AQA, OCR, Edexcel

A Level

A Level Biology

Exchange Across Membranes

Name:

M M E

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Total Marks: /38

Exchange Across Cell Membranes

One of the key features in the structure of the cell membranes is that it is partially permeable. This means that it is selective about what molecules are allowed to enter and leave the cell.

1. Diffusion is one of the mechanisms by which substances enter and leave the cell providing they are small enough and are lipid soluble.

a)

i) Explain why diffusion is described as a passive process? (2 marks)

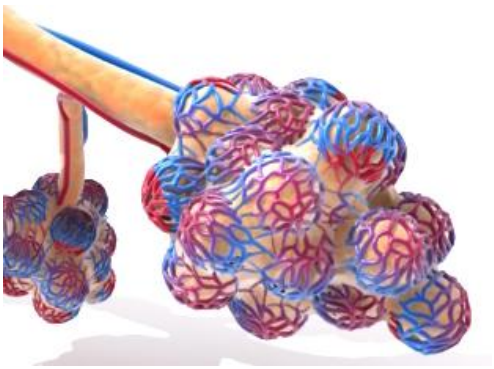
b) The rate of diffusion depends on several factors, including pH and temperature.

i) The concentration gradient is one of these factors – how does the concentration gradient affect the rate of diffusion? (1 mark)

ii) Identify two other factors and how they affect the rate of diffusion. (4 marks)

2.

a) The role of the alveoli is to maintain efficient gas exchange between the lungs and the blood. The diagram below shows alveoli from a human lung and the capillaries that surround it.



i) With reference to the key factors that affect the rate of diffusion discussed in question one, discuss how the alveoli is adapted for efficient gas exchange. (3 marks)

ii) People who suffer from emphysema, a disease usually caused by smoking or exposure to air pollution, have a greatly reduced amount of elastin in their alveolar walls. Why do people who suffer from emphysema often suffer from an increased rate of breathing? (4 marks)

3.

a) Osmosis is a process that effects all living organisms which are required to maintain an appropriate osmotic balance in order for tissues and cells to function correctly.

i) What does the term water potential mean? (1 mark)

ii) Draw an animal cell in a hypertonic solution, with arrows to show the net movement of water. (2 marks)

iii) If a plant cell was placed in a hypotonic solution, what would happen to it? (2 marks)

b) Cystic fibrosis is a recessive, hereditary disease characterised by a thick mucus build up in certain tissues of the body.
People who do not suffer from cystic fibrosis have a watery mucus surrounding their cells which does not build up. In these cells the CFTR gene is fully functional and allows chloride ions to be transported out of the cell.

i) What mechanism is used to transport chloride ions out of the cell? (1 mark)

ii) What affect does this have on the water potential inside the cell? (1 mark)

iii) In cystic fibrosis sufferers, there is a mutation in the gene that codes for the CFTR membrane protein making it less efficient. How does the faulty CFTR gene in cystic fibrosis sufferers cause the characteristic thick mucus? (4 marks)

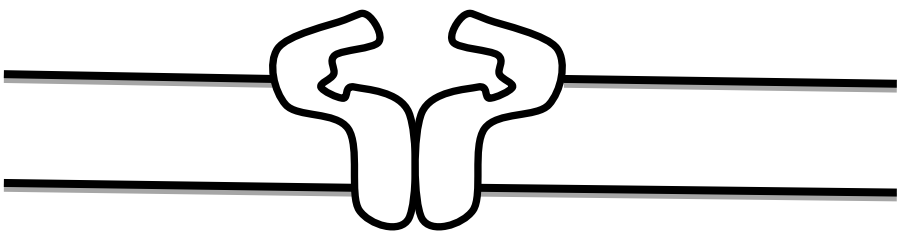
4. Some molecule are too large to pass directly through the membrane like in osmosis and diffusion, so they have to enter or leave the cell via carrier proteins and channel proteins.

a)

i) What other molecules cannot pass directly through the membrane? (1 mark)

ii) Is facilitated diffusion a passive or active process and why? (2 marks)

b) The diagram below shows a valinomycin membrane protein which transports K^+ ions across the cell membrane.

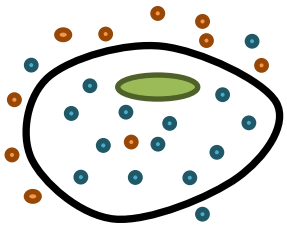


i) Explain the mechanism by which K^+ is transported into the cell via the valinomycin membrane protein. (3 marks)

c) Active transport is another mechanism by which substances enter and leave cells.

i) What is active transport? (1 mark)

ii) The diagram below shows the simplified internal and external environment of a cell. Explain how a co-transporter is used in facilitating the movement of these two molecules into the cell. (3 marks)



Key:
Glucose
Calcium

d) Some molecules cannot enter or leave the cell by any of the mechanisms discussed so far.

i) Some proteins that are too large to fit through the membrane proteins enter the cell by endocytosis – explain how this mechanism works. (3 marks)