

Exam

Name \_\_\_\_\_

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

- 1) Who was/were the first to propose that cell membranes are phospholipid bilayers? 1) \_\_\_\_\_  
A) S. Singer and G. Nicolson  
B) H. Davson and J. Danielli  
C) C. Overton  
D) E. Gorter and F. Grendel  
E) I. Langmuir
- 2) Which of the following types of molecules are the major structural components of the cell membrane? 2) \_\_\_\_\_  
A) proteins and cellulose  
B) phospholipids and proteins  
C) nucleic acids and proteins  
D) phospholipids and cellulose  
E) glycoproteins and cholesterol
- 3) When biological membranes are frozen and then fractured, they tend to break along the middle of the bilayer. The best explanation for this is that 3) \_\_\_\_\_  
A) water that is present in the middle of the bilayer freezes and is easily fractured.  
B) the hydrophobic interactions that hold the membrane together are weakest at this point.  
C) the carbon-carbon bonds of the phospholipid tails are easily broken.  
D) the integral membrane proteins are not strong enough to hold the bilayer together.  
E) hydrophilic interactions between the opposite membrane surfaces are destroyed on freezing.
- 4) According to the fluid mosaic model of cell membranes, which of the following is a *true* statement about membrane phospholipids? 4) \_\_\_\_\_  
A) They have hydrophilic tails in the interior of the membrane.  
B) They can move laterally along the plane of the membrane.  
C) They frequently flip-flop from one side of the membrane to the other.  
D) They are free to depart from the membrane and dissolve in the surrounding solution.  
E) They occur in an uninterrupted bilayer, with membrane proteins restricted to the surface of the membrane.
- 5) In order for a protein to be an integral membrane protein it would have to be which of the following? 5) \_\_\_\_\_  
A) completely covered with phospholipids  
B) hydrophobic  
C) exposed on only one surface of the membrane  
D) hydrophilic  
E) amphipathic

- 6) Which of the following is a reasonable explanation for why unsaturated fatty acids help keep any membrane more fluid at lower temperatures? 6) \_\_\_\_\_
- A) Unsaturated fatty acids have a higher cholesterol content and therefore more cholesterol in membranes.
  - B) The double bonds result in shorter fatty acid tails and thinner membranes.
  - C) Unsaturated fatty acids permit more water in the interior of the membrane.
  - D) The double bonds block interaction among the hydrophilic head groups of the lipids.
  - E) The double bonds form kinks in the fatty acid tails, forcing adjacent lipids to be further apart.
- 7) Of the following functions, which is most important for the glycoproteins and glycolipids of animal cell membranes? 7) \_\_\_\_\_
- A) active transport of molecules against their concentration gradients
  - B) maintaining the integrity of a fluid mosaic membrane
  - C) facilitated diffusion of molecules down their concentration gradients
  - D) a cell's ability to distinguish one type of neighboring cell from another
  - E) maintaining membrane fluidity at low temperatures
- 8) Which of these are not embedded in the lipid bilayer at all? 8) \_\_\_\_\_
- A) integral proteins
  - B) glycoproteins
  - C) peripheral proteins
  - D) transmembrane proteins
  - E) integrins
- 9) The formulation of a model for a structure or for a process serves which of the following purposes? 9) \_\_\_\_\_
- A) It asks a scientific question.
  - B) It functions as a testable hypothesis.
  - C) It can only be arrived at after years of experimentation.
  - D) It serves as a data point among results.
  - E) It records observations.
- 10) Which of the following is true of the evolution of cell membranes? 10) \_\_\_\_\_
- A) The evolution of cell membranes is driven by the evolution of glycoproteins and glycolipids.
  - B) As populations of organisms evolve, different properties of their cell membranes are selected for or against.
  - C) Cell membranes cannot evolve if proteins do not.
  - D) An individual organism selects its preferred type of cell membrane for particular functions.
  - E) Cell membranes have stopped evolving now that they are fluid mosaics.
- 11) What kinds of molecules pass through a cell membrane most easily? 11) \_\_\_\_\_
- A) monosaccharides such as glucose
  - B) small and hydrophobic
  - C) large and hydrophobic
  - D) large polar
  - E) ionic

12) Which of the following statements is *correct* about diffusion?

12) \_\_\_\_\_

- A) It requires an expenditure of energy by the cell.
- B) It is very rapid over long distances.
- C) It is a passive process in which molecules move from a region of higher concentration to a region of lower concentration.
- D) It requires integral proteins in the cell membrane.
- E) It is an active process in which molecules move from a region of lower concentration to one of higher concentration.

Use the diagram of the U-tube in Figure 7.2 to answer the questions that follow.

The solutions in the two arms of this U-tube are separated by a membrane that is permeable to water and glucose but not to sucrose. Side A is half filled with a solution of 2 M sucrose and 1 M glucose. Side B is half filled with 1 M sucrose and 2 M glucose. Initially, the liquid levels on both sides are equal.

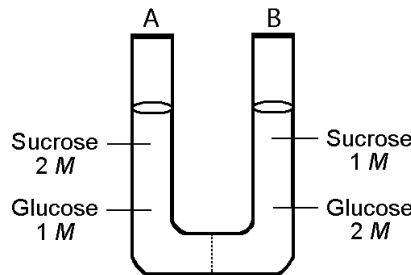


Figure 7.2

13) Initially, in terms of tonicity, the solution in side A with respect to that in side B is

13) \_\_\_\_\_

- A) plasmolyzed.
- B) hypotonic.
- C) isotonic.
- D) hypertonic.
- E) saturated.

14) Celery stalks that are immersed in fresh water for several hours become stiff and hard. Similar stalks left in a salt solution become limp and soft. From this we can deduce that the cells of the celery stalks are

14) \_\_\_\_\_

- A) hypertonic to fresh water but hypotonic to the salt solution.
- B) hypotonic to both fresh water and the salt solution.
- C) isotonic with fresh water but hypotonic to the salt solution.
- D) hypertonic to both fresh water and the salt solution.
- E) hypotonic to fresh water but hypertonic to the salt solution.

Refer to Figure 7.3 to answer the following questions.

The solutions in the arms of a U-tube are separated at the bottom of the tube by a selectively permeable membrane. The membrane is permeable to sodium chloride but not to glucose. Side A is filled with a solution of 0.4 M glucose and 0.5 M sodium chloride (NaCl), and side B is filled with a solution containing 0.8 M glucose and 0.4 M sodium chloride. Initially, the volume in both arms is the same.

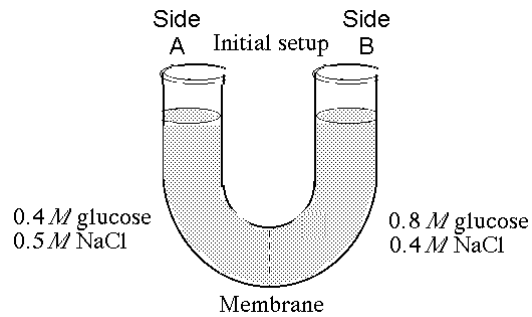


Figure 7.3

15) Which of the following statements *correctly* describes the normal tonicity conditions for typical plant and animal cells?

15) \_\_\_\_\_

- A) The animal cell is in an isotonic solution, and the plant cell is in a hypertonic solution.
- B) The animal cell is in a hypertonic solution, and the plant cell is in an isotonic solution.
- C) The animal cell is in a hypertonic solution, and the plant cell is in a hypotonic solution.
- D) The animal cell is in a hypotonic solution, and the plant cell is in an isotonic solution.
- E) The animal cell is in an isotonic solution, and the plant cell is in a hypotonic solution.

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Read the following information and refer to Figure 7.4 to answer the following questions.

Five dialysis bags, constructed from a semi-permeable membrane that is impermeable to sucrose, were filled with various concentrations of sucrose and then placed in separate beakers containing an initial concentration of 0.6 M sucrose solution. At 10-minute intervals, the bags were massed (weighed) and the percent change in mass of each bag was graphed.

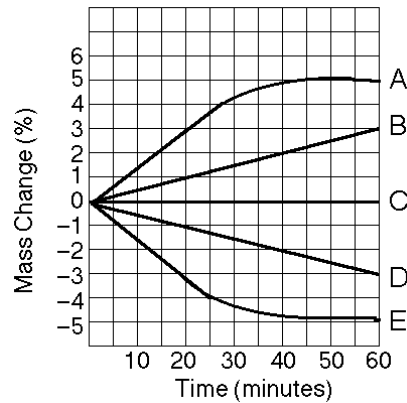


Figure 7.4

- 16) Which line represents the bag that contained a solution isotonic to the 0.6 molar solution at the beginning of the experiment? 16) \_\_\_\_\_

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

- 17) When a plant cell, such as one from a peony stem, is submerged in a very hypotonic solution, what is likely to occur? 17) \_\_\_\_\_
- A) the cell membrane will lyse
  - B) plasmolysis will shrink the interior
  - C) the cell will become flaccid
  - D) the cell will burst
  - E) the cell will become turgid

- 18) What are the membrane structures that function in active transport? 18) \_\_\_\_\_
- A) cholesterol
  - B) integral proteins
  - C) cytoskeleton filaments
  - D) carbohydrates
  - E) peripheral proteins

19) If a membrane protein in an animal cell is involved in the cotransport of glucose and sodium ions into the cell, which of the following is most likely true? 19) \_\_\_\_\_

- A) Glucose is entering the cell along its concentration gradient.
- B) Sodium ions can move down their electrochemical gradient through the cotransporter whether or not glucose is present outside the cell.
- C) A substance that blocked sodium ions from binding to the cotransport protein would also block the transport of glucose.
- D) Potassium ions move across the same gradient as sodium ions.
- E) The sodium ions are moving down their electrochemical gradient while glucose is moving up.

20) An organism with a cell wall would have the most difficulty doing which process? 20) \_\_\_\_\_

- A) facilitated diffusion
- B) active transport
- C) phagocytosis
- D) osmosis
- E) diffusion