

Model Answers: Easy

1

The correct answer is **D** because:

- The movement of molecules from low concentration to high concentration (against their concentration gradient) requires **energy** and therefore is **active transport**
- The movement of molecules from high concentration to low concentration is **diffusion**, if this movement requires the aid of a **protein** (for example because the molecule is **charged** and cannot pass directly through the phospholipid bilayer) this is **facilitated diffusion**

2

The correct answer is **A** because being energy **independent** means that the transport does **not** require energy. **Diffusion** does not require energy because molecules will travel from an area of high concentration to an area of low concentration in order to achieve **equilibrium** (equal concentrations on either side of the membrane).

Active transport, endocytosis and exocytosis all require energy.

3

The correct answer is **D** because:

- **Plasmolysis** is the shrinking of the plant cell membrane and protoplasm **away** from the cell wall due to a reduction in the volume of the cell's cytoplasm
- The reduction of the cytoplasm volume is due to water leaving the cell by **osmosis** when the cell is in a solution with a **lower water potential** than it
- Water potential is a measure of the purity of water and the strong saline solution contains more solutes than the cell cytoplasm and therefore will have a lower water potential
- Water moves via osmosis (a special type of diffusion) from a high water potential to a lower water potential to achieve **equilibrium** across a membrane

Animal cells do **not** plasmolyse because they do **not** have a **cell wall**. In saline solution, animal cells will **shrink**.

In pure water, the water will move from the pure water (high water potential) **into** the cell (lower water potential). This will cause **animal cells** to swell and **burst** and **plant cells** to become **turgid**. Plant cells do not burst because the cell wall is strong and holds the cell together.

4

The correct answer is **B** because glucose is polar and amino acids are charged, therefore neither can pass through the hydrophobic middle section of the phospholipid bilayer. Therefore, hydrophilic protein pores must be used to enable the transport of glucose and amino acids across the cell membrane.

Water and oxygen can pass through the phospholipid bilayer because they are small molecules and can pass between phospholipids in the cell membrane. Although water is polar, because it is so small, one molecule of water can pass through the bilayer without disrupting its structure.

5

The correct answer is **D** because:

- The dark grey circle represents a large **solid particle** which **cannot** cross the membrane
- The particle is then **engulfed** by the cell which forms a **vesicle** from the cell surface membrane which contains the particle within the cell
- The light grey circle represents a **lysosome** which is a vesicle within a cell that contains **digestive enzymes** and usually has an **acidic** internal environment
- The lysosome **fuses** with the vesicle in order to **degrade** the engulfed particle
- This is an example of **endocytosis** (bulk transport into a cell) and specifically **phagocytosis** (bulk transport of solid matter into a cell).

Exocytosis is bulk transport **out** of a cell, for example, secretion of an enzyme or hormone produced by the cell.

Facilitated diffusion and **protein pumps** both use **transmembrane proteins** in the cell surface membrane that transport small molecules (such as glucose) and ions into and out of cells.

6

The correct answer is **D** because:

- Bulk transport is the movement of large structures or large amounts of structures and/or liquid across the cell membrane using **vesicular transport**
- Bacterium is engulfed by phagocytes during the process of **phagocytosis** (cell eating) which is a specific type of **endocytosis** for solid particles and a form of bulk transport
- Enzymes and neurotransmitters are **secreted** by cells into the extracellular fluid during **exocytosis**, which is bulk transport **out** of the cell
- The uptake of liquid into a cell is known as **pinocytosis** (cell drinking) which is a specific type of **endocytosis** and a form of bulk transport

7

The correct answer is **D** because:

- Molecules are only actively transported (require energy) if they are being pumped against their concentration gradient
- If glucose is moving from an area of high concentration to an area of low concentration then it diffuses (does not require energy)
- As glucose is a polar molecule, it requires a protein carrier to create a hydrophilic pore in the cell membrane for it to pass through to cross the membrane

Protein channels are specific to one type of molecule, for example, sodium ion channels and chloride ion channels have different sized pores because the ions are different sizes, therefore they are selective.

Proteins can be transported across the membrane by bulk transport (endocytosis and exocytosis). In endocytosis, the protein will be surrounded by the cell membrane and engulfed into a vesicle within the cell. In exocytosis secretory proteins leave the Golgi apparatus in a vesicle which then fuses with the cell surface membrane to release the proteins.

Polar and charged solutes can cross the cell membrane, they just require a channel protein or carrier protein to facilitate their crossing. Polar and charged solutes are unable to pass through the phospholipid bilayer directly as this would disrupt the membrane structure due to the clash of hydrophobic and hydrophilic molecules.

8

The correct answer is **C** because:

- All molecules have **kinetic energy** which causes them to move **randomly** and collide
- Diffusion occurs because molecules will move randomly **down** a concentration gradient in order to create an **even** distribution of the molecule (concentration **equilibrium**)

Diffusion does not use cellular energy (ATP) to move molecules as this would be **active** transport.

The attraction between molecules (intermolecular force) is **not** strong enough to work over distance and only has an effect if the molecules are very close or touching.

9

The correct answer is **D** because:

- The question states that substance X travels through a protein **channel**, which is a hydrophilic pore in the membrane created by a protein
- Protein channels do not undergo conformational changes when they transport molecules, therefore the chloride ion uses the protein channel to **diffuse** down its concentration gradient into a cell

Osmosis is the movement of **water** down its concentration gradient and this process does not require proteins.

Glucose can only move across a membrane if it is facilitated by a protein because it is polar and therefore this statement would have to say “**facilitated diffusion**” to be correct.

Active transport requires **carrier proteins** (transmembrane transport proteins that undergo conformational change) **not** channel proteins.

10

The correct answer is **C** because:

- The solute potential is the extent to which the solute molecules decrease the water potential of the solution
- The **more** solute there is, the lower the tendency for water to move out of the solution and therefore the **lower** the water potential
- Pressure potential is the **amount** of pressure the solution is under, for example, there is a high pressure on the blood in arteries or there is a high pressure if a plunger is being forced down onto a solution
- **Increasing** the pressure on a solution increases the tendency of water to move out of it – that is, it **increases** its water potential
- Therefore, water potential (Ψ) from solute potential (Ψ_s) and pressure potential (Ψ_p)

The exam board specification states that you are not expected to know the details about the solute potential and pressure potential but it is useful to understand.