Chapter 7 **Cell Structure and Function** **Name _____**

Worksheet Passive and Active Transport

Background Information

When one area has more of a substance than another, that area has a high concentration of the substance. When an area has less of a substance than another, it has a low concentration of the substance. A **concentration gradient** is the difference between these areas. Very often the cell membrane is the boundary between areas of different concentrations. Some materials cross the cell membrane by simple diffusion.

In **diffusion**, substances in an area of higher concentration move to an area of lower concentration. This occurs until the amount of the substances on each side of the membrane is equal. This equal distribution of substances is called **equilibrium**.

Diffusion is a form of **passive transport**. It does not require cells to use energy to move materials. **Active transport** requires a cell to use energy to move materials. In this process, materials are often moved against a concentration gradient from areas of lower concentration to areas of higher concentration.

In Figure 1, molecules of substance A are shown on either side of a cell membrane. This model is typical of plant roots and the minerals in the soil. The concentration of A (minerals) is greater inside the root cell than outside.

In Figure 2, when substance B enters the cell, it is bound to a phosphate molecule. The combination of B and the phosphate cannot pass through the cell membrane. It is too large. Only molecules of substance B that are not bound to the phosphate can pass back through the cell. This model is an example of facilitated diffusion and B could represent glucose entering the cell.

Figure 1

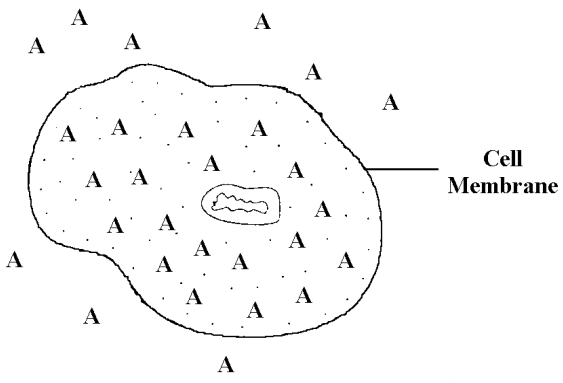
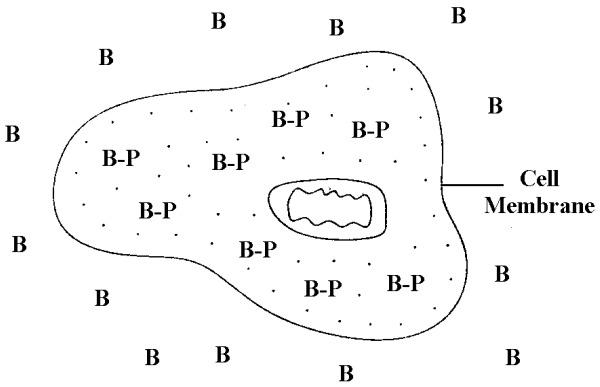


Figure 2



1. In Figure 1, how can a plant transport minerals into its root cells when there is already a higher concentration in them than in the surrounding soil?

2. In Figure 1, would water move into or out of the root cells? Explain your answer.

3. In Figure 2, where is the concentration of B (glucose) more concentrated? Will the B-P diffuse out of the cell? Explain your answer.

Background Information

Body cells use active transport to move sodium ions and potassium ions across cell membranes. Living cells pump sodium out of the cytoplasm into the area surrounding the cells. At the same time, they pump potassium from outside the cell into the cytoplasm. This system is known as the **sodium-potassium pump**. These ions are pumped against a concentration gradient, and the cell uses energy in the form of ATP.

4. Add 15 Na^+ and 10 K^+ ions to Figure 3 to show that active transport is at work. Remember to show a concentration gradient by drawing more of one type of ion on one side of the membrane. How many ATP molecules would it take to pump the 15 Na^+ and 10 K^+ ions against their concentration gradients? _____

5. Suppose that the active transport of sodium and potassium stopped. Illustrate what would happen by completing the drawing in Figure 4.

Figure 3

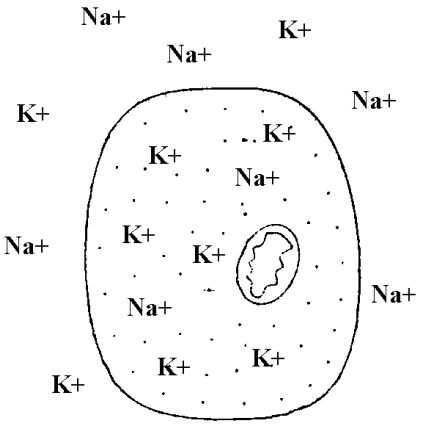
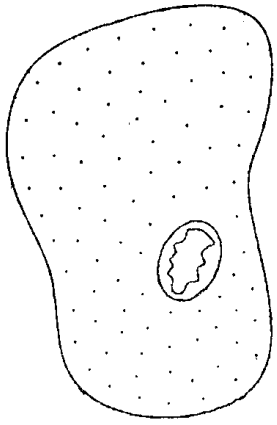


Figure 4



6. In Figure 3, would the outside of the membrane be + or - relative to the inside of the cell? This is how nerve cells use the sodium-potassium pump to create an electrical difference with their cell membrane.

7. If a cells capability of producing ATP failed, which of the following processes might continue? osmosis, active transport, or diffusion