

Math Skills

LESSON 3

Use Ratios

The area of a rectangle is the length times the width, or $A = l \times w$. The surface area of a rectangular solid is the sum of the areas of the six surfaces. The volume of this solid is the product of the length, width, and height, or $V = l \times w \times h$. The ratio of surface area to volume compares the amount of surface area on a three-dimensional solid to the volume of the solid. This ratio may be expressed as A/V or $A:V$.

A rectangular solid measures **10** cm wide, **5** cm long, and **2** cm tall. What is the ratio of surface area to volume?

Step 1 Calculate the surface area. Add the areas of the six surfaces.

$$(10 \times 5) + (10 \times 5) + (5 \times 2) + (5 \times 2) + (2 \times 10) + (2 \times 10) = 160 \text{ cm}^2$$

Step 2 Calculate the volume.

$$10 \times 5 \times 2 = 100 \text{ cm}^3$$

Step 3 Write the ratio. Divide by the greatest common factor to simplify.

$$A:V = 160:100$$

$$160 \div 20 = 8 \text{ and } 100 \div 20 = 5$$

$$A/V = 8:5$$

Practice

1. A rectangular solid has a surface area of 22 cm^2 and a volume of 6 cm^3 . What is the surface-area-to-volume ratio?

$$\begin{aligned} 22:6 \\ \div 2 \quad \div 2 \\ 11 \\ 11:3 \end{aligned}$$

3. A rectangular solid measures 5 cm long by 3 cm wide by 1 cm high. What is the surface-area-to-volume ratio?

$$\begin{aligned} SA: (5 \times 3) + (5 \times 3) + (3 \times 1) + (3 \times 1) + (1 \times 5) + (1 \times 5) \\ 15 + 15 + 3 + 3 + 5 + 5 = 46 \\ V = L \cdot W \cdot H = 5 \times 3 \times 1 = 15 \\ 46:15 \end{aligned}$$

2. A rectangular solid has a surface area of 52 cm^2 and a volume of 24 cm^3 . What is the surface-area-to-volume ratio?

$$\begin{aligned} 52:24 \\ \div 4 \quad \div 4 \\ 13:6 \end{aligned}$$

4. A rectangular solid measures 8 cm long by 2 cm wide by 2 cm high. What is the surface-area-to-volume ratio?

$$\begin{aligned} 9:4 \\ (8 \times 2) + (8 \times 2) + (8 \times 2) + (8 \times 2) + (2 \times 2) + (2 \times 2) \\ 16 + 16 + 16 + 16 + 4 + 4 = 72 \\ 32 + 32 + 8 = 72 \\ V = 8 \cdot 2 \cdot 2 = 32 \\ 72:32 \\ 9:4 \end{aligned}$$

Content Practice B

LESSON 3

Moving Cellular Material

Directions: List a fact or term next to each bullet to complete the chart.

Information to Find	Answers
1. What passes through a cell using passive transport?	<ul style="list-style-type: none"> • O₂ • CO₂ • small molecules <p style="text-align: right;">H₂O</p>
2. What are three types of passive transport?	<ul style="list-style-type: none"> • Diffusion • Osmosis • Facilitated Diffusion
3. How do substances move in passive transport?	<ul style="list-style-type: none"> • ↑ to ↓ concentration high low
4. What is the diffusion of water molecules only?	<ul style="list-style-type: none"> • osmosis
5. What is used in facilitated diffusion to assist the transport of sugar and sodium molecules?	<ul style="list-style-type: none"> • carrier proteins channel proteins
6. What is only used in active transport?	<ul style="list-style-type: none"> • energy
7. How do substances move in active transport?	<ul style="list-style-type: none"> • ↓ to ↑ concentration
8. Which proteins are used in active and passive transport?	<ul style="list-style-type: none"> • carrier proteins
9. What does a cell do to a substance in endocytosis?	<ul style="list-style-type: none"> • surrounds + brings into cell
10. What does a cell use to eliminate a substance that is too large to leave by diffusion?	<ul style="list-style-type: none"> • exocytosis
11. Which structures join with the cell's membrane during exocytosis?	<ul style="list-style-type: none"> • vesicles

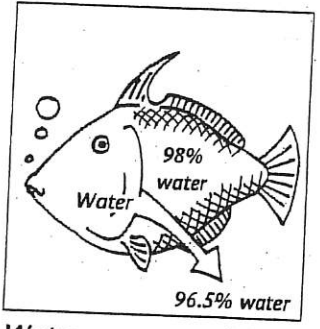
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SECTION 2-2 REVIEW AND REINFORCE

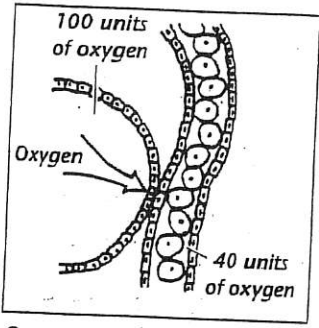
The Cell in Its Environment

◆ Understanding Main Ideas

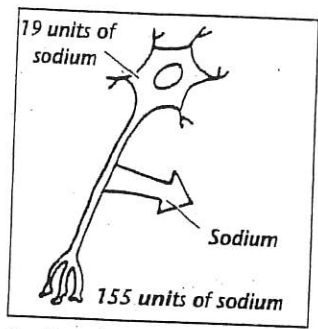
Fill in the blank to identify the process illustrated in each of the following figures.



Water moves out of the cells of a saltwater fish and into the ocean.



Oxygen moves from the lungs into the bloodstream.



Sodium is pumped out of a nerve cell.

1. osmosis 2. diffusion 3. active transport

Answer the following questions on a separate sheet of paper.

4. Explain how osmosis differs from diffusion. *osmosis = H₂O*
diffusion = any other molecule *Moving from ↑ to ↓ concentration*
5. Compare and contrast active and passive transport. *Both move substances but active = energy*
passive = no energy
6. Identify two methods of active transport. *Endocytosis / Exocytosis*
7. State one reason that cells are small. *Easier to transport within the cell. Materials entering and leaving the cell have a short distance to travel.*

◆ Building Vocabulary

If the statement is true, write true. If the statement is false, change the underlined word or words to make the statement true.

- T 8. If a membrane is selectively permeable, it lets some but not all substances pass through.
- F 9. Osmosis is the process by which molecules tend to move from an area of higher concentration to an area of lower concentration. *Diffusion*
- F 10. The process by which water moves across a selectively permeable membrane is called diffusion. *osmosis*
- F 11. Diffusion and osmosis are types of active transport. *Passive transport*
- F 12. Passive transport requires energy. *Active transport*

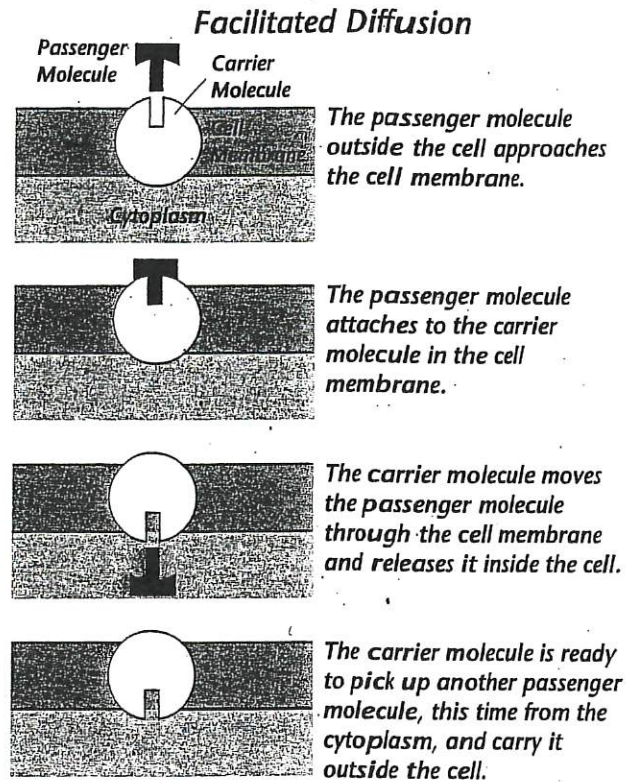
SECTION 2-2

ENRICH

Facilitated Diffusion

The text describes two methods of passive transport: diffusion and osmosis. The diagram to the right shows another method of passive transport, called facilitated diffusion.

Why is facilitated diffusion needed? Some molecules are unable to pass through the cell membrane even though they are moving from an area of higher to an area of lower concentration. To pass through the cell membrane, these molecules must be facilitated, or helped, by a carrier molecule that is embedded in the cell membrane. The carrier molecule attaches to a passenger molecule of the substance, carries it through a channel in the cell membrane, and then releases it. The process can carry substances both into and out of cells, as shown in the diagram, and it requires no energy.



Answer the following questions on a separate sheet of paper.

- Why isn't energy required for the passenger molecule to be carried across the cell membrane by the carrier molecule? *Still moving from ↑ to ↓ concentration*
- Why do the passenger molecules need to be helped by the carrier molecule? *It can't go across the membrane on its own. (size, shape).*
- If the substance entering the cell was in higher concentration inside the cell than outside the cell, what type of transport would be required? Explain your answer. *Active transport because you would need energy to pump the molecule across.*
- What is the difference between facilitated diffusion with the help of a carrier molecule and active transport with the help of a transport protein? *Active transport goes against the gradient which required energy.*
- Assume a person has defective carrier molecules for a given substance. Explain what effect this would have on the person's cells.

Specific substances couldn't enter or leave the cell. It could result in the cells death.

Facilitated Diffusion is going with the concentration gradient. No energy required