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NZQA | Mana Tohu Mātauranga o Aotearoa
New Zealand Qualifications Authority

Level 2 Biology 2025

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 2–16 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 11

QUESTION ONE: Photosynthesis in different environments

Photosynthesis is a vital process for both terrestrial (land-based) plants and aquatic (water-based) plants. The rate of photosynthesis varies throughout the day. Carbon dioxide (CO_2) is a critical component for photosynthesis for plants in all environments, and is often found to be a limiting factor in aquatic environments such as rivers and streams.

Climbing clubmoss (*Lycopodium volubile G.Forst.*), a common New Zealand terrestrial plant.

Common water milfoil (*Myriophyllum propinquum*), a common New Zealand aquatic plant.

Discuss the process and importance of photosynthesis to plants, and how environmental factors can influence this reaction in both terrestrial and aquatic environments.

In your answer, include discussion of:

- the process of photosynthesis, including details of the main stages and the role of chlorophyll
- why the rate of photosynthesis changes from sunrise to sunset, and how factors such as light intensity and temperature influence this variation
- why the limited availability of CO_2 in aquatic environments leads to lower rates of photosynthesis, compared to terrestrial plants found in similar locations.

Photosynthesis has two main stages the light dependent stage and the light indepent stage. In the light dependent stage chlorophyll will absorb solar energy into the plant. This energy will be used to split water molecules keeping the H atoms and leaving oxygen as a waste product. this energy also converts low energy ADP into high energy ATP. (this happens in the thylakoid) In the light indepenet phase

the stroma brings in CO_2 molecules and then they move into the cytoplasm. When in the cytoplasm CO_2 will react with H atoms (from breaking H_2O) with the help of enzymes and ATP to make glucose.

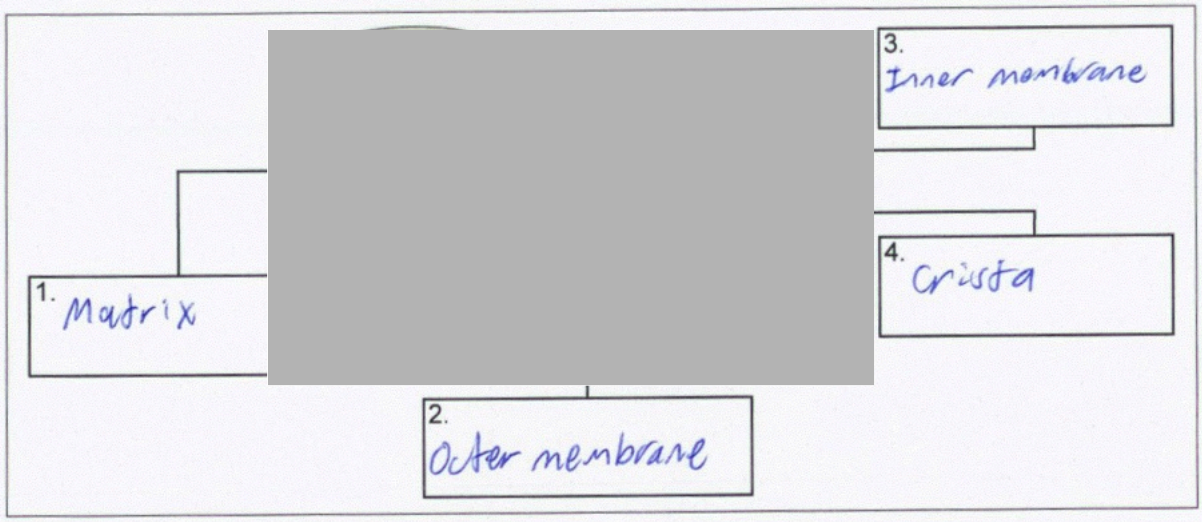
The reason ~~why~~ photosynthesis changes it's intensity from sunrise to sunset is because it will have less solar energy to absorb. At sunrise and throughout the day the plant will have alot of solar energy to keep breaking down water and converting ADP into ATP. This then ~~does~~ means the plant can make more glucose. This is also because at higher temperatures enzyme activity increases meaning they will move faster allowing for the reaction to make glucose will happen faster. At sunset and colder temperatures the oppsite will happen. Less water breaking down, less ADP becoming ATP, less active enzymes. Meaning less glucose.

~~This is~~ be Less CO_2 is a problem for aquatic plants because it means less glucose is being produced. This is because without enough glucose it doesn't matter how much solar energy the plants chlorophyll absorb or how ~~much~~ fast enzymes are moving without enough CO_2 they cannot react because there is no carbon or oxygen

for them to react with. For terrestrial plants they can make as much glucose as possible because there not capped on how much CO_2 is in the air.

QUESTION TWO: Cell respiration

(a) Mitochondria allow cells to meet their energy needs. Label the following structures in the mitochondrion diagram below: outer membrane, inner membrane, matrix, and crista.



(b) The cheetah (*Acinonyx jubatus*) is the fastest land animal, capable of reaching speeds of up to 112 km/h, in short bursts, to catch prey.

A cheetah running at full speed.

Discuss where and when anaerobic and aerobic respiration occur in the cheetah.

In your answer, include discussion of:

- anaerobic respiration and aerobic respiration in the cheetah's cells, and identify where each type of respiration occurs in an animal cell
- why the cheetah can carry out anaerobic respiration for only short periods of time
- the advantages and disadvantages of the cheetah carrying out both anaerobic and aerobic respiration.

Aerobic ~~Anaerobic~~ respiration happens in the mitochondria. This type of respiration is for when your body has enough oxygen. It starts by splitting glucose in half making 2 ATP. This glucose

and oxygen enter the mitochondria where in the matrix the make CO_2 and H_2O (waste products). This reaction release a lot of energy which then allows 36x ADP to become 36x ATP. In total making 38x ATP. ~~Aerobic~~ Anaerobic respiration happens in the cytoplasm this respiration splits glucose in half making 2x ATP. Which is then immediately used. (Anaerobic)

The reason the cheetah can carry out anaerobic respiration for short periods of time is because after the 2x ATP is made lactic acid is also produced as a side effect. This lactic acid builds up in the cheetah's ~~system~~ cytoplasm. This lactic acid stops the cheetah from doing more anaerobic respiration.

The advantages of anaerobic respiration is that the cheetah gets energy fast. Allowing the cheetah to do quick ~~be~~ intense bursts of movement. The disadvantages is that lactic acid builds up ~~in~~ in the cheetahs cytoplasm ~~and this is why we~~ which oxygen has to be used later to turn it back into glucose. It's also a wasteful use of glucose only making 2x ATP. The advantages of aerobic respiration is that you get more energy per glucose spent 38x ATP. It also doesn't

leave lactic acid as a by product. The disadvantages is that it needs oxygen for the reaction to take place. It also takes longer for the energy to come to the body making it better for longer less intense actions.

QUESTION THREE: Enzyme function and temperature

Temperature fluctuations can impact the activity of enzymes, thereby influencing the rate of all cellular activities in an organism.

Discuss the importance of enzymes in cellular processes, and how temperature affects enzyme activity.

In your answer, include discussion of:

- the structure of enzymes
- the role of enzymes in biological processes
- the mechanism by which enzymes function
- why high and low temperatures have different effects on enzyme activity.

You may include diagrams in the space below to support your answer (optional).

the rde of enzymes is to be a catalyst and speed up reactions. They do this by lowering the activation energy required to start the reaction.

At high temperatures enzymes will move faster allowing there to be more reactions per second. this is a dable edged sword because if the enzymes get to hot they will start to get denatured. This changes there shape no lnger allowing them to bind to a substrate. At to low temparteres enzyme activity slows way down. This means there will be less collisions per secand slowing down the rate of the reaction.

Enzymes are structured to fit perfectly into a spefic substrate. This can be any shape as lng as it fits into its spefic substrate.

Achievement

Subject: Biology

Standard: 91156

Total score: 11

Q	Grade score	Marker commentary
One	A4	The response described: • the role of chlorophyll in absorbing light / solar energy • the light dependent phase of photosynthesis occurring in thylakoids • the light independent phase of photosynthesis in stroma • why carbon dioxide is needed for photosynthesis.
Two	A4	The response identified: • mitochondrion structures and the location aerobic respiration in mitochondria • the location of anaerobic respiration in cytoplasm. The response described some advantages and disadvantages of anaerobic and aerobic respiration.
Three	A3	The response described: • the role of enzymes as biological catalysts in the response and the effect of high temperatures denaturing enzymes • the effect of low temperatures decreasing the rate of reaction.