Unit 3 Assignment

Name: _____ Date: _____ Score: _____/108

Part 1: Multiple Choice (10 marks)

1. Which of the following best describes the current model of a cell membrane?
    a. Cholesterol embedded between a double layer of protein molecules
    b. Protein molecules embedded in a double layer of phospholipid molecules
    c. Phospholipids embedded in a double layer of carbohydrate molecules
    d. A layer of phospholipids embedded in a double layer of glycogen
2. Which of the following is true about the phospholipids that make up the cell membrane?
    a. They are the main constituent of the plasma membrane
    b. Hydrophilic heads face each other in the inner part of the membrane
    c. Hydrophobic tails face the outside and inside of the cell
    d. All are correct
3. Why are donor cells sometimes rejected from a recipient's body?
    a. The recipient's body does not recognize the glycoproteins and glycolipids, so the immune system attacks the foreign cells
    b. The donated cells have a different cellular fingerprint than the cells of the recipient
    c. A donor's cells may have different sugar chains
    d. All of the above may cause rejection
4. Which molecules account for a cell membrane's flexible and fluid nature?
    a. Glycolipids
    b. Phospholipids
    c. Proteins
    d. Cellulose
5. What is the function of cholesterol in the plasma membrane?
    a. It acts as carrier channels to allow steroids into the cell
    b. It stiffens and controls fluidity in the membrane
    c. It acts a fingerprint for cell-to-cell recognition
    d. All of the above are correct

6. What process allows molecules to move into the cell without the use of any chemical energy?
    a. Endocytosis
    b. Pinocytosis
    c. Phagocytosis
    d. Facilitated transport
7. How is energy used during the process of exocytosis?
    a. To alter the membrane shape and allow the vesicle to merge with the cell membrane to force contents out of the cell
    b. To alter the membrane shape and allows the vesicle to merge with the cell membrane to force contents into the cell
    c. To change the structure of carrier proteins to allow molecules into the cell
    d. To change the structure of carrier proteins to allow molecules out of the cell
8. An example of this process is the absorption of small nutrient particles into the villi of the small intestine by “sipping”
    a. Exocytosis
    b. Pinocytosis
    c. Phagocytosis
    d. Endocytosis
9. When a macromolecule is completely surrounded, the membrane pinches together forming an intracellular vesicle inside the cytoplasm of the cell. This describes the process of:
    a. Exocytosis
    b. Endocytosis
    c. Active transport
    d. Facilitated transport
10. Approximately how much of the cell’s energy is used for active transport?
    a. 10%
    b. 25%
    c. 40%
    d. 75%

Part 2: Short Answer (21 marks)

1. The cell's plasma membrane is said to be semi-permeable. What does this mean? (1 mark)

2. What is the Law of Diffusion? (2 marks)

3. Give an example of a gas diffusing through a gas (1 mark).

4. Give an example of a liquid diffusing through a liquid (1 mark).

5. List at least four factors that affect the rate of diffusion (4 marks).

6. Define osmosis (2 marks).

7. If you add salt to a cup of water, which would be the solvent and which would be the solute? (2 marks)

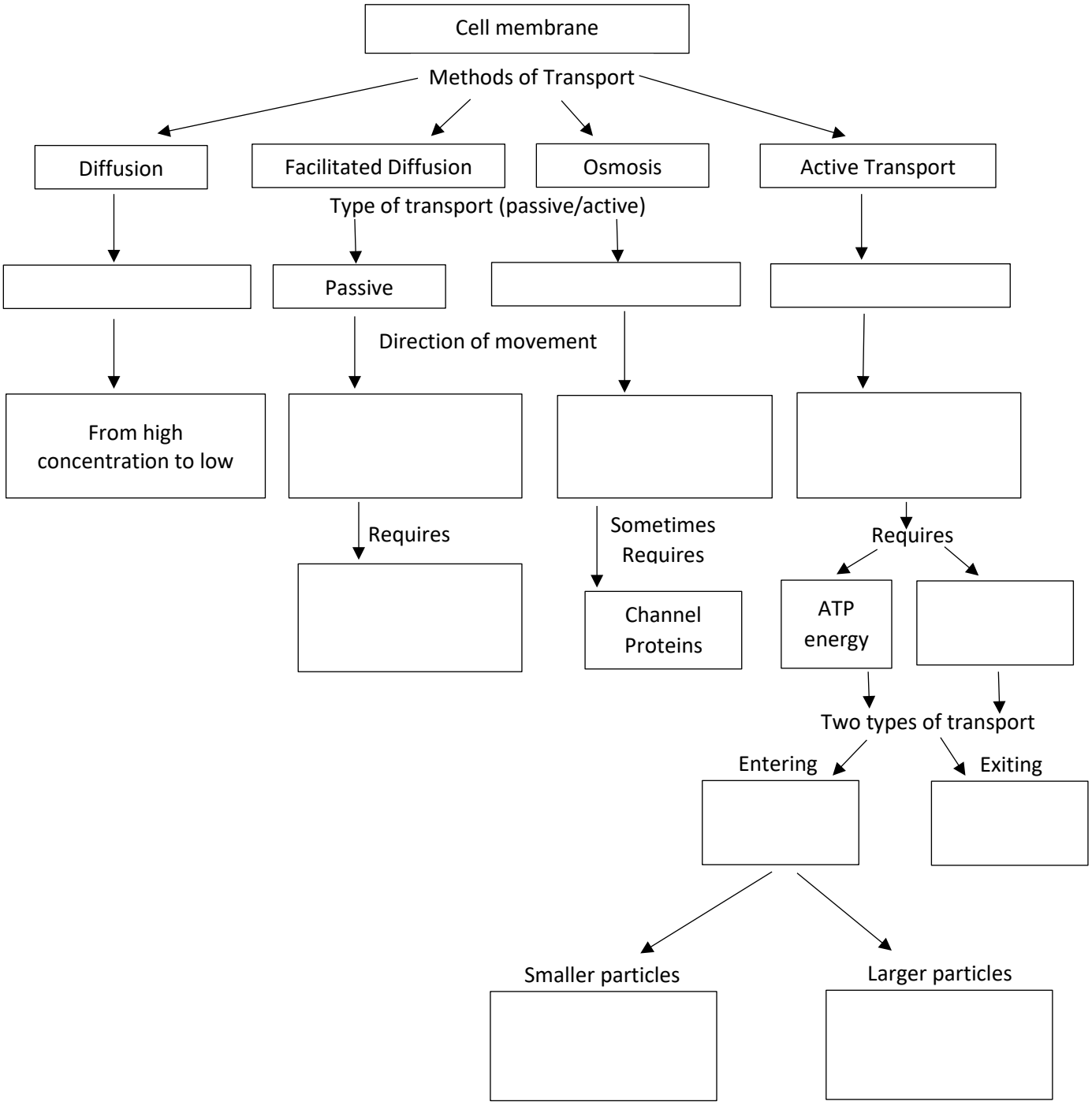
8. What would happen if a semi-permeable bag containing a high concentration of a protein solution was placed in a beaker of water? Explain (2 marks).

9. Why does spraying roads with salt in the winter often cause the death of plants at the edge of the road? (2 marks)

10. What happens to an animal cell that is placed in a hypotonic environment? What is the term for this? (2 marks)

11. How do plants resist the adverse effects of too much turgor pressure? (2 marks)

Part 3: Fill in the Blanks (21 marks)



Part 4: Potato Lab (27 marks)

In previous lessons you were introduced to the effects of different types of solutions on cells. Solutions were isotonic (equal amount of solute both inside and outside the cell), hypotonic (less solute in the solution in comparison to the inside of the cell), and hypertonic (more solute in the solution in comparison to the inside of the cell).
In this lab assignment you will use sucrose (sugar) solutions to investigate the effect of the three types of "tonic' environments on potato sections.

Virtual Lab

Ready? Let's get started!
This is a virtual lab. You won't actually perform the lab, but you will be expected to submit the following write-up for teacher assessment:

1. Interpret the data table to determine which test tubes contain hypertonic, hypotonic, and isotonic solutions.
2. Calculate the change in mass of each potato in a test tube
3. Answer questions based on lab findings

Virtual Equipment

- 3 potato wedges
- 3 equal-volume test tubes labelled #1, #2, #3
- 3 numbered (#1, #2, #3) sucrose solutions of unknown solute concentrations
- Volumetric flask
- Digital scale

Virtual Procedure

Let's assume you have done the following steps of the experiment procedure.

1. Label the test tubes as #1, #2, #3
2. Using a volumetric flask, pour 25mL of the #1 sucrose solution into the test tube labelled #1
3. Repeat Step 2 for sucrose solutions and test tubes #2 and #3.
4. Cut three potato wedges of equal size.
5. Weigh each potato wedge. Each must weigh 10 grams, so make necessary cuts until they are the same weight.
6. Place one wedge in each test tube.
7. Let sit for 24 hours and reweigh each potato.

Virtual Experimental Data

Here's the experimental data after weighting the potatoes that were in sucrose solutions of unknown solute concentrations for 24 hours.

Test Tube #	Type of Solution?	Initial Mass (g)	Final mass (g)	% change in mass = change/initial x 100%
1		10	7	
2		10	12	
3		10	10	

You'll need to complete the data table by determining the percent change in mass for each potato and then identify the type of solution (isotonic, hypotonic, or hypertonic) in each of the three test tubes. What do you think should be done first? To determine the types of solutions in the test tubes, you'll need to determine the percent change in mass of reach potato. These percent changes in mass will help you to deduce or interpret which test tube contains an isotonic solution, which contains a hypertonic solution, and which contains a hypotonic solution of sucrose.

Here's the formula you need to calculate the percent change in mass

$$\% \text{ change in mass} = (\text{change in mass}/\text{initial mass}) \times 100\%$$

Enter your results in the appropriate spaces in the experimental data table.
Now you should be able to identify the solutions in test tubes #1, #2, #3. Enter your deduction in the data table.

Use the results from the data table in this virtual lab and the information from previous lessons to answer the following questions. Please answer in full sentences. (3 marks each).

1. Use the terms hypotonic, hypertonic, and isotonic to classify each solution and explain why water moved as it did – either into or out of the potato – for each of the solutions.

_____

_____

_____

_____

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_____

2. Use the term osmosis and other terminology (ie. Hypertonic, hypotonic and isotonic, etc) to explain how to revive a wilted plant.

3. For red blood cells to remain healthy, what kind of solution must they be in? Explain.

4. Would raising the temperature of the hypertonic solution affect the rate of osmosis for the potato? Explain.

5. When a person with swollen gums rinses with salt water the swelling of the gums may be reduced. Using appropriate terms, including osmosis, hypotonic, hypertonic, or isotonic, explain why this happens.

6. Using what you now know about cellular transport, what type of solution do you think would be an efficient weed killer. Explain.

Part 5: Cell Size (28 marks)

Answer the following questions with complete sentences. Show your work.

1. Assume that a cell is spherical in shape and has a radius of 1 millimeter.

   Remember:

   Surface Area = $4\pi r^2$

   Volume = $\frac{4}{3}\pi r^3$

   a. Calculate the surface are of this spherical cell (2 marks).

   b. Calculate the volume of this cell (2 marks).

   c. Calculate the surface-area-to-volume ratio of the cell (2 marks).

2. Assume that a cell is cubic in shape. Suppose each side (length, width, height) of the cube is 1 millimeter.

   To find the surface area and volume of a cube, use the following equations:

   Surface Area = length x width x number of sides

   Volume = length x width x height

   a. Calculate the surface area of this cubic cell (2 marks).

   b. Calculate the volume of this cubic cell (2 marks).

   c. Calculate the surface-area-to-volume ratio of this cell (2 marks).

3. Will the cubic cell or spherical cell be more efficient at taking in nutrients? Explain (2 marks).

4. Complete the following chart, assuming that the examples are spherical cells (9 marks).

Cell	Radius	Surface Area	Volume	Ratio (surface area to volume)
1	1			
2	2			
3	3			
4	5			

a. Which cell (1, 2, 3, or 4) has the largest surface are? (1 mark)

b. Which cell (1, 2, 3, or 4) has the largest volume? (1 mark)

c. Which cell has the largest ratio of surface-area-to-volume? (1 mark)

d. Which (1, 2, 3, or 4) will be the least efficient at taking in nutrients? Explain (2 marks).