Learning Assignment 3 36 points

NAME\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. A batch of cells are found to contain 300 mM glucose and 150 mM CaCl2 inside the cell. The cell membrane has pores which are permeable to glucose but not to ions. These cells are then placed in a NaCl solution which has an osmolarity of 450 milliosmoles. What happens to the cells after the solution comes to equilibrium? (3 Points)

a. The cells remain the same size as they were originally  
 b. The cells swell  
 c. The cells shrink  
 d. There is not enough information given in the problem to determine what happens

2. A patient is given an isotonic NaCl solution IV (intravenously, in a vein). Which of the following accurately depicts how the fluid and ions redistribute when equilibrium is reached? (3 Points)

a. Approximately 2/3 of the fluid will enter the cells but most of the NaCl (ions) will remain in the extracellular compartment.  
 b. No additional fluid or ions will enter the cells and approximately ¼ of the fluid and ions will remain in the vascular system and ¾ of the fluid and ions will redistribute to the interstitial fluid.  
 c. The fluid and ions redistribute with 2/3 of both going into the cells and 1/3 of both remaining in the extracellular fluid, equally distributed between the plasma and interstitial fluid.   
 d. All of the fluid and ions will remain in the plasma.  
 e. No additional fluid or ions will enter the cells and the fluid and ions will redistribute in the extracellular space with ½ of the fluid and ions remaining in the vascular system and ½ of the fluid and ions going into the interstitial fluid.

3. A new group of cells is found to contains 300 mM glucose and 150 mM CaCl2 inside the cell. The cell membrane of the cells is not permeable to glucose or to ions. These cells are then placed in a CaCl2 solution which has an osmolarity of 450 milliosmoles. What happens to the cells after the solution and cells have come to equilibrium? (3 Points)

a. The cells remain the same size as they were originally  
 b. The cells swell  
 c. The cells shrink  
 d. There is not enough information given in the problem to determine what happens

4. You now find a new group of cells where the interior contains 150 mM CaCl2. The cell   
membrane of the cells are not permeable to ions but are now permeable to glucose. You place these cells into a solution which has 200 mM (NaCl) solution with 100 mM glucose. What happens to the cells? (3 Points)

a. They remain the same size as they were originally  
 b. The cells swell  
 c. The cells shrink  
 d. There is not enough information given in the problem to determine what happens

5. A cell is placed into an unknown solution and allowed to come to equilibrium. The volume of the cell is ultimately found to have increased. Which of the following statements is DEFINITELY TRUE concerning the original unknown solution? Assume all solutes inside the cell are not permeable to the cell membrane. (3 points)

a. The original solution was hyposmotic to the cell  
 b. The original solution could have been hyposmotic or isosmotic to the cell but not   
hyperosmotic  
 c. The original solution could have been hyposmotic, isosmotic or hyperosmotic to the cell  
 d. The original solution was hyperosmotic to the cell  
 e. The original solution could have been hyperosmotic or isosmotic to the cell but not   
hyposmotic.

6. A cell is found with the following concentrations of solutes inside: 300 mM glucose and 150 mM CaCl2. The cell membrane of these cells is made with pores which are permeable to glucose but not to ions. These cells are isolated and then placed in a 150 mM CaCl2. What happened to the cells after the solution and the cells come to equilibrium? (3 Points)

a. They cells remain the same size  
 b. The cells have increased in size; they swell  
 c. The cells have decreased in size; they shrink  
 d. There is not enough information given in the problem to determine what happens

7. You now have a new source of cells where the interior contains 150 mM CaCl2. The cell membrane are now impermeable to ions and impermeable to glucose. You place these cells into 150 mM NaCl solution with 150 mM glucose added. What happens to the cells? (3 Points)

a. They cells remain the same size  
 b. The cells have increased in size; they swell  
 c. The cells have decreased in size; they shrink  
 d. There is not enough information given in the problem to determine what happens

Assume that Solution A by itself is hyposmotic to cells and is the same in each of the following questions (8-11) and that you don’t know the concentration of non-penetrating and penetrating solutes in Solution A. All of the solutes in the cell are non-penetrating. Circle the correct response for each part below.

8. Solution A is hyposmotic to cells. What can you say about the tonicity solution A? (3 points)

a. Solution A is hypotonic  
 b. Solution A is isotonic  
 c. Solution A is hypertonic  
 d. Solution A could be hypotonic, isotonic or hypertonic  
 e. Solution A could be hypotonic or isotonic, but not hypertonic

9. Solution A + 5% Glucose (a penetrating solute) is hyperosmotic to cells. What can you say about the tonicity of this mixture? (3 points)

a. Solution A + 5% Glucose is hypotonic  
 b. Solution A + 5% Glucose is isotonic  
 c. Solution A + 5% Glucose is hypertonic  
 d. Solution A + 5% Glucose could be hypotonic, isotonic or hypertonic  
 e. Solution A + 5% Glucose could be hypotonic or isotonic, but not hypertonic

10. Solution A + Albumin (a non-penetrating solute) is isosmotic. What can you say about the tonicity of this mixture? (3 points)

a. Solution A + Albumin is hypotonic  
 b. Solution A + Albumin is isotonic  
 c. Solution A + Albumin is hypertonic  
 d. Solution A + Albumin could be hypotonic, isotonic or hypertonic  
 e. Solution A + Albumin could be hypotonic or isotonic, but not hypertonic

11. Solution A + Globulin (a non-penetrating solute) is hyperosmotic. What can you say about the tonicity of the mixture? (3 points)

a. It is hypotonic  
 b. It is isotonic  
 c. It is hypertonic  
 d. It could be hypotonic, isotonic or hypertonic  
 e. It could be hypotonic or isotonic, but not hypertonic

12. A patient is given a hypertonic Albumin (protein) solution. Which of the following accurately depicts how the fluid and protein redistribute when equilibrium is reached? (3 points)

a. All of the fluid and protein given remains in the vascular system with additional fluid leaving the cells and redistributing in the plasma.  
 b. ¼ of the fluid and protein given remains in the plasma with ¾ redistributing to the interstitial fluid. Additional fluid leaves from the cells and redistributes in a similar way.  
 c. All of the albumin stays in the vascular compartment, but the fluid redistributes equally between the plasma and interstitial fluid. Additional fluid leaves from the cells and redistributes in a similar way.  
 d. The fluid and protein redistribute equally between the plasma and interstitial fluid. Additional fluid leaves from the cells and redistributes in a similar way.  
 e. 2/3 of the fluid alone enters the cells and 1/3 of the fluid with albumin redistributes equally between the plasma and interstitial fluid.