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Discovering Cells

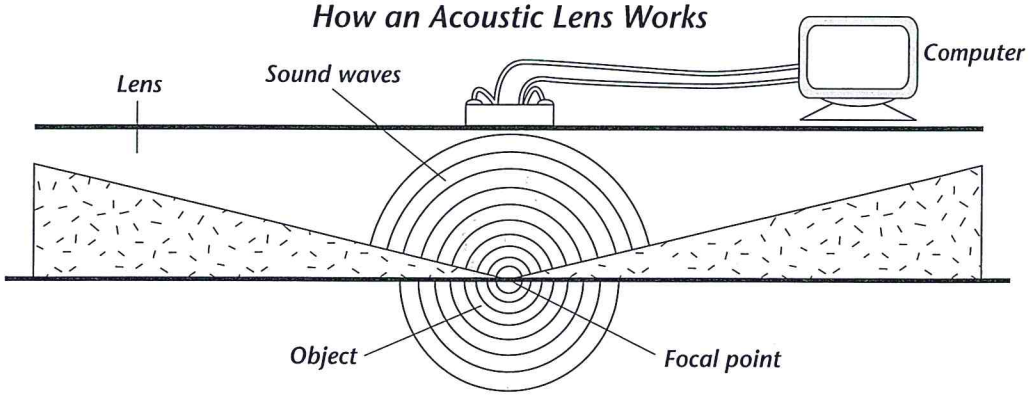
Because the beam of electrons used in electron microscopes damages live biological specimens, scientists have developed new kinds of microscopes for use with these kinds of samples. Read the passage and examine the diagram below. Then answer the questions that follow on a separate sheet of paper.

Recent Advances in the Microscope

One new type of microscope is the transmission positron microscope, or TPM. Like the transmission electron microscope, or TEM, the TPM sends a beam of atomic particles through a specimen. However, instead of using a beam of electrons, the TPM uses a beam of positrons, which are positively charged atomic particles that do not harm living specimens as electrons do.

Another new type of microscope is the acoustic microscope. It uses sound waves instead of beams of atomic particles to "see" an object. As shown in the figure, the echoes of sound waves bouncing off the specimen are translated onto a screen as a microscopic image. The sound waves that are used are very high in frequency, but they do no damage to living things. Doctors have used the acoustic microscope to view changes in living cells and to examine living cells for cancer without removing the cells from the body.

How an Acoustic Lens Works



1. Compare and contrast transmission electron microscopes and transmission positron microscopes.
2. Explain how acoustic microscopes work.
3. Why are transmission positron microscopes and acoustic microscopes important tools for understanding how living cells function?

Name _____ Date _____ Class _____

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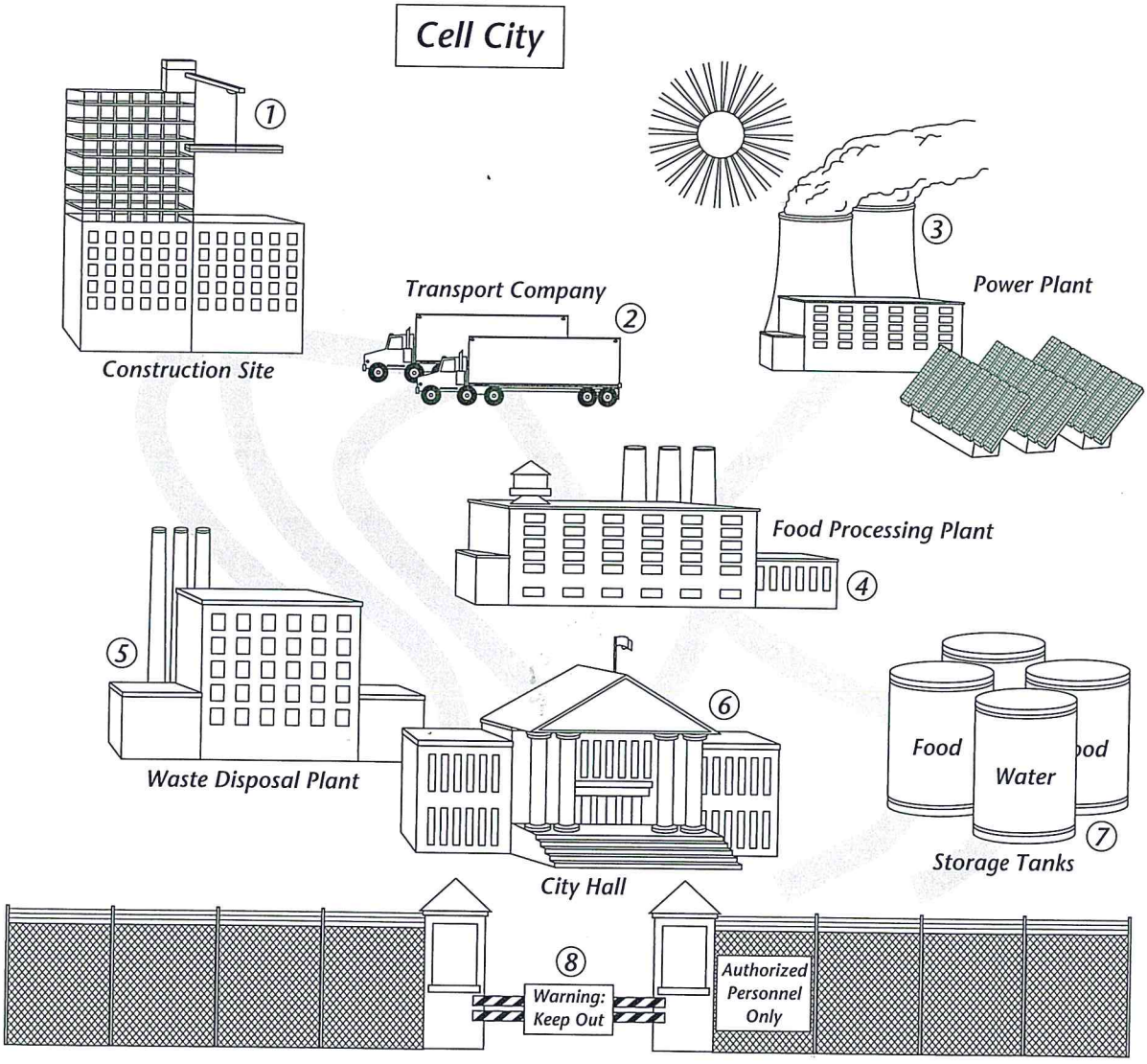
Looking Inside Cells

The figure below shows a city that is a model for a cell. Study the figure, and answer the questions that follow on a separate sheet of paper.

Modeling Cell Structures



1. State the function performed by each numbered structure in the figure.
2. Now name a cell structure that performs each of these same functions.
3. Does "Cell City" represent a plant cell or an animal cell? Explain your answer.

Name _____ Date _____ Class _____

Enrich

Chemical Compounds in Cells

Read the passage below and complete the table. Then answer the questions that follow the table on a separate sheet of paper.

Amino Acids and Proteins

Though there are only 20 common amino acids, they can be combined in different ways to produce thousands of unique proteins. Proteins that differ in the order or type of amino acids they contain may have different structures and functions. In fact, a change in even a single amino acid can sometimes affect the way a protein works.

Suppose that proteins could consist of just two amino acids. To see how many unique proteins, each composed of just two amino acids, can be formed from five different amino acids, fill in the spaces in the table below. Some of the spaces have been filled in to show you how. Assume that each letter represents a different amino acid.

Amino Acids	*A*	*B*	*C*	*D*	*E*
A	*AA*	*AB*	*AC*		
B	*BA*				
C					
D					
E					

1. What does each letter pair in the table represent?
2. Based on your completed table, how many unique proteins, each composed of just two amino acids, can be formed from five different amino acids?
3. How many unique proteins, each made up of just two amino acids, could be formed from six different amino acids? From 20 different amino acids?
4. Most proteins are made up of not just two, but hundreds or even thousands of amino acids. How does this affect the number of unique proteins that could be formed from just a few amino acids?

Name _____ Date _____ Class _____

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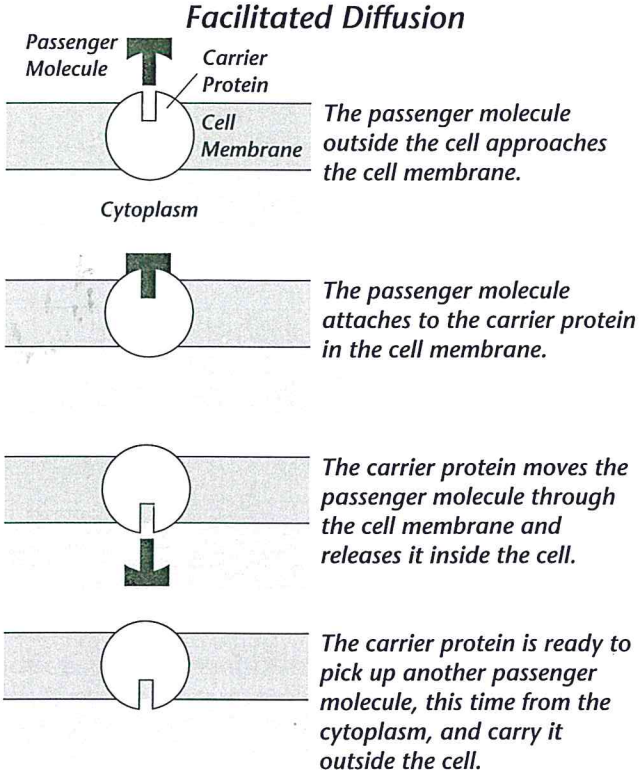
The Cell in Its Environment

Read the passage and study the diagram. Then use a separate sheet of paper to answer the questions that follow.

Facilitated Diffusion

Some molecules are unable to pass through the cell membrane even though they are moving from an area of higher concentration to an area of lower concentration. To pass through the cell membrane, these molecules must be facilitated, or helped, by a carrier protein in the cell membrane. The passenger molecule attaches to the carrier protein. The carrier protein moves the passenger molecule through the cell membrane and releases it inside the cell. The process can carry substances both into and out of cells, as shown in the diagram, and it requires no cellular energy.



1. Why isn't cellular energy required for the passenger molecule to be carried across the cell membrane by the carrier protein?
2. Why do the passenger molecules need to be helped by the carrier protein?
3. 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.
4. What is the difference between facilitated diffusion with the help of a carrier protein and active transport with the help of a transport protein?
5. Assume a person has defective carrier proteins for a given substance. Explain what effect this would have on the person's cells.

Place the outside corner, the corner away from the dotted line, in the corner of your copy machine to copy onto letter-size paper.