

Section B
Answer **one** question.

07

Write an essay on **one** of the topics below.**EITHER**

07 . 1

The importance of nitrogen-containing substances in biological systems.

[25 marks]**OR**

07 . 2

The importance of diffusion in organisms.

[25 marks]

7.2 The Importance of Diffusion in Organisms

Plan - ~~action potential~~ →
 - ~~chemosynthesis~~ ^{o.p.} → allows ATP to be produced in large quantities
 - water reabsorption

Diffusion is the ^{passive} movement of substances from an area of high concentration to an area of lower concentration down its concentration gradient.

In oxidative phosphorylation during aerobic respiration hydrogen ions are moved from the matrix into the inter-membrane space using energy from electrons moving along the electron transport chain in a series of oxidation-reduction reactions of transport proteins. This creates a concentration gradient between the high concentration

AO1
✓
AO2
✓



of H^+ in the intermembrane gap and a lower concentration of H^+ in the matrix of the ~~mitochondrion~~ mitochondrion. H^+ ions therefore diffuse back into the matrix in a process called chemiosmosis, through the enzyme ATP synthase. The diffusion of H^+ ions provides the energy for an ATP molecules to be synthesised from ADP and P_i in a condensation reaction. ~~The~~ The most amount of ATP is produced in the oxidative phosphorylation stage of ~~photosynthesis~~ respiration. ATP ~~is~~ provides the immediate source of energy for many reactions + processes in organisms e.g muscle contraction. Diffusion in oxidative phosphorylation is therefore important at providing ^{large enough quantities} ~~sufficient~~ of ATP for all the processes in an organism.

~~The~~ In setting up a resting potential, the sodium-potassium pump actively transports three sodium ions out of the axon and two potassium ions into the axon. This sets up a potential difference, which is further ^(made more negative) increased by the diffusion of potassium ions out of the axon down its concentration gradient. This creates a resting potential of around -70 mV . When an action potential reaches the axon, voltage-gated Na^+ channels open, allowing Na^+ to diffuse into

Turn over ►



the axon down its electrochemical gradient, depolarising the axon, and creating a potential difference of around $+35\text{mV}$. ~~Then~~ Here, diffusion allows a resting potential to be set up, which allows an action potential to be ~~prop~~ propagated along the axons. Action potentials allow for a quick response in animals e.g. in muscle contraction, which helps increase response to changes in environmental & internal conditions.

X01
✓ X02

Osmosis is the movement of water molecules, from a higher water potential to a lower water potential, and is a passive process, so I will consider it as a type of diffusion. In fresh water amoeba, ^{small} ~~vacuoles~~ are vesicles are created, and mineral ions, such as Na^+ , are actively transported into them. This lowers the water potential in the vesicle, so water moves in by osmosis. The vesicles fuse together to form a larger contractile vacuole, which binds to the cell-surface membrane, and empties the water out of the cell via exocytosis. This form of osmoregulation is important in fresh water amoeba, in order to prevent lysis of the cell as water is continually moving into

gas
exchange

V Good
X03



the amoeba by osmosis as inside the cell the cytoplasm has a lower water potential than the surrounding water.

✓ 10.1
✓ 10.2
✓ 10.3

In fish, oxygen diffuses into the blood stream, and carbon dioxide diffuses out in the gills. Gas exchange takes place over filaments, where the blood ^(in capillaries) and water flow next to each in opposite directions, forming a counter-current mechanism. This helps maintain a concentration gradient along the whole of the exchange surface, allowing the maximum amount of diffusion. This means the ^{haemoglobin in the} blood can become more fully saturated. This is important as there is low oxygen concentrations in the water, so the fish need to extract as much oxygen as possible. Oxygen is required in aerobic respiration, to act as a terminal acceptor of electrons in ~~oxy~~ oxidative phosphorylation, so gas exchange is important ~~then~~ in order to perform efficient respiration to produce enough ATP.

✓ 10.1
✓ 10.2

22

Super

25

Turn over ►

