nelsonnet

End-of-chapter exam

Chapter 1: Cell membrane

Multiple-choice questions

Place a circle around the correct choice.

1 Which of the following statements correctly describes the function of the cell membrane?
- **A** The cell membrane strengthens the cell and gives it shape.
- **B** The cell membrane contains a phospholipid bilayer embedded with proteins.
- **C** The cell membrane selectively permits material to pass into and out of the cell.
- **D** The cell membrane is composed of cellulose.

2 Desalination plants all around the world take seawater and turn it into fresh drinking water. Many use reverse osmosis, a process said to be similar to osmosis in plant cells. In reverse osmosis, energy is used to force water under pressure through very fine selectively permeable membranes. This allows the water molecules to pass through, but not salts and other matter. The salts that are unable to pass through the membranes are collected in a concentrated form. However, there are environmental concerns about what to do with this concentrated salty waste water. Which statement is correct and relevant to this information?
- **A** In osmosis, water moves into the cell from the outside because pure water will move across a selectively permeable membrane in order to dilute the higher concentration of salt in the cytoplasm of the cell.
- **B** Environmental concerns about the concentrated salty waste arise because if the waste water contacts plants, water will leave the plant to 'even out' the salt concentration, causing the plant to wilt.
- **C** A major difference between reverse osmosis and osmosis in plant cells is that, unlike during osmosis in plants, which is passive, large amounts of energy are required to keep reverse osmosis working.
- **D** Although it is said that reverse osmosis is like osmosis in plants, the plant cell wall and cell membrane achieve the separation of dissolved salts and water in osmosis.

3 Moss plants are highly salt tolerant. This is because moss cells are able to maintain a low internal sodium concentration even when suspended in salty water. Which of the following mechanisms would explain this observation?
- **A** The removal of sodium ions by active transport.
- **B** The uptake of sodium ions by diffusion.
- **C** The uptake of water by osmosis.
- **D** The removal of water by active transport.

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4 Haemodialysis machines are used to remove waste substances, such as urea, water and salts, from the blood of people with kidney disease. During haemodialysis, the patient's blood is pumped through selectively permeable, artificial membrane tubes that are surrounded by dialysis fluid. The composition of dialysis fluid is similar to blood, but can be varied as required to control the transfer of wastes out of the blood. Which of the following statements is correct?

A There is no urea in the dialysis fluid; therefore, all of the urea in the patient's blood will diffuse out of the blood and into the dialysis fluid.

B The pumping of blood through the membrane tubes and the movement of the surrounding dialysis fluid in the opposite direction maintains a steep concentration gradient, which will increase the rate of diffusion.

C If a person consumed less salt (sodium chloride) it would be necessary to decrease the concentrations of sodium and chloride ions in the dialysis fluid to prevent too much salt leaving the blood.

D If a person consumed extra salt (sodium chloride) it would be necessary to supply energy to enable the active transport of the sodium and chloride ions out of the blood into the dialysis fluid.

5 An example of passive movement across the plasma membrane is:

A a freshwater organism using its contractile vacuole to remove water.

B kidney tubules absorbing glucose to ensure none is excreted in the urine

C a white blood cell engulfing an invading microorganism.

D water entering a wilted lettuce leaf that is soaking in water.

6 Osmosis is the movement of:

A water from a region of low solute concentration to one of high solute concentration.

B water from a region of high solute concentration to one of low solute concentration.

C water against a concentration gradient.

D solutes from high to low concentration.

7 In Liddle's syndrome a gene mutation codes for a defective sodium ion channel in the collecting ducts of the kidney. The ion channel is always active, resulting in too many sodium ions (Na^+) being reabsorbed into the blood and too few excreted in the urine. This leads to elevated osmotic pressure of the blood, resulting in high blood pressure. In some patients with Liddle's syndrome, the gene mutation may also increase the number of sodium ion channels. Which of the following is consistent with this information?

A A suitable treatment would be a high salt diet to increase the amount of salt excreted in the urine.

B The high blood pressure results from the movement of water from the collecting ducts into the blood.

C An increase in the number of sodium ion channels in the collecting ducts of the kidney would reduce the effect of the defective ion channels.

D Water would move from a high sodium ion concentration in the blood to the low sodium ion concentration in the tubules.

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8 GLUT4 glucose transporters carry glucose into cells such as those that make up muscles. When blood insulin concentrations are low, GLUT4 glucose transporters are present in the membranes of cytoplasmic vesicles, where they are unable to transport glucose. Binding of insulin to receptors on cells leads to rapid fusion of the vesicles with the plasma membrane and insertion of the glucose transporters, enabling the cell to efficiently take up glucose. When blood levels of insulin decrease and insulin receptors are no longer occupied, the glucose transporters are recycled back into the cytoplasm. Recent studies of individuals with Type 2 diabetes have shown that although insulin is unable to stimulate translocation of GLUT4 to the plasma membrane, a bout of exercise does. Which of the following is consistent with this information?

A The facilitated diffusion of glucose by GLUT4 moves glucose up its concentration gradient into cells.

B The presence of insulin stimulates endocytosis of the GLUT4 cytoplasmic vesicles; its absence causes exocytosis.

C Exercise stimulates the fusion of vesicles containing GLUT4 glucose transporters with the plasma membrane.

D The membrane recognition proteins to which insulin binds are called glycoproteins because they are a protein combined with a sugar molecule.

9 Which of the following does *not* describe a concentration gradient?

A The difference in concentration between two regions.

B An unequal distribution of ions across the cell membrane.

C A measurement of how the concentration of oxygen changes from one place to another.

D The concentration that exists in two different areas.

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