Do not write outside the box

Section B
Answer **one** question.

0 7 Write an essay on **one** of the topics below.

EITHER

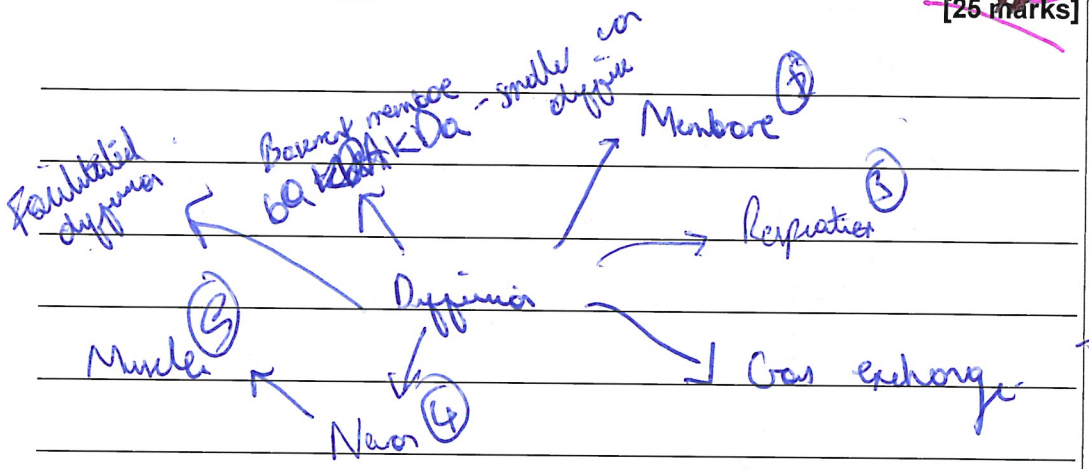
0 7 . 1 The importance of nitrogen-containing substances in biological systems.

[25 marks]

OR

0 7 . 2 The importance of diffusion in organisms.

[25 marks]



Diffusion is the net movement of molecules and ions from an area of high concentration to an area of low concentration down a concentration gradient until evenly distributed. This mechanism incorporated with proteins is called facilitated diffusion. Facilitated diffusion uses both carrier and channel proteins when exchanging molecules and ions which normal diffusion is no longer adequate. The movements allow an equilibrium.

Types of mols moved? Properties of membrane? Ions and molecules such as glucose either have a charge e.g. Na+

✓T

Osmosis?

Using only **Figure 7**, evaluate the importance of PIP1 in the movement of carbon dioxide and water through leaves of poplar trees.

[3 marks]

Loss of PIP reduces water and CO_2 movement. Not significant because stomatal elevation doesn't overlap. Great effect on CO_2 transport

15

Turn over for the next question

...s or has legs to diffuse through the phospholipid bilayer. Carrier proteins allow specific and complementary molecules such as glucose to bind and be transported via facilitated diffusion. Water-soluble molecules are also unable to diffuse through the phospholipid bilayer. Instead they facilitately diffuse via channel proteins. Channel proteins are water-filled hydrophilic channels which allow specific water-soluble ions to pass through. Each channel only opens in the presence of a specific ion. It is like a gate at this control the entry and exit of ions which allow molecules and ions to be transported throughout the membrane, providing key molecules for processes such as overall respiration e.g. glucose.

✓1

Gas exchange is a key concept. Most gas exchange surfaces have 2 key concepts. They have a large surface area and they are thin, providing a short diffusion pathway. The organism can likewise maintain a steep concentration gradient for diffusion. For example, single-celled organisms absorb and release gases by diffusion through their outer surface. They have a relatively large surface area, a thin surface and a short diffusion pathway (O_2 can take part in biochemical reactions as soon as it diffuse into the cell) - no need for a gas exchange system.

In addition, there is a lower concentration of O_2 in water than in air. So fish have special adaptations to get enough. Each gill made up of thin plates called gill filaments, giving a big surface area for diffusion to occur quickly. Lamellae also have a lot of blood capillaries and a thin layer of cells to speed up diffusion. Blood flows through the lamellae in one direction and water flows in the opposite direction. Counter-current system. This helps maintain a large concentration gradient. Concentration of O_2 in H_2O always higher than that of blood, so as much O_2 as possible diffuses from H_2O into the blood. This mechanism highlights the important role of the oxygen transport via diffusion within organisms. What what do we need O_2 for?

VGR

VGR

When glucose is eventually transported through the membrane via facilitated diffusion it will be stored and eventually used within aerobic respiration. Oxidation occurs within the presence of oxidative phosphorylation. H^+ released from $NADH_2$ and $FADH_2$ as they are oxidised to NAD and FAD. The H atom splits into H^+ and e^-. E^- move down the electron transport chain, losing energy at each carrier. The energy is then used by electron carriers to pump H^+ from the mitochondrial matrix into the intermembrane space. The concentration

VR

Do not write outside the box

of H^+ is now high in the intermembrane space than in the mitochondrial matrix - forming an electrochemical gradient. This diffusion gradient allows the H^+ to move back across the inner mitochondrial membrane and into the matrix, via ATP synthase, allowing the synthesis of ATP to occur. ATP can then be used as an energy source for many other process, such as the contraction of muscles, producing movement and impulses for organisms. ✓Relevance. ✓R

Diffusion is a key concept between a neuron and a cell in terms of a synapse. An action potential is generated and reaches the end of a neuron, it causes neurotransmitters to be released into the synaptic cleft. The neurotransmitter, e.g. acetylcholine diffuses across the synaptic cleft and bind to the specific and complementary receptor on the sarcolemma. Although This causes the movement of Na^+ channels to open and flood in the post-synaptic membrane - depolarisation occurs. Ca^{2+} channels just open in the pre-synaptic membrane and diffuse into the neuron, causing vesicles to move and fuse. These vesicles can contain hormones such as noradrenaline. This allows the threshold potential to be exceeded and triggers an ✓NS

T-✓✓
GE-✓✓
14 R-✓✓ Relevant
Max. NS-✓
B-✓✓✓
R-✓
QWC-✓✓
R1

action potential can be fired. This link directly with the initiation of movement within an organism in term of the sliding filament model

When a action potential stimulates a muscle cell, it depolarises the sarcolemma. Depolarisation spreads down the T-tubule to the sarcoplasmic reticulum. This opens Ca^{2+} channels on the endoplasmic stimulum and diffuse out into muscle fibre cytoplasm. Tropomyosin changes shape and move from myosin binding site on actin and form cross bridges. The myosin bends, sliding the actin filament, this means sarcomere occurs. Ca^{2+} activate ATPase, hydrolysis of ATP provides energy - this allow the myosin head to be released from the actin. Binding can happen, resulting the myosin head and the muscle relaxes. This process until the diffusion of ions allow the muscle to contract, providing movement and also relaxing the muscle, meaning less fatigue is occurred for the organism. Referenced