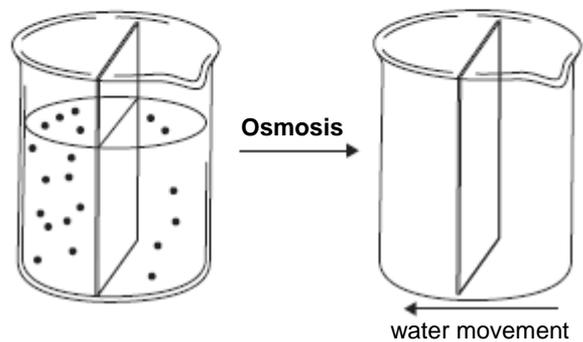
diffusion	energy required	exocytosis	osmosis
endocytosis	energy not required	facilitated diffusion	protein pumps

Passive Transport	Active Transport

Diffusion is the movement of particles from an area of high concentration to an area of low concentration. Osmosis is the diffusion of water through a selectively permeable membrane. Study the beakers at the right. The arrows between beakers tell you what process is occurring.



1. In the beakers on the right, draw the result of the described process. Draw changes in water levels. Draw changes in the number of solute particles. Remember to draw on both sides of the membrane.



2. Look at the top left beaker. What would happen if the membrane did not allow water or solute particles to pass through it?

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8. In the table below, draw how each type of cell will look after being placed in a hypertonic solution.

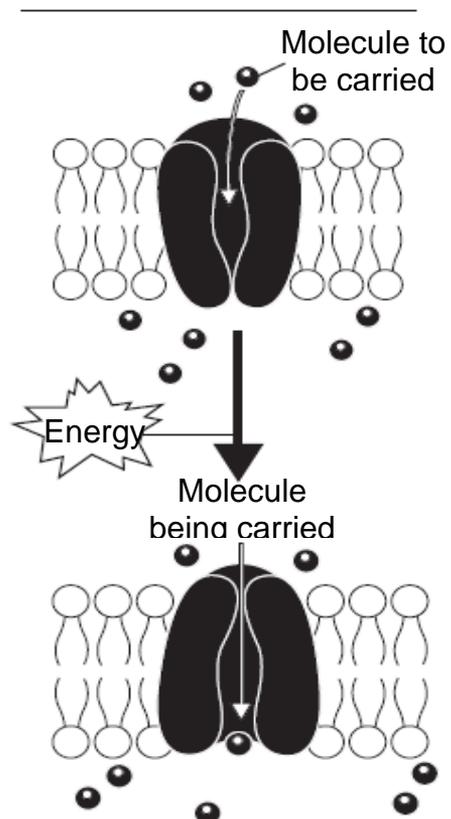
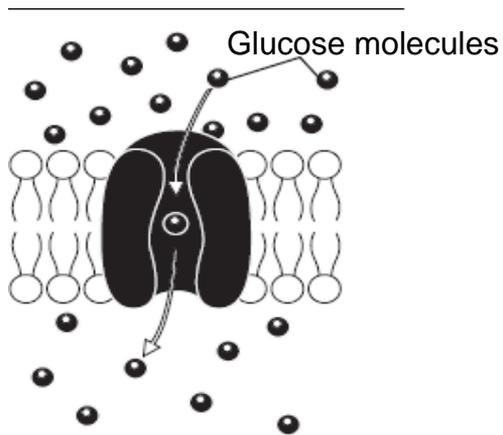
Appearance of Cells in a Hypertonic Solution	
Animal Cells	Plant Cells

## Active Transport

Facilitated diffusion takes place when a substance diffuses across the cell membrane through a protein channel. Active transport takes place when the cell uses energy to carry a substance across the cell membrane against a concentration difference.

*Follow the directions.*

1. Label each diagram as either facilitated diffusion or active transport.



Answer the questions. Circle the correct answer.

2. Which process can move molecules from a lower concentration solution on one side of the membrane to a higher concentration solution on the other side?

active transport                      facilitated diffusion

3. Which process does not require energy?

active transport                      facilitated diffusion

4. What does the word *facilitated* mean in *facilitated diffusion* ?

hindered                                  helped

9. What is the function of active transport in moving small molecules and ions across cell membranes? Give an example.

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10. How does ATP enable transport proteins to move ions across a cell membrane?

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11. What are the proteins used in active transport called? \_\_\_\_\_

12. Complete the table to summarize the types of bulk transport.

## The Cell as an Organism

For Questions 1–5, complete each statement by writing the correct word or words.

1. The term \_\_\_\_\_ refers to the relatively constant internal physical and chemical state of a living cell.

2. Unicellular prokaryotes, called \_\_\_\_\_, are adapted to living in a remarkable number of different places.

3. Some unicellular eukaryotes, called \_\_\_\_\_, contain chloroplasts.

4. Yeasts are unicellular \_\_\_\_\_, which are eukaryotes.

5. Other unicellular eukaryotes include \_\_\_\_\_ and algae.

6. How do single-celled organisms maintain homeostasis?

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7. Why is maintaining homeostasis particularly important to single-celled organisms?

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# Multicellular Life

8. How are the cells of a multicellular organism like a baseball team?

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9. How does a multicellular organism maintain homeostasis?

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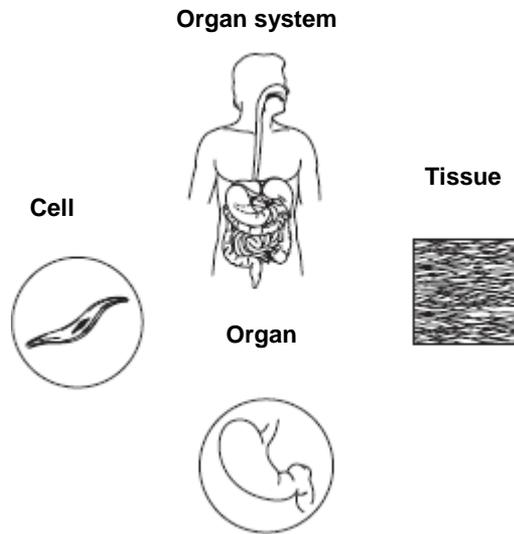
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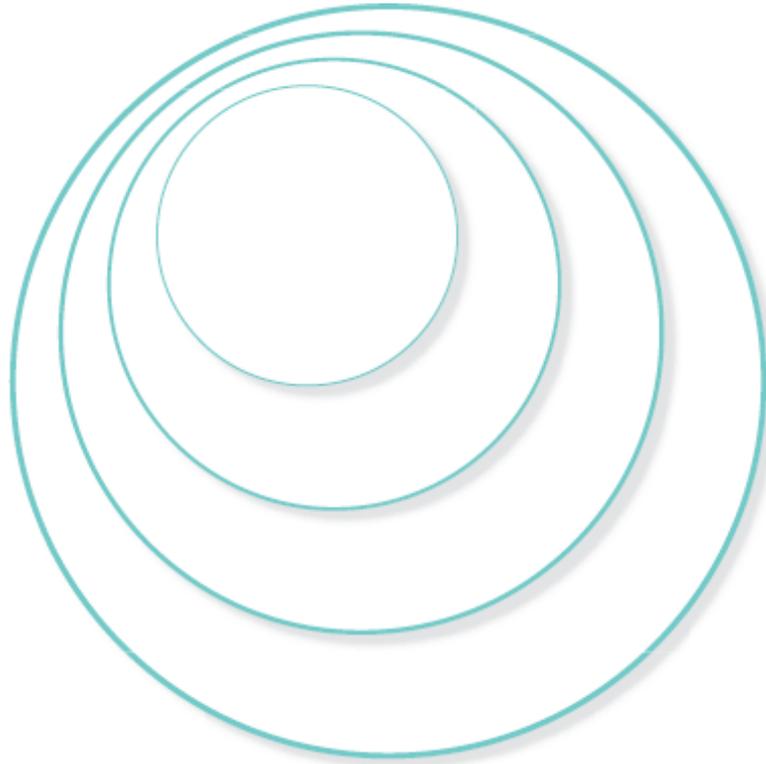
The levels of organization in a multicellular organism are cells, tissues, organs, and organ systems.

*Follow the directions.*

1. Draw an arrow from the drawing that shows the least complex level of organization to the next most complex level of organization.
2. Draw an arrow to the next most complex level of organization.
3. Draw an arrow to the most complex level of organization.



10. The Venn diagram below consists of four concentric circles. Complete the diagram to show the relationships among four levels of organization of life. Use the terms *cells*, *organ*, *organ system*, and *tissue*.



11. Starting with the outermost circle of the diagram, explain how each level is related to the next level within each circle.

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