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NZQA

Mana Tohu Mātauranga o Aotearoa
New Zealand Qualifications Authority

Level 2 Biology 2024

91156 Demonstrate understanding of life processes at the cellular level

Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of life processes at the cellular level.	Demonstrate in-depth understanding of life processes at the cellular level.	Demonstrate comprehensive understanding of life processes at the cellular level.

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

You should attempt ALL the questions in this booklet.

If you need more room for any answer, use the extra space provided at the back of this booklet.

Check that this booklet has pages 2–12 in the correct order and that none of these pages is blank.

Do not write in the margins (////). This area will be cut off when the booklet is marked.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

Achievement

TOTAL 12

QUESTION ONE: Cellular respiration

(a) Write the word equation **or** the chemical equation for aerobic respiration.

Oxygen + glucose → ATP + Carbon dioxide

(b) *Phoneutria* is a genus of spiders mainly found in South America, commonly referred to as Brazilian wandering spiders.

The sensitive hairs on their bodies help detect vibrations of passing prey, and they can feed on insects, lizards, and frogs. During the day, they will hide for many hours under logs, rocks, or inside termite mounds and banana plants.

These spiders are known for their remarkable speed and agility, and are considered to be one of the fastest spiders in the world. When capturing prey or escaping from predators, they can move at speeds of up to 50 cm per second.

Brazilian wandering spider searching leaf litter for prey.

Discuss the processes of anaerobic and aerobic respiration, linking them to the activities of the Brazilian wandering spider.

In your answer, include discussion of:

- the processes of anaerobic respiration and aerobic respiration in the Brazilian wandering spider, including where in the cell each form of respiration takes place
- why the Brazilian wandering spider can only carry out anaerobic respiration for short periods of time when attacking or escaping
- the advantages and disadvantages associated with the Brazilian wandering spider using both anaerobic and aerobic respiration.

Aerobic respiration is respiration that requires oxygen to function.
Anaerobic respiration does not need oxygen to function. It is given by the equation, Glucose → ATP + lactic acid.
Aerobic respiration is much more efficient than anaerobic respiration, it can turn glucose into much more ATP than anaerobic respiration. This is why it is the primary source of energy for most organisms. But anaerobic respiration is much faster. This is why it is often used when organisms are using large

amounts of energy. When the spider moves very fast it needs energy for its muscles so it switches from aerobic to anaerobic, but it cannot maintain it for long periods of time. For one, it does not have enough glucose to convert to energy, its a finite resource. Secondly, anaerobic respiration creates lactic acid. Lactic acid lowers the pH in the spider and makes it harder to continue.

All enzymes have an optimal pH, and if the pH changes from that optimal level, the rate of enzyme reaction decreases. If the pH changes too much from the optimal pH, the hydrogen bonds within the enzyme can break deforming, and denaturing the enzyme so that it cannot be used again.

Enzymes have an active site which is where they attach to substrates to form substrate-enzyme complexes.

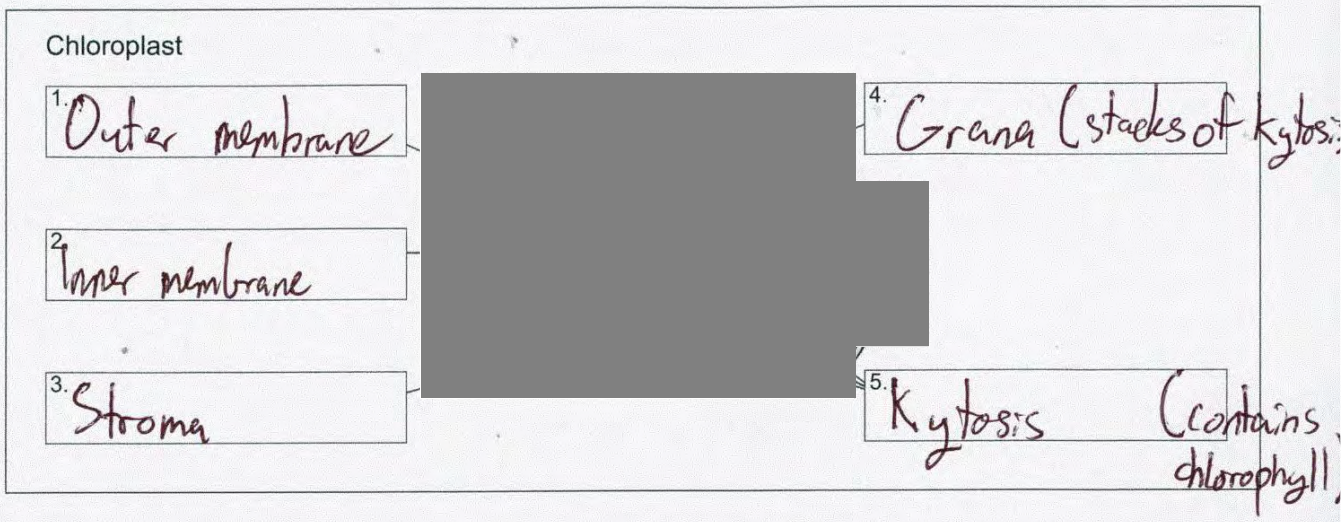
The advantages of aerobic respiration is that it is efficient, oxygen is a bountyful resource, and it creates clear energy (lactic acid free) The disadvantage is that it can only be used when oxygen is present. The advantage of anaerobic respiration is that it is fast and does not depend on oxygen. A disadvantage is that it creates the by product of lactic acid.

aerobic respiration takes place in the mitochondria. Electron transport chain, glycosis and the kreb cycle all take part in aerobic respiration.

Anaerobic respiration occurs in the cytoplasm.

QUESTION TWO: Photosynthesis

(a) Label the key parts of the chloroplast in the diagram below.



Leaves of some plants that grow in the shade are known as 'shade leaves'. These leaves can be up to five times more efficient in capturing and using the same amount of sunlight as plants whose leaves grow in direct sunlight, which are known as 'sun leaves'.

Shade leaves lose water more quickly than sun leaves when all environmental conditions are the same. Shade leaves are generally larger in area but thinner than sun leaves. Shade leaves also tend to have larger chloroplasts, as well as more chloroplasts within each cell, compared to leaves that grow in full sunlight.

(b) With reference to the information above, evaluate how leaf structure, and the size and number of chloroplasts within plant cells, can be influenced by the availability of light.

In your answer, include discussion of:

- the process of photosynthesis, describing its key stages
- the correlation between the size and number of chloroplasts in shade leaves and sun leaves, and how this size and number difference is linked to photosynthesis
- why shade leaves would lose water more quickly than sun leaves under the same environmental conditions.

Photosynthesis is made up of two stages. The light dependent and the light independent stages.

During the light dependent reaction, (the one that goes first) the energy from the light is used to split the water molecules into hydrogen and oxygen. The oxygen is released as a by product.

$6CO_2 + 6H_2O \xrightarrow{6} H_{12}O_6C_6 + 6O_2$

light + Carbon dioxide + water → Glucose + oxygen.

Next is the light independent reaction, the one that doesnt need light.
By the way the process of light splitting the water is called photolysis. And the light dependent reaction needs light.

In the light independent reaction, the hydrogen and carbon dioxide combine to form glucose.

Grana are arranged so that kytosis experience the greatest amount of light and can absorb the most light.

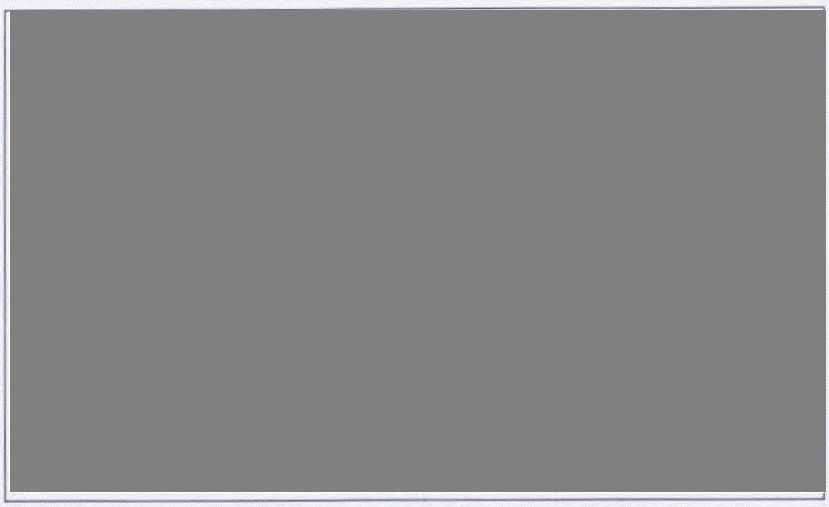
leaves that are in direct sunlight get lots of sunlight so their chloroplasts dont need to be as big.
Shade leaves need much bigger chloroplasts to absorb the same amount of energy.

Shade leaves and sun leaves are made to be in different conditions. Sun leaves are designed for direct sunlight so are more equipped to deal with evaporating water. This is why when they both are put in the same conditions, shade leaves lose water faster.

Inside the kytosis is where the chlorophyll are. so this is where the light dependent reactions take place.

QUESTION THREE: Cell division

In both plants and animals, cells undergo a cycle of growth, followed by division.



Cell surface area to volume ratio.

Evaluate the impact of changes in the surface area to volume ratio on the diffusion process, and why changes in this ratio may trigger cell division.

In your answer, include discussion of:

- the process of diffusion and its role in cellular activities
- how and why the surface area to volume ratio undergoes changes during the growth of a cell
- how the surface area to volume ratio influences the movement of substances into and out of the cell
- the relationship between the surface area to volume ratio, diffusion, and the initiation of cell division, giving examples of when cell division rates are high in both plants and animals.

Diffusion is the passive process of materials moving from an area of high concentration to an area of low concentration.
Diffusion is how gasses such as oxygen enter the cell, through the cell membrane.

Mitosis rates are highest at the point on the plant where it is growing, such as the shoots or where the plant is healing a wound.

Or in animals mitosis is higher where the person is growing or skin cells, which constantly need replacing.

Stages of mitosis

1) Prophase: this is when the chromosomes condense and are visable under a microscope.
2) Metaphase: Chromosomes move to the middle of the cell and align randomly in the centre, this is called independent assortment and is to increase genetic diversity.

This is when homologues chromosomes exchange strands of DNA to increase genetic diversity. The point where they meet is called the chiasma.

3) Anaphase, this is when chromosomes are pulled to opposite ends of the cell by spindle fibres. This is when the laws of segregation happens. This seperates alleles to ensure that each gamete only has one allele for each trait.

4) Telophase: This is when the chromosome decondense and become visable again.
5) Cytokinesis: The cytoplasm splits and the cell becomes two.

Achievement

Subject: Biology

Standard: 91156

Total score: 12

Q	Grade score	Marker commentary
One	A4	The response covers the anaerobic respiration reaction and describes the advantages and disadvantages of both aerobic and anaerobic respiration. It highlights that aerobic respiration produces more adenosine triphosphate (ATP) per glucose and can only occur in the presence of oxygen, while anaerobic respiration is faster but cannot be sustained for long periods. Additionally, the locations where aerobic and anaerobic respiration occur are described.
Two	A4	The response includes a labeled diagram of a chloroplast and a description of photosynthesis. It also describes parts of the light-dependent and light-independent reactions, though the locations of these reactions are not specified.
Three	A4	The response describes that diffusion moves substances from a high to low concentration and is a passive process. It involves the movement of substances, such as oxygen, through a cell membrane. Additionally, it describes examples of high rates of cell division in plant shoots and animal skin cells.