

# Chapter 04 Test Bank

Student: \_\_\_\_\_

1. Which of the following statements regarding the structure and function of cell membranes is correct?
- A. The phospholipid bilayer is arranged so that the hydrophilic heads of the phospholipid molecule face the extra- and intracellular fluids.
  - B. Some proteins integrated into the membrane serve as channels for the passage of nonpolar molecules through the membrane.
  - C.

Peripheral membrane proteins function as channels associated with transport of ions through the membrane.

- D. Cholesterol molecules function to transport ions from one side of the plasma membrane to the other.
- E.

The plasma membrane is a layer of phospholipid molecules with their hydrophilic head groups in contact with the extracellular solution and the hydrophobic tail groups in contact with the intracellular solution.

2. Which is TRUE regarding diffusion?
- A. It depends upon the random motion of molecules.
  - B. It results in net movement of molecules from regions of low concentration to regions of high concentration.
  - C. It is the principle mechanism by which molecules are moved over large distances in the body.
  - D. It requires energy in the form of ATP.
  - E. It requires integral membrane proteins to occur.

3. A solute, X, is placed in compartment A of a two compartment container and allowed to diffuse to compartment B and attain diffusion equilibrium. At that point in time,
- A. there will be no further movement of any solute molecules between compartments.
  - B. solutes will be moving in both directions equally.
  - C. solutes will only continue to move from A to B.
  - D. solutes will only continue to move from B to A.
  - E.

the concentration in compartment B will be much higher than that in compartment A.

4. Which of the following statements regarding the diffusion of a nonpolar solute X across a cell membrane is correct?

- A. At equilibrium the net flux of X across the cell membrane is zero.
- B. At equilibrium, X will cease moving across the cell membrane.
- C. Solute X will be unable to reach equilibrium because it is nonpolar.
- D. Solute X will reach equilibrium, but the concentration will be much higher on the inside of the cell because of the smaller volume.
- E. At equilibrium, movement of X across the membrane will be much faster in one direction than in the other.

5. Which of the following would decrease the net flux of a penetrating solute into a cell?

- A. increasing the permeability constant for that solute
- B. decreasing the temperature
- C. increasing the concentration of the solute in the extracellular fluid
- D. increasing the area of the cell membrane
- E. decreasing the thickness of the membrane

6. Equal amounts of two solutes, A and B, are placed into the same beaker of water at the same time. Solute A reaches diffusion equilibrium faster than solute B. What is the most likely explanation for this observation?

- A. The temperature was greater for solute A than solute B.
- B. The concentration gradient for A was greater than B.
- C. Solute A is smaller than solute B.
- D. Solute A traveled a shorter distance than solute B.
- E. Solute B is more soluble in water than solute A.

7. In general, polar molecules diffuse more rapidly through the lipid bilayer part of cell membranes than do nonpolar molecules. This statement is:

- A. true.
- B. false, because polar molecules diffuse through less rapidly because the bilayer is polar throughout its width.
- C. false, because polar molecules diffuse through less rapidly because the bilayer is nonpolar throughout its width.
- D. false, because nonpolar molecules diffuse through more rapidly because much of the bilayer is nonpolar.
- E. false, because the rate of diffusion of nonpolar and polar molecules through the bilayer is essentially the same as long as the molecules are the same size.

8. The permeability of the plasma membrane to mineral ions:

- A. is not influenced by channels formed by proteins.
- B. is the same in all cell types.
- C. is affected by differences in electrical charge on the two sides of the membrane.
- D. is zero in all living cells.
- E. is only possible because of the hydrophobic interior of the lipid bilayer.

9. Ion channels in cell membranes:

- A. are nonspecific.
- B. are not affected by differences in electrical potential across the membrane.

- C. may open in response to binding a ligand.
- D. only allow ions to move from the extracellular fluid into the cell.
- E. only allow ions to move from the intracellular fluid out of the cell.

10. Which is true about mediated transport across cell membranes?

- A. It refers to the movement of ions through protein channels.
- B. It refers both to simple diffusion and to the active transport of molecules.
- C. It is characterized by saturable carriers and a maximum velocity of transport.
- D. As the concentration gradient across a membrane increases, the transport rate always increases.
- E. It is nonspecific; any transporter can transport any molecule across the cell membrane.

11. Which is true about mediated transport of substances across cell membranes?

- A. It involves a specific membrane protein that functions as a carrier molecule.
- B. It always involves the movement of substances against a concentration gradient.
- C. It is always directly coupled to the splitting of ATP molecules.
- D. There is no limit to how fast it can occur as the concentration gradient becomes larger.
- E. It is the main mechanism for transporting hydrophobic molecules across membranes.

12. Which of the following is a feature that distinguishes active transport from facilitated diffusion?

- A. saturation of transport rate
- B. requirement for a carrier molecule
- C. carrier molecules have specificity
- D. presence of a transport maximum
- E. requirement for metabolic energy

13. Which is true regarding the mediated transport of a substance across a plasma membrane?

- A. It depends upon the binding of that substance to a specific site on the membrane protein.
- B. It depends upon movement of proteins from one side of the membrane to the other.
- C. It always increases in direct proportion to the increasing concentration of the substance on one side of the membrane.
- D.

Both "depends upon the binding of that substance to a specific site on the membrane protein" and "depends upon movement of proteins from one side of the membrane to the other" are correct.

E.

All of the choices are correct.

14. Which is a form of cellular transport that involves the movement of molecules into cells without passing through the plasma membrane's structural matrix?

- A. diffusion
- B. osmosis
- C. facilitated diffusion

- D. endocytosis
- E. apoptosis

15. By what transport mechanism does glucose enter most cells?

- A. diffusion through the lipid bilayer
- B. primary active transport
- C. secondary active transport
- D. diffusion through a protein channel
- E. facilitated diffusion

16. What is the best description of a secondary active transport process that cotransports an amino acid with  $\text{Na}^+$ ?

- A. Both  $\text{Na}^+$  and the amino acid bind on the side of the membrane where the  $\text{Na}^+$  concentration is lowest, and undergo net movement to the other side of the membrane.
- B.  $\text{Na}^+$  and the amino acid bind to opposite sides of the membrane, and  $\text{Na}^+$  undergoes net transport from the side of the membrane with higher  $\text{Na}^+$  concentration toward the side with lower concentration, while the amino acid moves in the opposite direction.
- C. Both  $\text{Na}^+$  and the amino acid bind on the side of the membrane where the  $\text{Na}^+$  concentration is higher, and both are transported to the side of the membrane where the  $\text{Na}^+$  concentration is lower.
- D. Both  $\text{Na}^+$  and the amino acid bind to the side of the membrane where the amino acid concentration is highest and are transported toward the side of the membrane where the amino acid concentration is lower.
- E.  $\text{Na}^+$  and the amino acid bind to opposite sides of the membrane, and the amino acid undergoes net transport from the side of the membrane with lower  $\text{Na}^+$  concentration to the side of the membrane where the  $\text{Na}^+$  concentration is higher.

17. Which of the following statements about the  $\text{Na}^+$ - $\text{K}^+$  ATPase pump is *false*?

- A. It transports  $\text{Na}^+$  out of cells and  $\text{K}^+$  into cells.
- B. It binds to, and hydrolyzes, ATP.
- C. It is constantly active in all cells.
- D. Its activity requires the expenditure of metabolic energy.
- E. It transports  $\text{Na}^+$  and  $\text{K}^+$  in a 1:1 ratio.

18. A cell is placed into a 1 millimolar solution of substance X and over time you witness the concentration of X inside the cell increase to 5 millimolar. What is the best explanation for this observation?

- A. X is moving into the cell by simple diffusion.
- B. X is moving into the cell by diffusion through a protein channel.
- C. X is moving into the cell by facilitated diffusion.
- D. X is moving into the cell by primary active transport.
- E. Water is leaving the cell by osmosis.

19. If the ATP-generating mechanisms in a cell are poisoned and the cell depletes its ATP reserves, which would occur first?

- A. Primary active transport of molecules would cease.

- B. Secondary active transport of molecules would cease.
- C. Facilitated diffusion of molecules would cease.
- D. Ion concentration gradients would reach equilibrium across the cell membrane.
- E. All transport processes would cease immediately when the ATP was depleted.

20. "Osmosis" refers to the movement of what substance across semipermeable membranes?

- A. glucose
- B. charged particles
- C. lipid molecules
- D. water
- E. solutes

21. If pure water and a solution containing a nonpenetrating solute are separated by a membrane that is permeable only to water, what would occur?

- A. Water will diffuse by osmosis until the water concentrations in the two compartments become equal.
- B. Water will diffuse by osmosis until all of the the water is on the same side as the solute.
- C. Water will diffuse by osmosis toward the side with the solute, until stopped by opposing hydrostatic pressure.
- D. No movement will occur between the compartments.
- E. Water will diffuse by osmosis away from the side with the solute, until stopped by hydrostatic pressure.

22. If all other conditions remain the same and the concentration of a nonpenetrating solute increases inside a cell, which is most likely to occur?

- A. Water will tend to enter the cell because the interior has an increased osmolarity.
- B. Water will tend to leave the cell because the interior has an increased osmolarity.
- C. Water will tend to enter the cell because the interior has a decreased osmolarity.
- D. Water will tend to leave the cell because the interior has a decreased osmolarity.
- E.

The solute will diffuse across the membrane until its concentration is equal on both sides of the membrane.

23. What will happen if a normal cell is placed in a hypotonic solution?

- A. It will swell in size.
- B. It will shrink in size.
- C. It will stay the same size.
- D. The result can't be predicted.

24. What will happen if a normal cell is placed in a hyperosmotic solution?

- A. It will swell in size.
- B. It will shrink in size.
- C. It will stay the same size.
- D. It may swell, shrink, or stay the same size, depending upon the concentration of penetrating and nonpenetrating solutes in the solution.

25. If a normal cell is placed into an unknown solution and it shrinks, what can be concluded about the unknown solution?
- A. Its nonpenetrating solute concentration is greater than that of a normal cell.
  - B. Its nonpenetrating solute concentration is less than that of a normal cell.
  - C. Its nonpenetrating solute concentration is equal to that of a normal cell.
  - D. Its penetrating solute concentration is less than that of a normal cell.
  - E. Its penetrating solute concentration is greater than that of a normal cell.
26. Why do solutions for injection or infusion into people with low blood volume normally contain 150 mM NaCl?
- A. This is a hypotonic solution, which will cause water movement into dehydrated blood cells.
  - B. This is an isotonic solution, and the water in it will follow Na and Cl into the intracellular fluid compartment.
  - C. This is a hypertonic solution, which will raise the blood volume and pressure more rapidly than an isotonic solution would.
  - D. This is an isotonic solution, and NaCl will keep the added volume in the extracellular fluid compartment.
  - E. NaCl are penetrating solutes, which will get them more quickly into blood cells to increase their volume.
27. Which of these is an example of a hypertonic solution?
- A. 200 mM NaCl
  - B. 300 mM glucose
  - C. 100 mM MgCl<sub>2</sub>
  - D. 400 mM urea
  - E. 100 mM NaCl
28. Which of the following solutions is *not* isotonic to human cells?
- A. 150 mM NaCl
  - B. 300 mM urea
  - C. 100 mM MgCl<sub>2</sub>
  - D. 300 mOsm NaCl
29. Regarding the tonicity and osmolarity of solutions, which of the following statements is *not* true?
- A. The term "tonicity" refers to the effect that a solution has on the degree of stretch or shrinking of the cell membrane.
  - B. The term "osmolarity" refers to the osmotic properties of a solution, regardless of its tonicity.
  - C. Isotonic solutions are always isoosmotic.
  - D. Hypoosmotic solutions are always hypotonic.
  - E. Hypertonic solutions are always hyperosmotic.
30. Which of the following statements regarding endocytosis and exocytosis is correct?
- A. Endocytosis is a method by which large molecules may be secreted from a cell.
  - B. Exocytosis is a method by which large molecules may be secreted from a cell.
  - C. Pinocytosis is a form of endocytosis; phagocytosis is a type of exocytosis.

- D. Pinocytosis is a form of exocytosis; phagocytosis is a type of endocytosis.
- E. Pinocytosis and phagocytosis are both types of exocytosis.

31.

Which form of endocytosis is nonspecific, in that it occurs by the formation of an invagination of the plasma membrane, which then fills with interstitial fluid of the immediate area?

- A. active transport
- B. hyperosmotic vesicular entrapment
- C. phagocytosis
- D. pinocytosis
- E. hydrosmosis

32. What type of cellular transport involves the cytosolic protein clathrin?

- A. exocytosis
- B. receptor-mediated endocytosis
- C. primary active transport
- D. secondary active transport
- E. pinocytosis

33. What process lowers blood plasma levels of cholesterol-containing lipoproteins?

- A. second messenger-activated, sterol transgenesis
- B. hydrophobic phagocytosis
- C. simple, transcellular membrane diffusion
- D. Na<sup>+</sup> gradient-dependent, secondary active transport
- E. clathrin-dependent, receptor-mediated endocytosis

34.

Once formed inside of the cell, most endocytic vesicles will fuse with which organelle for sorting?

- A. endoplasmic reticulum
- B. golgi apparatus
- C. endosome
- D. nucleus
- E. mitochondria

35.

At any given time it is possible to see endocytotic vesicles docked to intracellular organelles such as those which may receive their contents for modification, synthesis, packaging, and then release. Which organelle would be most likely to be involved in this process as a destination for a transport vesicle formed for this purpose along the plasma membrane?

- A. Golgi apparatus
- B. peroxisome
- C. lysosome
- D. mitochondrion
- E. ribosome

36. Which of the following statements about epithelial cells and epithelial transport is NOT correct?

- A. Epithelial cell membranes express different transport proteins on different cell surfaces.
- B. Epithelial cells lining the small intestine have Na, K-ATPase pumps only in their basolateral membranes.
- C.

The plasma membrane of epithelial cells that faces the inside of a hollow or fluid-filled chamber in the body is called the basolateral membrane.

- D. The pathway taken by substances that flow between epithelial cells is called the paracellular pathway.
- E. When substances cross epithelial barriers by going through the cell membranes and cytosol, it is called the transcellular pathway.

37. Which lists the epithelial cell barrier compartments in the order of the typical Na<sup>+</sup> concentrations, from highest to lowest?

- A. intracellular, lumen side, blood side
- B. blood side, lumen side, intracellular
- C. blood side, intracellular, lumen side
- D. lumen side, intracellular, blood side
- E. lumen side, blood side, intracellular

38. What is the most common transport mechanism by which glucose and other organic solutes cross the luminal membrane of an epithelial cell layer?

- A. secondary active cotransport with Na<sup>+</sup>
- B. glucose ATPase pump
- C. facilitated diffusion
- D. simple diffusion through the paracellular pathway
- E. through an ion channel

39. The greater the concentration difference of a substance between two volumes separated by a permeable membrane, the lesser the magnitude of the net flux of the substance.

True False

40. All other factors being equal, the rate of diffusion across a permeable surface will be greater for small molecules than for larger ones.

True False

41. Molecules increase their rate of diffusion as temperature increases.



True False

42. In general, polar molecules diffuse more rapidly across cell membranes than do nonpolar molecules.

True False

43. The component of the plasma membrane that acts as a selective barrier to diffusion of polar molecules is the integral proteins.

True False

44. Although permeability to mineral ions does not vary much from one cell to another, different cells vary considerably in their permeability to nonpolar molecules.

True False

45. Specific proteins in the membranes mediate movement of lipid-soluble molecules into cells.

True False

46. Integral membrane proteins can form channels through which ions such as  $\text{Na}^+$  and  $\text{K}^+$  can diffuse.

True False

47.

Mediated transport is required in order for glucose, amino acids, and fatty acids to pass into cells because none of these substances can diffuse through plasma membranes.

True False

48. In active transport, the affinity of any given binding site for the molecule to be transported changes as the site goes from facing one side of the membrane to facing the other side.

True False

49. The final equilibrium state reached by a molecule that enters a cell by facilitated diffusion is the same as that for a molecule that enters the cell by diffusion.

True False

50. The Na/K ATPase pump is an enzyme that phosphorylates itself.

True False

51. In most of the cells in the body there is an electrical difference such that the inside of cells is positive with respect to the outside.

True False

52. The concentration of calcium in the cytosol of most resting cells is very much lower than the concentration of extracellular calcium.

True False

53. Because of the active transport of  $\text{Na}^+$  and  $\text{K}^+$ , the intracellular concentration of  $\text{Na}^+$  is lower than the extracellular concentration, whereas the reverse is true for  $\text{K}^+$ .

True False

54. The  $\text{Na}^+/\text{K}^+$ -ATPase carrier transports sodium ions out of cells and potassium ions into cells on a one-to-one basis.

True False

55. Active transport, facilitated diffusion and osmosis all directly require the expenditure of metabolic energy.

True False

56. Both primary and secondary active transport require the expenditure of metabolic energy.

True False

57. Adding one mole of  $\text{NaCl}$  to one liter of water will lower the water concentration twice as much as adding one mole of glucose.

True False

58. Adding one gram of  $\text{NaCl}$  to one liter of water will lower the water concentration twice as much as adding one gram of glucose.

True False

59. The higher the osmolarity of a solution, the higher the concentration of water in it.

True False

60. The intracellular concentration of water in the cells of the body is normally the same as the extracellular concentration of water.  
True False
61. If a cell were placed in a solution of 0.15 M NaCl, it would shrink.  
True False
62. In the body, Na<sup>+</sup> ions behave as if they are nonpenetrating solutes because they are actively transported out of cells.  
True False
63. In the body, K<sup>+</sup> ions behave as if they are penetrating solutes because they are actively transported into cells.  
True False
64. The fate of all endocytotic vesicles is digestion of their contents by lysosomal enzymes.  
True False
65. A portion of a cell's plasma membrane is removed during endocytosis.  
True False
66. Endocytosis of any kind requires metabolic energy.  
True False
67. Most cells can perform pinocytosis, but only a few kinds can perform phagocytosis.  
True False
68. Phagocytic leukocytes use phagocytosis to engulf foreign bacteria and destroy them within ribosomes.  
True False
69. Pinocytosis is a method by which molecules can leave cells whose membranes are impermeable to the molecules.  
True False

70. The clathrin protein involved in carrying out receptor mediated transport remains with an endosome as it moves deep within the cell and is degraded entirely along with the ingested internal contents.

True False

71. The luminal side of an epithelial cell is also known as the basolateral side.

True False

72. The plasma membranes of epithelial cells facing the lumen of hollow organs or tubes have the same transport proteins as the plasma membranes that face the interstitial fluid.

True False

73. Most organic solutes cross epithelial membranes by simple diffusion on the lumen side followed by active transport across the blood side of the membrane.

True False

74. Net movement of solute across an epithelium that is permeable to water is always accompanied by movement of water in the opposite direction.

True False

## Chapter 04 Test Bank **Key**

1. Which of the following statements regarding the structure and function of cell membranes is correct?

**A.** The phospholipid bilayer is arranged so that the hydrophilic heads of the phospholipid molecule face the extra- and intracellular fluids.

B. Some proteins integrated into the membrane serve as channels for the passage of nonpolar molecules through the membrane.

C.

Peripheral membrane proteins function as channels associated with transport of ions through the membrane.

D. Cholesterol molecules function to transport ions from one side of the plasma membrane to the other.

E.

The plasma membrane is a layer of phospholipid molecules with their hydrophilic head groups in contact with the extracellular solution and the hydrophobic tail groups in contact with the intracellular solution.

*Bloom's: Level 1. Remember*  
*Learning Outcome: 04.01*  
*Section: 04.01*  
*Topic: Cells*

2. Which is TRUE regarding diffusion?

- A.** It depends upon the random motion of molecules.
- B. It results in net movement of molecules from regions of low concentration to regions of high concentration.
- C. It is the principle mechanism by which molecules are moved over large distances in the body.
- D. It requires energy in the form of ATP.
- E. It requires integral membrane proteins to occur.

*Bloom's: Level 1. Remember*  
*Learning Outcome: 04.01*  
*Section: 04.01*  
*Topic: Cells*  
*Topic: General principles of physiology*

3. A solute, X, is placed in compartment A of a two compartment container and allowed to diffuse to compartment B and attain diffusion equilibrium. At that point in time,

- A. there will be no further movement of any solute molecules between compartments.
- B.** solutes will be moving in both directions equally.
- C. solutes will only continue to move from A to B.
- D. solutes will only continue to move from B to A.
- E.

the concentration in compartment B will be much higher than that in compartment A.

*Bloom's: Level 2. Understand*  
*Learning Outcome: 04.01*  
*Section: 04.01*  
*Topic: Cells*  
*Topic: General principles of physiology*

4. Which of the following statements regarding the diffusion of a nonpolar solute X across a cell membrane is correct?

- A.** At equilibrium the net flux of X across the cell membrane is zero.
- B. At equilibrium, X will cease moving across the cell membrane.
- C. Solute X will be unable to reach equilibrium because it is nonpolar.
- D. Solute X will reach equilibrium, but the concentration will be much higher on the inside of the cell because of the smaller volume.
- E. At equilibrium, movement of X across the membrane will be much faster in one direction than in the other.

*Bloom's: Level 2. Understand*  
*Learning Outcome: 04.01*  
*Section: 04.01*  
*Topic: Cells*  
*Topic: General principles of physiology*

5. Which of the following would decrease the net flux of a penetrating solute into a cell?
- A. increasing the permeability constant for that solute
  - B.** decreasing the temperature
  - C. increasing the concentration of the solute in the extracellular fluid
  - D. increasing the area of the cell membrane
  - E. decreasing the thickness of the membrane

*Bloom's: Level 1. Remember*

*Learning Outcome: 04.01*

*Section: 04.01*

*Topic: Cells*

*Topic: General principles of physiology*

6. Equal amounts of two solutes, A and B, are placed into the same beaker of water at the same time. Solute A reaches diffusion equilibrium faster than solute B. What is the most likely explanation for this observation?
- A. The temperature was greater for solute A than solute B.
  - B. The concentration gradient for A was greater than B.
  - C.** Solute A is smaller than solute B.
  - D. Solute A traveled a shorter distance than solute B.
  - E. Solute B is more soluble in water than solute A.

*Bloom's: Level 2. Understand*

*Learning Outcome: 04.01*

*Section: 04.01*

*Topic: Cells*

*Topic: General principles of physiology*

7. In general, polar molecules diffuse more rapidly through the lipid bilayer part of cell membranes than do nonpolar molecules. This statement is:
- A. true.
  - B. false, because polar molecules diffuse through less rapidly because the bilayer is polar throughout its width.
  - C. false, because polar molecules diffuse through less rapidly because the bilayer is nonpolar throughout its width.
  - D.** false, because nonpolar molecules diffuse through more rapidly because much of the bilayer is nonpolar.
  - E. false, because the rate of diffusion of nonpolar and polar molecules through the bilayer is essentially the same as long as the molecules are the same size.

*Bloom's: Level 1. Remember*

*Learning Outcome: 04.01*

*Section: 04.01*

*Topic: Cells*

*Topic: General principles of physiology*

8. The permeability of the plasma membrane to mineral ions:
- A. is not influenced by channels formed by proteins.
  - B. is the same in all cell types.
  - C.** is affected by differences in electrical charge on the two sides of the membrane.
  - D. is zero in all living cells.

E. is only possible because of the hydrophobic interior of the lipid bilayer.

*Bloom's: Level 1. Remember*

*Learning Outcome: 04.01*

*Section: 04.01*

*Topic: Cells*

*Topic: General principles of physiology*

9. Ion channels in cell membranes:

- A. are nonspecific.
- B. are not affected by differences in electrical potential across the membrane.
- C.** may open in response to binding a ligand.
- D. only allow ions to move from the extracellular fluid into the cell.
- E. only allow ions to move from the intracellular fluid out of the cell.

*Bloom's: Level 1. Remember*

*Learning Outcome: 04.01*

*Section: 04.01*

*Topic: Cells*

*Topic: General principles of physiology*

10. Which is true about mediated transport across cell membranes?

- A. It refers to the movement of ions through protein channels.
- B. It refers both to simple diffusion and to the active transport of molecules.
- C.** It is characterized by saturable carriers and a maximum velocity of transport.
- D. As the concentration gradient across a membrane increases, the transport rate always increases.
- E. It is nonspecific; any transporter can transport any molecule across the cell membrane.

*Bloom's: Level 2. Understand*

*Learning Outcome: 04.02*

*Section: 04.02*

*Topic: Cells*

*Topic: General principles of physiology*

11. Which is true about mediated transport of substances across cell membranes?

- A.** It involves a specific membrane protein that functions as a carrier molecule.
- B. It always involves the movement of substances against a concentration gradient.
- C. It is always directly coupled to the splitting of ATP molecules.
- D. There is no limit to how fast it can occur as the concentration gradient becomes larger.
- E. It is the main mechanism for transporting hydrophobic molecules across membranes.

*Bloom's: Level 2. Understand*

*Learning Outcome: 04.02*

*Section: 04.02*

*Topic: Cells*

*Topic: General principles of physiology*

12. Which of the following is a feature that distinguishes active transport from facilitated diffusion?

- A. saturation of transport rate
- B. requirement for a carrier molecule
- C. carrier molecules have specificity

- D. presence of a transport maximum
- E.** requirement for metabolic energy

*Bloom's: Level 1. Remember*

*Learning Outcome: 04.02*

*Section: 04.02*

*Topic: Cells*

*Topic: General principles of physiology*

13. Which is true regarding the mediated transport of a substance across a plasma membrane?

- A.** It depends upon the binding of that substance to a specific site on the membrane protein.
- B. It depends upon movement of proteins from one side of the membrane to the other.
- C. It always increases in direct proportion to the increasing concentration of the substance on one side of the membrane.
- D.

Both "depends upon the binding of that substance to a specific site on the membrane protein" and "depends upon movement of proteins from one side of the membrane to the other" are correct.

E.

All of the choices are correct.

*Bloom's: Level 1. Remember*

*Learning Outcome: 04.02*

*Section: 04.02*

*Topic: Cells*

*Topic: General principles of physiology*

14. Which is a form of cellular transport that involves the movement of molecules into cells without passing through the plasma membrane's structural matrix?

- A. diffusion
- B. osmosis
- C. facilitated diffusion
- D.** endocytosis
- E. apoptosis

*Bloom's: Level 1. Remember*

*Learning Outcome: 04.04*

*Section: 04.04*

*Topic: Cells*

*Topic: General principles of physiology*

15. By what transport mechanism does glucose enter most cells?

- A. diffusion through the lipid bilayer
- B. primary active transport
- C. secondary active transport
- D. diffusion through a protein channel
- E.** facilitated diffusion



*Bloom's: Level 1. Remember*  
*Learning Outcome: 04.02*  
*Section: 04.02*  
*Topic: Cells*  
*Topic: General principles of physiology*

16. What is the best description of a secondary active transport process that cotransports an amino acid with  $\text{Na}^+$ ?

- A. Both  $\text{Na}^+$  and the amino acid bind on the side of the membrane where the  $\text{Na}^+$  concentration is lowest, and undergo net movement to the other side of the membrane.
- B.  $\text{Na}^+$  and the amino acid bind to opposite sides of the membrane, and  $\text{Na}^+$  undergoes net transport from the side of the membrane with higher  $\text{Na}^+$  concentration toward the side with lower concentration, while the amino acid moves in the opposite direction.
- C.** Both  $\text{Na}^+$  and the amino acid bind on the side of the membrane where the  $\text{Na}^+$  concentration is higher, and both are transported to the side of the membrane where the  $\text{Na}^+$  concentration is lower.
- D. Both  $\text{Na}^+$  and the amino acid bind to the side of the membrane where the amino acid concentration is highest and are transported toward the side of the membrane where the amino acid concentration is lower.
- E.  $\text{Na}^+$  and the amino acid bind to opposite sides of the membrane, and the amino acid undergoes net transport from the side of the membrane with lower  $\text{Na}^+$  concentration to the side of the membrane where the  $\text{Na}^+$  concentration is higher.

*Bloom's: Level 2. Understand*  
*Learning Outcome: 04.02*  
*Section: 04.02*  
*Topic: Cells*  
*Topic: General principles of physiology*

17. Which of the following statements about the  $\text{Na}^+-\text{K}^+$  ATPase pump is *false*?

- A. It transports  $\text{Na}^+$  out of cells and  $\text{K}^+$  into cells.
- B. It binds to, and hydrolyzes, ATP.
- C. It is constantly active in all cells.
- D. Its activity requires the expenditure of metabolic energy.
- E.** It transports  $\text{Na}^+$  and  $\text{K}^+$  in a 1:1 ratio.

*Bloom's: Level 1. Remember*  
*Learning Outcome: 04.02*  
*Section: 04.02*  
*Topic: Cells*  
*Topic: General principles of physiology*

18. A cell is placed into a 1 millimolar solution of substance X and over time you witness the concentration of X inside the cell increase to 5 millimolar. What is the best explanation for this observation?

- A. X is moving into the cell by simple diffusion.
- B. X is moving into the cell by diffusion through a protein channel.
- C. X is moving into the cell by facilitated diffusion.
- D.** X is moving into the cell by primary active transport.
- E. Water is leaving the cell by osmosis.

*Bloom's: Level 2. Understand*  
*Learning Outcome: 04.02*  
*Topic: Cells*  
*Topic: General principles of physiology*

19. If the ATP-generating mechanisms in a cell are poisoned and the cell depletes its ATP reserves, which would occur first?

- A.** Primary active transport of molecules would cease.
- B. Secondary active transport of molecules would cease.
- C. Facilitated diffusion of molecules would cease.
- D. Ion concentration gradients would reach equilibrium across the cell membrane.
- E. All transport processes would cease immediately when the ATP was depleted.

*Bloom's: Level 3. Apply*  
*Learning Outcome: 04.02*  
*Section: 04.02*  
*Topic: Cells*  
*Topic: General principles of physiology*

20. "Osmosis" refers to the movement of what substance across semipermeable membranes?

- A. glucose
- B. charged particles
- C. lipid molecules
- D.** water
- E. solutes

*Bloom's: Level 1. Remember*  
*Learning Outcome: 04.03*  
*Section: 04.03*  
*Topic: Cells*  
*Topic: General principles of physiology*

21. If pure water and a solution containing a nonpenetrating solute are separated by a membrane that is permeable only to water, what would occur?

- A. Water will diffuse by osmosis until the water concentrations in the two compartments become equal.
- B. Water will diffuse by osmosis until all of the the water is on the same side as the solute.
- C.** Water will diffuse by osmosis toward the side with the solute, until stopped by opposing hydrostatic pressure.
- D. No movement will occur between the compartments.
- E. Water will diffuse by osmosis away from the side with the solute, until stopped by hydrostatic pressure.

*Bloom's: Level 2. Understand*  
*Learning Outcome: 04.03*  
*Section: 04.03*  
*Topic: Cells*  
*Topic: General principles of physiology*

22. If all other conditions remain the same and the concentration of a nonpenetrating solute increases inside a cell, which is most likely to occur?

- A.** Water will tend to enter the cell because the interior has an increased osmolarity.
- B. Water will tend to leave the cell because the interior has an increased osmolarity.
- C. Water will tend to enter the cell because the interior has a decreased osmolarity.
- D. Water will tend to leave the cell because the interior has a decreased osmolarity.

E.

The solute will diffuse across the membrane until its concentration is equal on both sides of the membrane.

*Bloom's: Level 2. Understand*

*Learning Outcome: 04.03*

*Section: 04.03*

*Topic: Cells*

*Topic: General principles of physiology*

23. What will happen if a normal cell is placed in a hypotonic solution?

- A.** It will swell in size.
- B. It will shrink in size.
- C. It will stay the same size.
- D. The result can't be predicted.

*Bloom's: Level 1. Remember*

*Learning Outcome: 04.03*

*Section: 04.03*

*Topic: Cells*

*Topic: General principles of physiology*

24. What will happen if a normal cell is placed in a hyperosmotic solution?

- A. It will swell in size.
- B. It will shrink in size.
- C. It will stay the same size.
- D.** It may swell, shrink, or stay the same size, depending upon the concentration of penetrating and nonpenetrating solutes in the solution.

*Bloom's: Level 2. Understand*

*Learning Outcome: 04.03*

*Section: 04.03*

*Topic: Cells*

*Topic: General principles of physiology*

25. If a normal cell is placed into an unknown solution and it shrinks, what can be concluded about the unknown solution?

- A.** Its nonpenetrating solute concentration is greater than that of a normal cell.
- B. Its nonpenetrating solute concentration is less than that of a normal cell.
- C. Its nonpenetrating solute concentration is equal to that of a normal cell.
- D. Its penetrating solute concentration is less than that of a normal cell.
- E. Its penetrating solute concentration is greater than that of a normal cell.

*Bloom's: Level 2. Understand*

*Learning Outcome: 04.03*

*Section: 04.03*

*Topic: Cells*

*Topic: General principles of physiology*

26. Why do solutions for injection or infusion into people with low blood volume normally contain 150 mM

NaCl?

- A. This is a hypotonic solution, which will cause water movement into dehydrated blood cells.
- B. This is an isotonic solution, and the water in it will follow Na and Cl into the the intracellular fluid compartment.
- C. This is a hypertonic solution, which will raise the blood volume and pressure more rapidly than an isotonic solution would.
- D.** This is an isotonic solution, and NaCl will keep the added volume in the extracellular fluid compartment.
- E. NaCl are penetrating solutes, which will get them more quickly into blood cells to increase their volume.

*Bloom's: Level 3. Apply*  
*Learning Outcome: 04.03*  
*Section: 04.03*  
*Topic: Cells*  
*Topic: General principles of physiology*

27. Which of these is an example of a hypertonic solution?

- A.** 200 mM NaCl
- B. 300 mM glucose
- C. 100 mM MgCl<sub>2</sub>
- D. 400 mM urea
- E. 100 mM NaCl

*Bloom's: Level 2. Understand*  
*Learning Outcome: 04.03*  
*Section: 04.03*  
*Topic: Cells*  
*Topic: General principles of physiology*

28. Which of the following solutions is *not* isotonic to human cells?

- A. 150 mM NaCl
- B.** 300 mM urea
- C. 100 mM MgCl<sub>2</sub>
- D. 300 mOsm NaCl

*Bloom's: Level 1. Remember*  
*Learning Outcome: 04.03*  
*Section: 04.03*  
*Topic: Cells*  
*Topic: General principles of physiology*

29. Regarding the tonicity and osmolarity of solutions, which of the following statements is *not* true?

- A. The term "tonicity" refers to the effect that a solution has on the degree of stretch or shrinking of the cell membrane.
- B. The term "osmolarity" refers to the osmotic properties of a solution, regardless of its tonicity.
- C.** Isotonic solutions are always isoosmotic.
- D. Hypoosmotic solutions are always hypotonic.
- E. Hypertonic solutions are always hyperosmotic.

*Bloom's: Level 2. Understand*  
*Learning Outcome: 04.03*  
*Section: 04.03*

Topic: Cells  
Topic: General principles of physiology

30. Which of the following statements regarding endocytosis and exocytosis is correct?
- A. Endocytosis is a method by which large molecules may be secreted from a cell.
  - B.** Exocytosis is a method by which large molecules may be secreted from a cell.
  - C. Pinocytosis is a form of endocytosis; phagocytosis is a type of exocytosis.
  - D. Pinocytosis is a form of exocytosis; phagocytosis is a type of endocytosis.
  - E. Pinocytosis and phagocytosis are both types of exocytosis.

Bloom's: Level 1. Remember  
Learning Outcome: 04.04  
Section: 04.04  
Topic: Cells  
Topic: General principles of physiology

31.

Which form of endocytosis is nonspecific, in that it occurs by the formation of an invagination of the plasma membrane, which then fills with interstitial fluid of the immediate area?

- A. active transport
- B. hyperosmotic vesicular entrapment
- C. phagocytosis
- D.** pinocytosis
- E. hydrosmosis

Bloom's: Level 1. Remember  
Learning Outcome: 04.04  
Section: 04.04  
Topic: Cells  
Topic: General principles of physiology

32. What type of cellular transport involves the cytosolic protein clathrin?
- A. exocytosis
  - B.** receptor-mediated endocytosis
  - C. primary active transport
  - D. secondary active transport
  - E. pinocytosis

Bloom's: Level 1. Remember  
Learning Outcome: 04.04  
Section: 04.04  
Topic: Cells  
Topic: General principles of physiology

33. What process lowers blood plasma levels of cholesterol-containing lipoproteins?
- A. second messenger-activated, sterol transgenesis
  - B. hydrophobic phagocytosis
  - C. simple, transcellular membrane diffusion
  - D. Na<sup>+</sup> gradient-dependent, secondary active transport

**E.** clathrin-dependent, receptor-mediated endocytosis

*Bloom's: Level 1. Remember*

*Learning Outcome: 04.04*

*Section: 04.04*

*Topic: Cells*

*Topic: General principles of physiology*

34.

Once formed inside of the cell, most endocytic vesicles will fuse with which organelle for sorting?

- A. endoplasmic reticulum
- B. golgi apparatus
- C.** endosome
- D. nucleus
- E. mitochondria

*Bloom's: Level 1. Remember*

*Learning Outcome: 04.04*

*Section: 04.04*

*Topic: Cells*

*Topic: General principles of physiology*

35.

At any given time it is possible to see endocytotic vesicles docked to intracellular organelles such as those which may receive their contents for modification, synthesis, packaging, and then release. Which organelle would be most likely to be involved in this process as a destination for a transport vesicle formed for this purpose along the plasma membrane?

- A.** Golgi apparatus
- B. peroxisome
- C. lysosome
- D. mitochondrion
- E. ribosome

*Bloom's: Level 1. Remember*

*Learning Outcome: 04.04*

*Section: 04.04*

*Topic: Cells*

36. Which of the following statements about epithelial cells and epithelial transport is NOT correct?

- A. Epithelial cell membranes express different transport proteins on different cell surfaces.
- B. Epithelial cells lining the small intestine have Na, K-ATPase pumps only in their basolateral membranes.
- C.**

The plasma membrane of epithelial cells that faces the inside of a hollow or fluid-filled chamber in the body is called the basolateral membrane.

- D. The pathway taken by substances that flow between epithelial cells is called the paracellular pathway.
- E. When substances cross epithelial barriers by going through the cell membranes and cytosol, it is called

the transcellular pathway.

*Bloom's: Level 1. Remember*  
*Learning Outcome: 04.05*  
*Section: 04.05*  
*Topic: Cells*

37. Which lists the epithelial cell barrier compartments in the order of the typical Na<sup>+</sup> concentrations, from highest to lowest?

- A. intracellular, lumen side, blood side
- B. blood side, lumen side, intracellular**
- C. blood side, intracellular, lumen side
- D. lumen side, intracellular, blood side
- E. lumen side, blood side, intracellular

*Bloom's: Level 1. Remember*  
*Learning Outcome: 04.05*  
*Section: 04.05*  
*Topic: Cells*

38. What is the most common transport mechanism by which glucose and other organic solutes cross the luminal membrane of an epithelial cell layer?

- A. secondary active cotransport with Na<sup>+</sup>**
- B. glucose ATPase pump
- C. facilitated diffusion
- D. simple diffusion through the paracellular pathway
- E. through an ion channel

*Bloom's: Level 1. Remember*  
*Learning Outcome: 04.02*  
*Section: 04.02*  
*Topic: Cells*  
*Topic: General principles of physiology*

39. The greater the concentration difference of a substance between two volumes separated by a permeable membrane, the lesser the magnitude of the net flux of the substance.

**FALSE**

*Bloom's: Level 1. Remember*  
*Learning Outcome: 04.01*  
*Section: 04.01*  
*Topic: Cells*  
*Topic: General principles of physiology*

40. All other factors being equal, the rate of diffusion across a permeable surface will be greater for small molecules than for larger ones.

**TRUE**

*Bloom's: Level 1. Remember*  
*Learning Outcome: 04.01*  
*Section: 04.01*

*Topic: Cells*  
*Topic: General principles of physiology*

41. Molecules increase their rate of diffusion as temperature increases.

**TRUE**

*Bloom's: Level 1. Remember*  
*Learning Outcome: 04.01*  
*Section: 04.01*  
*Topic: Cells*  
*Topic: General principles of physiology*

42. In general, polar molecules diffuse more rapidly across cell membranes than do nonpolar molecules.

**FALSE**

*Bloom's: Level 1. Remember*  
*Learning Outcome: 04.01*  
*Section: 04.01*  
*Topic: Cells*  
*Topic: General principles of physiology*

43. The component of the plasma membrane that acts as a selective barrier to diffusion of polar molecules is the integral proteins.

**FALSE**

*Bloom's: Level 1. Remember*  
*Learning Outcome: 04.01*  
*Section: 04.01*  
*Topic: Cells*

44. Although permeability to mineral ions does not vary much from one cell to another, different cells vary considerably in their permeability to nonpolar molecules.

**FALSE**

*Bloom's: Level 2. Understand*  
*Learning Outcome: 04.01*  
*Section: 04.01*  
*Topic: Cells*  
*Topic: General principles of physiology*

45. Specific proteins in the membranes mediate movement of lipid-soluble molecules into cells.

**FALSE**

*Bloom's: Level 1. Remember*  
*Learning Outcome: 04.01*  
*Section: 04.01*  
*Topic: Cells*  
*Topic: General principles of physiology*



46. Integral membrane proteins can form channels through which ions such as Na<sup>+</sup> and K<sup>+</sup> can diffuse.

**TRUE**

*Bloom's: Level 1. Remember*

*Learning Outcome: 04.01*

*Section: 04.01*

*Topic: Cells*

47.

Mediated transport is required in order for glucose, amino acids, and fatty acids to pass into cells because none of these substances can diffuse through plasma membranes.

**FALSE**

*Bloom's: Level 1. Remember*

*Learning Outcome: 04.01*

*Learning Outcome: 04.02*

*Section: 04.01*

*Section: 04.02*

*Topic: Cells*

*Topic: General principles of physiology*

48. In active transport, the affinity of any given binding site for the molecule to be transported changes as the site goes from facing one side of the membrane to facing the other side.

**TRUE**

*Bloom's: Level 2. Understand*

*Learning Outcome: 04.02*

*Section: 04.02*

*Topic: Cells*

*Topic: General principles of physiology*

49. The final equilibrium state reached by a molecule that enters a cell by facilitated diffusion is the same as that for a molecule that enters the cell by diffusion.

**TRUE**

*Bloom's: Level 2. Understand*

*Learning Outcome: 04.01*

*Learning Outcome: 04.02*

*Section: 04.01*

*Section: 04.02*

*Topic: Cells*

*Topic: General principles of physiology*

50. The Na/K ATPase pump is an enzyme that phosphorylates itself.

**TRUE**

*Bloom's: Level 1. Remember*

*Learning Outcome: 04.02*  
*Section: 04.02*  
*Topic: Cells*  
*Topic: General principles of physiology*

51. In most of the cells in the body there is an electrical difference such that the inside of cells is positive with respect to the outside.

**FALSE**

*Bloom's: Level 1. Remember*  
*Learning Outcome: 04.01*  
*Section: 04.01*  
*Topic: Cells*  
*Topic: General principles of physiology*

52. The concentration of calcium in the cytosol of most resting cells is very much lower than the concentration of extracellular calcium.

**TRUE**

*Bloom's: Level 1. Remember*  
*Learning Outcome: 04.02*  
*Section: 04.02*  
*Topic: Cells*

53. Because of the active transport of  $\text{Na}^+$  and  $\text{K}^+$ , the intracellular concentration of  $\text{Na}^+$  is lower than the extracellular concentration, whereas the reverse is true for  $\text{K}^+$ .

**TRUE**

*Bloom's: Level 2. Understand*  
*Learning Outcome: 04.02*  
*Section: 04.02*  
*Topic: Cells*  
*Topic: General principles of physiology*

54. The  $\text{Na}^+/\text{K}^+$ -ATPase carrier transports sodium ions out of cells and potassium ions into cells on a one-to-one basis.

**FALSE**

*Bloom's: Level 1. Remember*  
*Learning Outcome: 04.02*  
*Section: 04.02*  
*Topic: Cells*  
*Topic: General principles of physiology*

55. Active transport, facilitated diffusion and osmosis all directly require the expenditure of metabolic energy.

**FALSE**

*Bloom's: Level 1. Remember*

*Learning Outcome: 04.02*  
*Learning Outcome: 04.03*  
*Section: 04.02*  
*Section: 04.03*  
*Topic: Cells*  
*Topic: General principles of physiology*

56. Both primary and secondary active transport require the expenditure of metabolic energy.  
**TRUE**

*Bloom's: Level 1. Remember*  
*Learning Outcome: 04.02*  
*Section: 04.02*  
*Topic: Cells*  
*Topic: General principles of physiology*

57. Adding one mole of NaCl to one liter of water will lower the water concentration twice as much as adding one mole of glucose.  
**TRUE**

*Bloom's: Level 2. Understand*  
*Learning Outcome: 04.03*  
*Section: 04.03*  
*Topic: Cells*  
*Topic: General principles of physiology*

58. Adding one gram of NaCl to one liter of water will lower the water concentration twice as much as adding one gram of glucose.  
**FALSE**

*Bloom's: Level 2. Understand*  
*Learning Outcome: 04.03*  
*Section: 04.03*  
*Topic: Cells*  
*Topic: General principles of physiology*

59. The higher the osmolarity of a solution, the higher the concentration of water in it.  
**FALSE**

*Bloom's: Level 1. Remember*  
*Learning Outcome: 04.03*  
*Section: 04.03*  
*Topic: Cells*  
*Topic: General principles of physiology*

60. The intracellular concentration of water in the cells of the body is normally the same as the extracellular concentration of water.  
**TRUE**

*Bloom's: Level 1. Remember*  
*Learning Outcome: 04.03*

Section: 04.03  
Topic: Cells  
Topic: General principles of physiology

61. If a cell were placed in a solution of 0.15 M NaCl, it would shrink.

**FALSE**

Bloom's: Level 2. Understand  
Learning Outcome: 04.03  
Section: 04.03  
Topic: Cells  
Topic: General principles of physiology

62. In the body, Na<sup>+</sup> ions behave as if they are nonpenetrating solutes because they are actively transported out of cells.

**TRUE**

Bloom's: Level 2. Understand  
Learning Outcome: 04.02  
Learning Outcome: 04.03  
Section: 04.02  
Section: 04.03  
Topic: Cells  
Topic: General principles of physiology

63. In the body, K<sup>+</sup> ions behave as if they are penetrating solutes because they are actively transported into cells.

**FALSE**

Bloom's: Level 2. Understand  
Learning Outcome: 04.02  
Learning Outcome: 04.03  
Section: 04.02  
Section: 04.03  
Topic: Cells  
Topic: General principles of physiology

64. The fate of all endocytotic vesicles is digestion of their contents by lysosomal enzymes.

**FALSE**

Bloom's: Level 2. Understand  
Learning Outcome: 04.04  
Section: 04.04  
Topic: Cells  
Topic: General principles of physiology

65. A portion of a cell's plasma membrane is removed during endocytosis.

**TRUE**

Bloom's: Level 1. Remember  
Learning Outcome: 04.04

Section: 04.04  
Topic: Cells  
Topic: General principles of physiology

66. Endocytosis of any kind requires metabolic energy.

**TRUE**

Bloom's: Level 1. Remember  
Learning Outcome: 04.04  
Section: 04.04  
Topic: Cells  
Topic: General principles of physiology

67. Most cells can perform pinocytosis, but only a few kinds can perform phagocytosis.

**TRUE**

Bloom's: Level 1. Remember  
Learning Outcome: 04.04  
Section: 04.04  
Topic: Cells  
Topic: General principles of physiology

68. Phagocytic leukocytes use phagocytosis to engulf foreign bacteria and destroy them within ribosomes.

**FALSE**

Bloom's: Level 1. Remember  
Learning Outcome: 04.04  
Section: 04.04  
Topic: Cells  
Topic: General principles of physiology

69. Pinocytosis is a method by which molecules can leave cells whose membranes are impermeable to the molecules.

**FALSE**

Bloom's: Level 1. Remember  
Learning Outcome: 04.04  
Section: 04.04  
Topic: Cells  
Topic: General principles of physiology

70. The clathrin protein involved in carrying out receptor mediated transport remains with an endosome as it moves deep within the cell and is degraded entirely along with the ingested internal contents.

**FALSE**

Bloom's: Level 1. Remember  
Learning Outcome: 04.04  
Section: 04.04  
Topic: Cells  
Topic: General principles of physiology

71. The luminal side of an epithelial cell is also known as the basolateral side.

**FALSE**

*Bloom's: Level 1. Remember*

*Learning Outcome: 04.05*

*Section: 04.05*

*Topic: Cells*

72. The plasma membranes of epithelial cells facing the lumen of hollow organs or tubes have the same transport proteins as the plasma membranes that face the interstitial fluid.

**FALSE**

*Bloom's: Level 1. Remember*

*Learning Outcome: 04.05*

*Section: 04.05*

*Topic: Cells*

*Topic: General principles of physiology*

73. Most organic solutes cross epithelial membranes by simple diffusion on the lumen side followed by active transport across the blood side of the membrane.

**FALSE**

*Bloom's: Level 2. Understand*

*Learning Outcome: 04.05*

*Section: 04.05*

*Topic: Cells*

*Topic: General principles of physiology*

74. Net movement of solute across an epithelium that is permeable to water is always accompanied by movement of water in the opposite direction.

**FALSE**

*Bloom's: Level 2. Understand*

*Learning Outcome: 04.05*

*Section: 04.05*

*Topic: Cells*

*Topic: General principles of physiology*

## Chapter 04 Test Bank **Summary**

| <i>Category</i>              | <i># of Questions</i> |
|------------------------------|-----------------------|
| Bloom's: Level 1. Remember   | 47                    |
| Bloom's: Level 2. Understand | 25                    |
| Bloom's: Level 3. Apply      | 2                     |
| Learning Outcome: 04.01      | 20                    |
| Learning Outcome: 04.02      | 21                    |
| Learning Outcome: 04.03      | 18                    |

|   |    |
|---|----|
| Learning Outcome: 04.04                 | 14 |
| Learning Outcome: 04.05                 | 6  |
| Section: 04.01                          | 20 |
| Section: 04.02                          | 20 |
| Section: 04.03                          | 18 |
| Section: 04.04                          | 14 |
| Section: 04.05                          | 6  |
| Topic: Cells                            | 74 |
| Topic: General principles of physiology | 66 |