No part of the candidate's evidence in this exemplar material may be presented in an external assessment for the purpose of gaining an NZQA qualification or award.



91156



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 (22/22). 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.



Merit

#### **QUESTION ONE:** Cellular respiration

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

Glucose + Oxygen -> ATP + Carbon Dioxide + Water

(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
- 4 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.

In the Brazilian Wandering spider, aerobic respiration occurs in the mitochondria". This process REQUIRES Oxygen. It uses glucose from photosynthesis and Oxygen to create ATP (energy), Carbon Dioxide, and water.

Anaerobic respiration occurs in the cells cytoplasm. This Process does NOT require Oxygen in order to work. Aerobic respiration takes Glucose, and uses that to produce ATP, lactic acid and Carbon Dioxide for the Brazilian wondering spider. Biology 91156, 2024 00438

2

The Brazilian wandering spiders only carry out anaerobic respiration for short periods of time when attacking or escaping as anaerobic respiration produces lactic acid. Lactic acid causes cramps in muscles, and if it is built up for too long, it can kill cells cause them to die.

Advantages associated with the Brazilian wondering spider using aerobic respiration is that aerobic respiration produces around 36-38 ATP per glucose molecule which is a good amount of glucose, making it more efficient. Can be sustained langer longer periods Disadvantages associated with the Brazilian wandering spider using aerobic respiration is that it requires Oxygen in order to work. This is an disadvantage for when the Brazilion wandering spider as when the spider is low on oxygen, toia it cannot respire aerobically.

Advantages associated with the Brazilian wandering spider using anaerobic respiration, so when the spider has a low oxygen intake, it can respire anarobically and still have some energy to carry out its needed functions.

Disaduantages for the Brazilian wandering spider using anaerobic respiration is that although it can respire without oxygen, it only creates ZATP per glucose molecule. This makes it less efficient as aerobic respiration makes a significant amount MORE ATP than anaerobic respiration. Anaerobic respiration cannot be sustained for long periods of time which is another reason Brazilian wandering spiders can only attack and escape for short periods of time.

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#### **QUESTION TWO:** Photosynthesis

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

Chloroplast	4
Outer Membrane	Chlorophyll
2	
Inner Membrane	
Stroma	Thylakoid stack

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 split into two phases. The light-dependent phase, and the light-independent phase. The light-dependent phase requires sunlight. The light-dependent phase occurs in the chloroplasts thylakoids. The plant draws up water from the soil via the roots (through capilary action (tiny root hairs)). The sunlights energy is absorbed green Via the "pigment chlorophyll. This sunlight energy is used to split water into Biology 91156, 2024 00438

Hydrogen and Oxygen molecules. This process creates ATP in preparation for the light-independent phase. The plant then releases Oxygen as a waste product. The plant then goes into the light-independent phase. This phase does NOT require sonlight, "It occurs in the stroma (the fluid surrounding the thylakoids). This process is when the plant takes in Carbon Dioxide via the pores on the underside of the leaf (the stomata). The plant then joins the Carbon Dioxide with the Hydrogen from the light-dependent phase. The joining of Carbon Dioxide and Hydrogen molecules create glucose for plant respiration and growth.

The reason shade leaves have larger cloroplasts the then the sun leaves is because shade leaves do not get as much sunlight for the light-dependent phase due to being in the shade. The larger 1 chloroplasts and larger amount of chloroplasts give the shade leaves 1 a larger surface area to collect more sun, but more surface area (therefore more chlorophyll) to collect the sunlight 3. This is how they can capture five times more sunlight than sun leaves. f chloroplasts Sun leaves have a smaller amount 1 and smaller chlorophast as they are in the sunlight. If they had the bigger surface area more surface area like the shade leaves, they would gain too

6

#### **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 process is where the plant pass through a cells semi-permeable membrane, down the concentration gradient. Diffusion is a possive process, which means it does not require energy. Diffusion transports molecules from a high concentration, to a low concentration until equillibrium is reached. This helps the cell to be able to perform its functional needs.

# Merit

Subject: Biology

Standard: 91156

Total score: 17

Q	Grade score	Marker commentary
One	M5	The response explains that an advantage of aerobic respiration is that it can produce 36–38 ATP per glucose and can be sustained for longer periods. A disadvantage of aerobic respiration is that it requires oxygen and occurs at a slower rate. It explains that an advantage of anaerobic respiration is that it doesn't require oxygen, allowing animals to function effectively even with low oxygen availability. A disadvantage is that it can only occur for a short period, produces only two ATP, and results in lactic acid, which can cause cramps.
Two	M6	The response explains the details of both the light-dependent and light- independent phases. It also provides reasons for the higher number and size of chloroplasts in shade leaves, as well as the lower number and size of chloroplasts in sun leaves.
Three	M6	The response describes the diffusion process and its purpose. It explains the changes and reduction in the surface-area-to-volume ratio involved in cell growth. It also clarifies that when the surface-area-to-volume ratio becomes too small, the cell cannot efficiently transport nutrients and wastes, necessitating cell division. Additionally, it provides an example of a high cell-division rate in an animal and the reasons for this occurrence.