

- 1 a i** *Any two from the following:* calcium ions are: water soluble rather than lipid soluble / are charged ions / are hydrophilic while the phospholipid layer is hydrophobic.
- ii** Calcium ions are moved against their concentration gradient by active transport. The ions bind with receptors on the channels of carrier proteins which span the membrane. On the inside of the cell, ATP binds to the carrier protein causing it to change shape and open to the opposite side of the membrane. The calcium ions are then released to the other side of the membrane.
- b** Receptors on the membrane recognise antibodies that have attached themselves to antigens on the bacterial surface. As a result of a series of reactions, the surface of the bacterium becomes coated with proteins called opsonins. This facilitates the process where the membrane invaginates to enclose the bacteria and then fuses to form a vesicle called a phagosome.
- c** Lysosomes move towards the vesicle and fuse with it. Enzymes within the lysosomes firstly break down the cell wall of the bacteria by hydrolysing the murein of which it is made. Other enzymes from the lysosome hydrolyse the peptide bonds of proteins, the ester bonds of lipids and the glycosidic bonds of carbohydrates to produce smaller, soluble material. These soluble products are absorbed into the cytoplasm of the phagocyte.

Number 2 is on the next page!

- 3 a** Transport mechanism – box 2 = diffusion, box 3 = endocytosis / phagocytosis.

Example – box 5 = glucose / amino acids / ions / polar molecules, box 6 = water.

- b** Box 1 = facilitated diffusion, box 2 = active transport / sodium-potassium pump,
box 3 = diffusion / osmosis, box 4 = endocytosis (pinocytosis / phagocytosis) / exocytosis.

2 a 7.0 nm

b K allows the passage of ions, small water-soluble molecules and polar (charged) ones across the membrane by facilitated diffusion or active transport.

L acts as a recognition site for specific chemicals. It also stabilises the membrane by forming hydrogen bonds with water.

M permits the movement of lipid-soluble substances across the membrane while acting as a barrier to water soluble ones. The fatty acid tails of this layer also help to keep the membrane fluid.

N the cholesterol regulates the fluidity of the membrane depending on the temperature and influences its permeability. It also restricts the lateral movement of phospholipids and is a storage material.

c Glucose is a relatively large polar molecule and, being water soluble, cannot pass through the phospholipid bilayer.

d The graph shows that, at low glucose concentrations, the rate of uptake is dependent on glucose concentration and increases as the concentration of glucose increases up to a point after which the rate becomes constant. The levelling off is due to all the carrier proteins involved in facilitated diffusion being fully occupied in moving glucose. If it were a passive process the rate would not level off but continue to rise. If active transport were responsible the concentration of glucose would not affect the rate except at very low glucose concentrations.

e Active transport is an active process using ATP to move substances against a concentration gradient while facilitated diffusion is passive, does not use ATP and occurs down a concentration gradient.