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Level: HL IB in Biology

Subject: Biology

Topic: IB HL Biology

Type: Mark Scheme

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All International Baccalaureate IB Topic Questions HL Biology

BIOLOGY

HL - IB

Key skills

Answer 1

The correct answer is A because lipid-based hormones, such as steroid hormones, are able to cross the phospholipid bilayer. They can do this because they have hydrophobic sections which allow them to interact with the hydrophobic fatty acid tails of the phospholipids within the bilayer.

B is incorrect as protein-based hormones are too large to cross the membrane. These hormones function by binding to protein receptors in the cell surface membrane to bring about a change inside the cell.

C is incorrect as neurotransmitters function by binding to protein receptors in the cell surface membrane.

D is incorrect as charged molecules (ions) are able to cross the cell surface membrane only via transmembrane transport proteins; they do not pass directly through the phospholipid sections of the bilayer.

Answer 2

The correct answer is D because:

- Proteins within the cell membrane are not bound to any particular phospholipids and can move freely between the phospholipids in the plane of the membrane
- All the molecules of the cell membrane are constantly moving past one another due to random movement of molecules.
- The more fluid the membrane is, the more movement there is.

You can think of the phospholipid bilayer as water in a pond and the proteins are boats that are not anchored.

A is incorrect as proteins and phospholipids are not attached or bonded to each other in the cell membrane, they only share weak intermolecular attractions.

B is incorrect as proteins on the outer *and* inner layers, *and* proteins that span the whole membrane, are able to move freely between phospholipids

C is incorrect as proteins in the membrane are not all attached to structures in the cell and can move freely, like phospholipids.

Answer 3

The correct answer is A because

- Cholesterol is a relatively small molecule with both hydrophilic and hydrophobic regions; it takes the place of a phospholipid and forms intermolecular attractions with the fatty acid chains within the bilayer. This allows it to stabilise the membrane at high temperatures.
- Glycoproteins are proteins that have a carbohydrate (glyco) chain attached to the exterior side of the cell membrane; the carbohydrate chain acts as a tag which labels the cell and is used in cell recognition and adhesion.
- Phospholipids pack together tightly enough to limit the movement of large, polar molecules across membranes. Water is polar, so the phospholipids do act as a barrier to water movement to some extent, but because water is a relatively small molecule it can still move directly between the phospholipids.
- Proteins embedded into the phospholipid bilayer can provide a hydrophilic pore for specific charged and polar molecules to cross the membrane.

Answer 4

The correct answer is C because:

Substance Y is moving into the cell by facilitated diffusion, meaning that it is dependent on transport proteins to move across the membrane. Once the concentration of substance Y is high enough for all of the transport proteins to be in use at the same time, it is not possible for transport to occur any faster, and the rate of movement into the cell levels off; it can be said that the transport proteins are saturated. The proteins are only saturated briefly as they transport a molecule before they are available for use again, meaning that transport continues to occur at this constant rate.

A is incorrect because ATP is only required during the active transport of molecules; facilitated diffusion occurs down a concentration gradient and no ATP is required.

B is incorrect because equilibrium will not be reached in this situation. The X axis shows an increasing concentration of the substance outside the cell, so there is no opportunity for equilibrium to occur. We can also note here that if equilibrium were the reason, then there would be no reason for substance X to not show the same pattern as substance Y. Furthermore, equilibrium would lead to a reduction in the rate of entry to the cell, not a levelling off.

D is incorrect because the higher concentration does not alter the number of carrier proteins present or their effectiveness in transporting molecules, so they will continue to move substances into and out of the cell depending on the concentration gradient.