1. Label the following diagram with the following terms: **glycoprotein, cholesterol, hydrophilic region, hydrophobic region, phospholipid bilayer, and protein molecules.**

   6 marks total: 1 mark each

   Please Label the Parts of the Cell Membrane

2. Which of the following factors would affect the permeability of the cell membrane *(circle all correct answers)*?

   4 marks total: 1 mark for each

   A  Size of molecules
   B  Lipid solubility of molecules
   C  Presence of transport channels
   D  Presence of ATP inside the cell

3. During *(a) diffusion*, molecules move from a region of higher to lower concentration until they are distributed equally. The diffusion of water across a differentially permeable membrane is called *(b) osmosis*.

   In *(c) facilitated transport*, a carrier assists the movement of a molecule through a membrane without the expenditure of energy.

4. Which of the following would you **NOT** expect to find in the plasma membrane:

   A  Glycoproteins
   B  Glycolipids
   C  Cholesterol
   D  **Triglycerides**
   E  Phospholipids
5. Complete the following table to understand the functions of each component in a plasma membrane:

<table>
<thead>
<tr>
<th>Chemical Component</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lipids:</strong></td>
<td></td>
</tr>
<tr>
<td>Phospholipid bilayer</td>
<td>Acts as a barrier between the inside and outside of the cell; allows lipid-soluble molecules to pass through.</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>Reduces the permeability of the membrane to most biological molecules.</td>
</tr>
<tr>
<td><strong>Proteins:</strong></td>
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</tr>
<tr>
<td>Channel protein</td>
<td>Allows a particular molecule to cross the membrane.</td>
</tr>
<tr>
<td>Carrier protein</td>
<td>Selectively interacts with a specific molecule so that it can cross the membrane.</td>
</tr>
<tr>
<td>Receptor protein</td>
<td>Has a particular shape that allows a specific molecule, such as a hormone, to bind to it.</td>
</tr>
<tr>
<td>Enzymatic protein</td>
<td>Catalyzes a specific chemical reaction.</td>
</tr>
<tr>
<td><strong>Carbohydrates:</strong></td>
<td></td>
</tr>
<tr>
<td>Glycolipids – glycoproteins</td>
<td>Act as markers or identifiers for cells so that cells are recognized as belonging to self.</td>
</tr>
</tbody>
</table>

6. Label each of the situations listed below as to whether diffusion (D), osmosis (O), facilitated transport (F), active transport (A), exocytosis (E), phagocytosis (P), or pinocytosis (Pi) has taken place: answers may be used more than once.

8 marks total: 1 mark each

**F** Glucose enters the liver cells very quickly by binding to a receptor in the plasma membrane.

**D** An onion is detected by smell at the end of the kitchen table.

**O** A red blood cell shrinks in a solution containing 1% salt.

**D** Red dye crystals are equally distributed in a beaker of water.

**Pi** Fluid, containing minerals, enters a cell by forming a vesicle at the plasma membrane.

**E** Thyroid hormone exits the cell after the Golgi vesicle containing it fused with the plasma membrane.

**P** A bacterial cell is engulfed by a white blood cell.

**A** Sodium ions are pumped out of a cell against a concentration gradient.
7. Complete the table below to distinguish how molecules pass into and out of cells by writing **Yes** or **No**.

21 marks total: 1/3 mark each

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</thead>
<tbody>
<tr>
<td>a. Diffusion</td>
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<td></td>
<td></td>
<td></td>
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<td>b. Osmosis</td>
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<td>c. Facilitated transport</td>
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<td>d. Active transport</td>
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<td>e. Exocytosis</td>
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<td>f. Pinocytosis</td>
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<td>g. Phagocytosis</td>
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</table>

8. Define the following terms:
4 marks total: 1 mark each

a. Turgor pressure: **The internal pressure that adds to the strength of the cell and builds up when water moves by osmosis into a cell.**

b. Crenation: **describes red blood cells that shrink in a hypertonic solution.**

c. Plasmolysis: **Contraction of the cell contents as the cell shrinks due to the loss of water when placed in a hypertonic solution.**

d. Tonicity: **The strength of a solution in relationship to osmosis or the degree to which the concentration of solute versus solvent causes fluids to move into or out of cells.**

9. Red blood cells will not gain or lose water if they are put into 0.9% NaCl. Such a solution is said to be **(a) isotonic**. If the red blood cells were placed in 0.75% NaCl, such a solution would be considered **(b) hypotonic** and water would (c) **enter** the cell and cause the cells to undergo (d) **hemolysis**. On the other hand, if the red blood cells were placed in 1.5% NaCl, such a solution would be considered (e) **hypertonic**. In this case, water would (f) **leave** the cell and the red blood cells would (g) **shrink**. Such a condition is termed (h) **crenation**.

10. How does each of the following molecules enter a cell?
4 marks total: 1 mark each

   e. Oxygen **diffusion**
   f. Glucose **facilitated transport**
   g. Potassium ions **active transport**
   h. Water **osmosis**
11. Three experiments were set up according to the data table below. The membranes of the blood cells are impermeable to the solute. In each experiment the cells from column A, which were resting in isotonic solutions, were then placed in the solution in column B.

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
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<tbody>
<tr>
<td>Solute Concentration</td>
<td>Solute Concentration</td>
</tr>
<tr>
<td><em>Inside the Blood Cell</em></td>
<td><em>In Extracellular Fluid</em></td>
</tr>
<tr>
<td>Experiment 1</td>
<td>1%</td>
</tr>
<tr>
<td>Experiment 2</td>
<td>0.5%</td>
</tr>
<tr>
<td>Experiment 3</td>
<td>1%</td>
</tr>
</tbody>
</table>

a) Describe what will happen to the cells in each experiment when they are placed in the solutions in column B. Give reasons for your answers.

6 marks total: 1 mark for each “what” and 1 mark for each “why”

Experiment 1: No change because the solution is isotonic to the cell.

Experiment 2: Blood cell will lose water (shrink) because the solution is hypertonic to the cell.

Experiment 3: Blood cell will gain water (swell) because the solution is hypotonic to the cell.

b) Which experiment could be considered the control? Why? Experiment 1 is the control because the cells began in an isotonic solution and so experiment 1 made no changes to the cells or because the cell began in an isotonic solution so the results of the other experiments will be compared to that of experiment 1.

12. The following experimental steps were used to determine the tonicity of potato cells:

1) Five different sugar solutions were added to five numbered test tubes as shown in the data table.
2) Five discs of potato (cut from the same potato) were weighed and added to each test tube.
3) After 24 hours, the potato discs were again weighed to determine their change in mass.

<table>
<thead>
<tr>
<th>Test Tube</th>
<th>% Sugar Solution</th>
<th>Initial Potato Mass</th>
<th>Final Potato Mass</th>
<th>% Change In Mass</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>30.0</td>
<td>3.0 g</td>
<td>2.2 g</td>
<td>-27</td>
</tr>
<tr>
<td>2</td>
<td>20.0</td>
<td>3.3 g</td>
<td>2.8 g</td>
<td>-12</td>
</tr>
<tr>
<td>3</td>
<td>10.0</td>
<td>3.2 g</td>
<td>3.4 g</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>5.0</td>
<td>3.1 g</td>
<td>3.6 g</td>
<td>16</td>
</tr>
<tr>
<td>5</td>
<td>Distilled water</td>
<td>2.9 g</td>
<td>3.6 g</td>
<td>24</td>
</tr>
</tbody>
</table>

a) Account for the change in mass of the potato disc in test tube number 1.

1 mark
Potato mass reduced because the cells lost water when placed in a hypertonic solution.

b) Account for the change in mass of the potato disc in test tube number 5.  
1 mark  
Potato mass increased because the cells gained water when placed in a hypotonic solution.

c) Estimate the percentage sugar solution that would be isotonic to the potato cytoplasm. **Draw a graph to assist you**, and give an explanation for your estimate.  
8 marks total: 1 mark for each of the following: y axis scale, x axis scale, y axis label, x axis label, title, graph (line), answer (%) explanation  

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**Explanation:** 14% because this is the % solution where there is no change in mass in the potato disc.

13. Which of the following will be affected directly if the mitochondria in a cell are NOT functioning properly?  

A. Absorption of alcohol by the cell  
B. The movement of water into and out of the cell  
C. The movement of oxygen across the cell membrane  
**D. The movement of sugar from a low to a high concentration**

14. Which organelle is associated with endocytosis:  

A. Central vacuole  
B. Golgi apparatus  
C. **Lysosome**  
D. Mitochondria
15. Describe how the structure of the cell membrane permits molecules to enter the cell by the following processes.

3 marks total

A  **Osmosis:** protein-lined pores in the cell membrane allow water to pass across the cell membrane freely.

B  **Facilitated transport:** special proteins in the cell membrane help molecules enter the cell through specific channels.

C  **Pinocytosis:** the cell membrane is a double layer that can change its shape to engulf molecules.

16. Which of the following molecules is required in order to have the sodium – potassium pump work:

A  Phospholipid bilayer

B  **ATP**

C  Glucose

D  Cholesterol

E  Cell recognition protein

17. Which comparison is **NOT** correct:

A  Channel proteins – transport water

B  **Enzymatic proteins – cell recognition**

C  Carrier proteins – transport sodium ions

D  Integral proteins – within plasma membrane

E  Peripheral proteins – attach cytoplasmic protein

18. A small lipid-soluble molecule easily passes through the plasma membrane. Which of the following statements best describes the reason?

A  A protein carrier must be at work

B  **The plasma membrane has lipid molecules**

C  Phagocytosis engulfs the lipid molecule

D  The cell uses energy to transport the molecule

E  Active transport moves the molecule across the membrane
TRUE AND FALSE

For each of the following, circle the T if the statement is true. If the statement is false, circle the F and rewrite the statement to make it true:

3 marks total
T   F    Integral proteins in the plasma membrane have their hydrophobic regions embedded within the membrane ______________________________

T   F    During endocytosis, the plasma membrane invaginates and material enters the cell within a vesicle ______________________________

19. When a person drowns in a lake, water may sometimes enter the lungs. Would you therefore predict that the red blood cells found in the lung capillaries would swell, shrink, or remain the same size? Why?

2 marks total: 1 mark for what happens and 1 mark for why

The red blood cells would swell and lyse because the water in the lake is hypotonic to the blood.