SECTION 5-1 REVIEW

PASSIVE TRANSPORT

VOCABULARY REVIEW  Explain the relationship between the terms in each of the following pairs of terms.

1. concentration gradient, diffusion

2. osmosis, turgor pressure

3. hypertonic, plasmolysis

MULTIPLE CHOICE  Write the correct letter in the blank.

1. Substances that can pass through cell membranes by diffusion include
   - a. Na$^+$ ions.
   - b. Cl$^-$ ions.
   - c. glucose.
   - d. oxygen.

2. The contractile vacuole of a paramecium should be active when the paramecium is in
   - a. an isotonic environment.
   - b. a hypotonic environment.
   - c. a hypertonic environment.
   - d. any environment.

3. When a human red blood cell is placed in a hypotonic environment, it will
   - a. undergo cytolysis.
   - b. undergo plasmolysis.
   - c. experience a decrease in turgor pressure.
   - d. be at equilibrium.

4. Facilitated diffusion is often used to transport
   - a. ions.
   - b. water.
   - c. molecules that are not soluble in lipids.
   - d. molecules that are too small to diffuse across the membrane.

5. Na$^+$ ions enter cells by
   - a. diffusing across the lipid bilayer without assistance.
   - b. diffusing through Na$^+$ ion channels.
   - c. binding to Na$^+$ carrier proteins.
   - d. binding to Cl$^-$ ions.
SHORT ANSWER Answer the questions in the space provided.

1. What happens to the movement of molecules at equilibrium?  

2. How do carrier proteins transport substances across cell membranes?  

3. What types of stimuli can cause the gates on ion channels to open or close?  

4. Critical Thinking How does the interaction between a carrier protein and the substance it transports resemble the interaction between an enzyme and its substrate?  

STRUCTURES AND FUNCTIONS The drawings below show the appearance of a red blood cell and a plant cell in isotonic, hypotonic, and hypertonic environments. Label each environment in the spaces provided.

RED BLOOD CELL

a  ___________________________  b  ___________________________  c  ___________________________

PLANT CELL

d  ___________________________  e  ___________________________  f  ___________________________
SECTION 5-2 REVIEW

ACTIVE TRANSPORT

VOCABULARY REVIEW Define the following terms.

1. active transport

2. endocytosis

3. vesicle

4. phagocytosis

MULTIPLE CHOICE Write the correct letter in the blank.

1. Facilitated-diffusion carrier proteins and cell-membrane pumps both
   a. require an input of energy.
   b. are specific for the kinds of substances they transport.
   c. transport substances up their concentration gradients.
   d. carry out active transport.

2. The sodium-potassium pump transports
   a. Na\(^+\) out of the cell and K\(^+\) into the cell.
   b. Na\(^+\) and K\(^+\) in both directions across the cell membrane.
   c. K\(^+\) out of the cell and Na\(^+\) into the cell.
   d. Na\(^+\) during some cycles and K\(^+\) during other cycles.

3. The energy needed to power the sodium-potassium pump is provided by the
   a. binding of ATP to the pump.
   b. transport of ATP by the pump.
   c. removal of a phosphate group from ATP.
   d. formation of ATP.

4. Pinocytosis involves the transport of
   a. large particles out of a cell.
   b. fluids into a cell.
   c. whole cells into another cell.
   d. lysosomes out of a cell.

5. Exocytosis is a
   a. type of passive transport.
   b. mechanism by which cells ingest other cells.
   c. transport process in which vesicles are formed from pouches in the cell membrane.
   d. way for cells to release large molecules, such as proteins.
SHORT ANSWER Answer the questions in the space provided.

1. Why is the sodium-potassium transport mechanism called a “pump”?

2. Explain how a phagocyte destroys bacteria.

3. Describe how a cell produces and releases proteins.

4. Critical Thinking Why is it important that ions being transported across a cell membrane be shielded from the interior of the lipid bilayer?

STRUCTURES AND FUNCTIONS Use the figure to answer the following questions.

1. The diagrams below represent the six steps in one cycle of the sodium-potassium pump. The order of the steps has been scrambled. Beginning with diagram d (numbered 1), sequence the remaining diagrams by writing the appropriate numeral in each blank.

2. On which side of the membrane are Na⁺ ions released from the pump?

3. On which side of the membrane are K⁺ ions released from the pump?
STRUCTURES AND FUNCTIONS

1. Approximately 200 years elapsed between the discovery of cells in 1665 and the observation of mitochondria in muscle cells in 1857.
2. The third part of the cell theory was added in 1855. This was 190 years after cells were discovered.

Section 4-2

VOCABULARY REVIEW

1. An organelle is a cell component that performs specific functions for the cell.
2. The nucleus is an organelle that contains coded information in the form of DNA for regulating functions and reproduction and directs most of the activities of the cell.
3. A eukaryote is an organism whose cells contain a membrane-bound nucleus and other organelles.
4. A prokaryote is an organism that lacks a nucleus and membrane-bound organelles.

MULTIPLE CHOICE

1. a  2. b  3. a  4. d

SHORT ANSWER

1. Its flat platelike shape covers and protects the body’s surface.
2. Just as organs carry out the organism’s life functions, organelles maintain the life of the cell.
3. Eukaryotic cells have a membrane-bound nucleus and membrane-bound organelles.
4. The surface area increases by a factor of 100. The volume increases by a factor of 1,000.

STRUCTURES AND FUNCTIONS

1. a, prokaryotic cell; b, eukaryotic cell. 2. Features: eukaryotic cell has a nucleus and other membrane-bound organelles, but the prokaryotic cell does not; prokaryotic cell is smaller. 3. X, nucleus; Y, cell membrane

Section 4-3

VOCABULARY REVIEW

1. The nucleoplasm is the jellylike liquid that fills the nucleus. The nuclear envelope is a double membrane that surrounds the nucleus.
2. The cytoskeleton is the network of tubes and filaments that give a cell its shape and serves as tracks for the movement of organelles in the cell. Microtubules are one of three structural elements that make up the cytoskeleton.
3. Both are hairlike organelles that extend from the surface of a eukaryotic cell, but cilia are shorter and are present in larger numbers on a cell.

MULTIPLE CHOICE

1. d  2. a  3. c  4. b  5. c

SHORT ANSWER

1. Some proteins form channels or pores through which certain substances can pass. Other proteins bind to a substance on one side of the membrane and carry it to the other side.
2. Ribosomes are made of proteins and RNA. They are involved in protein synthesis.
3. The cytoskeleton is a network of long protein strands located in the cytosol. Three major components are microfilaments, microtubules, and intermediate filaments.

Section 4-4

VOCABULARY REVIEW

1. A cell wall is a rigid layer that lies outside the plasma membrane of a plant cell.
2. A plastid is an organelle that is surrounded by a double membrane and contains DNA.
3. Thylakoids are flattened membranous sacs that contain chlorophyll.
4. Chlorophyll is a green pigment that absorbs light and captures energy for a plant cell.
5. A central vacuole is a large, fluid-filled organelle that stores water, enzymes, and wastes in plant cells.

MULTIPLE CHOICE

1. b  2. b  3. a  4. c  5. c

SHORT ANSWER

1. Primary cell walls are assembled on the surface of the plasma membrane while the cell is growing. They can grow as the cell grows. Secondary cell walls are produced after the cell has stopped growing. Secondary cell walls cannot expand.
2. Plant cell walls are made of cellulose embedded in proteins and carbohydrates. Cell walls help support and protect the plant.
3. When water is plentiful, the central vacuole expands. The other organelles are pushed against the plasma membrane in a thin layer.
4. The nucleoid is not surrounded by a membrane and is therefore not a nucleus. Bacteria do not have an internal membrane system or membrane-bound organelles.

STRUCTURES AND FUNCTIONS

a. Golgi apparatus; b. cell wall; c. vacuole; d. nucleus; e. nucleolus; f. mitochondrion; g. ribosome; h. chloroplast; i. endoplasmic reticulum

Section 5-1

VOCABULARY REVIEW

1. A difference in the concentration of molecules in two areas, called a concentration gradient, can result in diffusion, the movement of molecules from the area of higher concentration to the area of lower concentration.
2. Osmosis is the diffusion of water molecules across a cell membrane. When osmosis results in water molecules entering a plant cell, the molecules exert a pressure against the cell wall, called turgor pressure.
3. A hypertonic solution has a higher solute concentration than the cytosol of a cell. In a hypertonic solution a plant cell will lose water and shrink away from the cell wall, a process called plasmolysis.

MULTIPLE CHOICE

1. d  2. b  3. a  4. c  5. b
SHORT ANSWER
1. At equilibrium, the movement of molecules continues, but because there is no concentration gradient, there is no net movement in any particular direction.
2. Carrier proteins bind to a molecule of the substance on one side of the membrane, change shape, transport the molecule across the membrane, and release the molecule on the other side.
3. The stimuli are stretching of the cell membrane, electrical signals, and chemicals in the cytosol or external environment.
4. Both involve the binding of a specific substance to a particular kind of protein and a change in shape of the protein as the process (transport or chemical reaction) proceeds. After the process is completed, the protein is unchanged.

STRUCTURES AND FUNCTIONS
a, hypotonic; b, hypertonic; c, isotonic; d, hypertonic; e, isotonic; f, hypotonic

Section 5-2

VOCABULARY REVIEW
1. Active transport is the movement of materials across a membrane from an area of lower concentration to an area of higher concentration.
2. Endocytosis is the process by which cells ingest external fluid, macromolecules, and large particles.
3. A vesicle is a membrane-bound organelle that pinches off from the cell membrane during endocytosis or fuses with the cell membrane during exocytosis.
4. Phagocytosis is a type of endocytosis in which cells ingest large particles or whole cells.

MULTIPLE CHOICE
1. b 2. a 3. c 4. b 5. d

SHORT ANSWER
1. The mechanism uses energy to move (pump) Na⁺ and K⁺ up their concentration gradients.
2. The phagocyte forms a pouch in its cell membrane and engulfs bacteria in the pouch. It then pinches off the pouch to form a vesicle. Lysosomes fuse with the vesicle, and lysosomal enzymes destroy the bacteria it contains.
3. Proteins are made on ribosomes and packaged into vesicles by the Golgi apparatus. The vesicles move to the cell membrane and fuse with it, releasing the proteins from the cell through exocytosis.
4. The interior of the lipid bilayer is nonpolar and therefore would repel ions, which are attracted to polar environments.

STRUCTURES AND FUNCTIONS
1. The correct order is d, c, f, b, a, e. 2. Na⁺ ions are released on the external side of the cell membrane.
3. K⁺ ions are released on the cytosolic side of the cell membrane.

Section 6-1

VOCABULARY REVIEW
1. Grana are stacks of thylakoids inside a chloroplast; the stroma is the solution that surrounds the thylakoids.
2. Carotenoids are accessory pigments that assist chlorophyll a in capturing light energy during photosynthesis.

Section 6-2

VOCABULARY REVIEW
1. The Calvin cycle is a biochemical pathway that produces a three-carbon sugar from carbon dioxide during photosynthesis.
2. Carbon fixation is the incorporation of carbon dioxide into organic compounds.
3. A stoma is a small pore on the surface of a plant through which water, O₂, CO₂, and other gases enter or leave the plant.
4. The C₃ pathway is a carbon fixation pathway in which CO₂ is incorporated into four-carbon compounds.
5. The CAM pathway is a carbon fixation pathway in which CO₂ is incorporated into organic compounds at night and released to enter the Calvin cycle during the day.

MULTIPLE CHOICE
1. a 2. c 3. d 4. b 5. d

SHORT ANSWER
1. In each turn of the cycle, three molecules of ATP and two molecules of NADPH are used.
2. CO₂ + H₂O + light energy → (CH₂O) + O₂
3. CAM plants open their stomata at night, whereas C₃ and C₄ plants open their stomata during the day.
4. Increasing the temperature initially accelerates the various chemical reactions involved in photosynthesis. At higher temperatures, many of the enzymes that catalyze these reactions become ineffective, and the stomata begin to close.
5. The stomata would open. That would allow more CO₂ to enter the leaf from the surrounding air, stimulating photosynthesis.

STRUCTURES AND FUNCTIONS
Clockwise from the top: 3 CO₂, 6 3-PGA, 6 ATP, 6 ADP, 0 NADPH, 6 NADP⁺, 6 G3P, 3 ATP, 3 ADP, 3 RuBP