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91156



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Level 2 Biology, 2017

91156 Demonstrate understanding of life processes at the cellular level

2.00 p.m. Wednesday 22 November 2017

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 space for any answer, use the page(s) provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–11 in the correct order and that none of these pages is blank.

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

Achievement

TOTAL

12

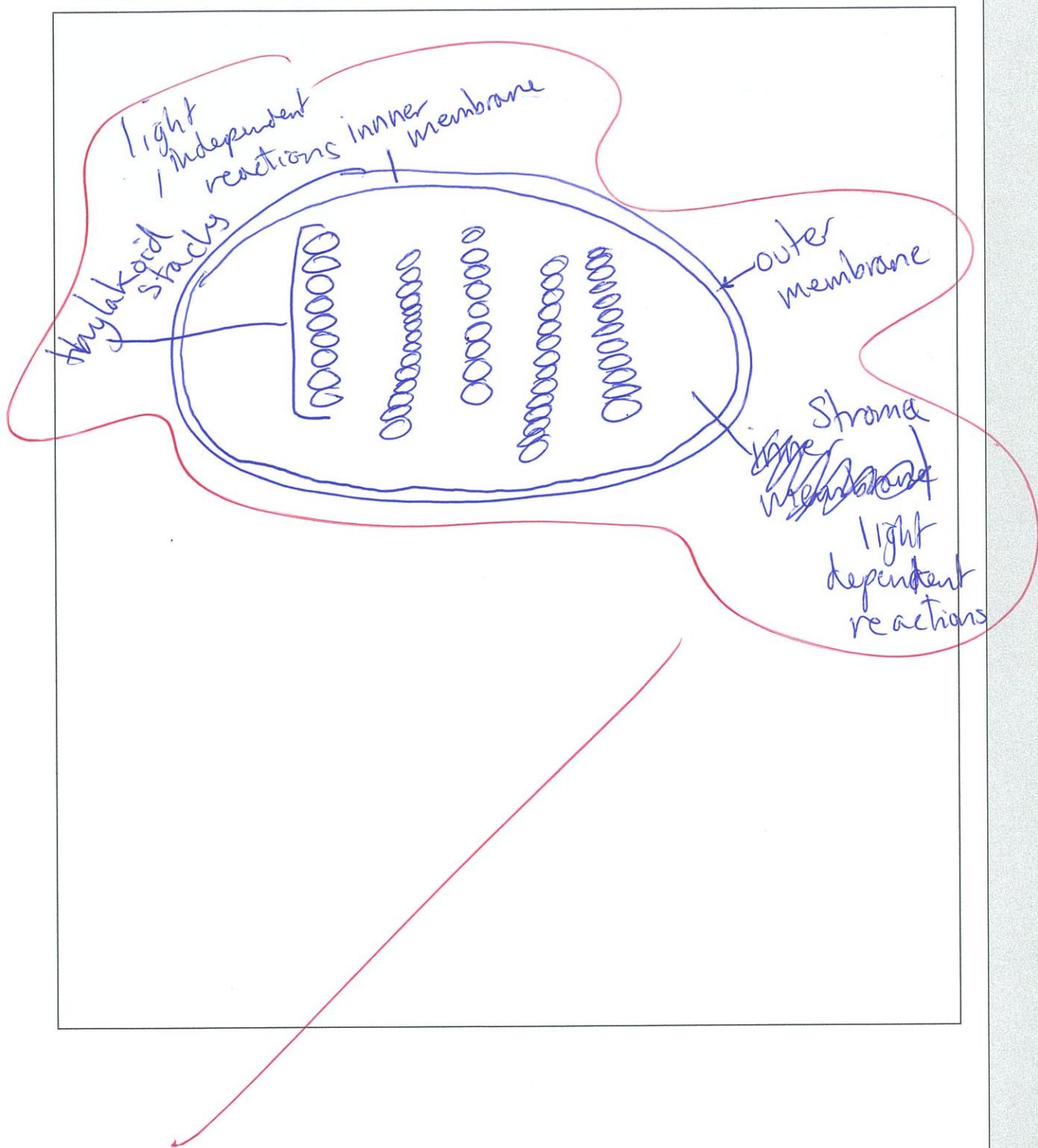
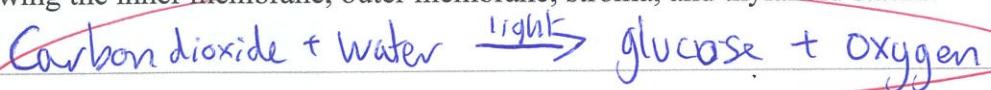
ASSESSOR'S USE ONLY

QUESTION ONE: PHOTOSYNTHESIS

- (a) Describe osmosis AND explain how it occurs in root cells of a plant.

Osmosis is a type of passive transport which occurs in water, it is when something travels down the concentration gradient from a ~~low~~ high concentration to a low concentration. Because osmosis is passive it requires no ATP. In plants ~~as~~ plant cells water travels into the cells via osmosis; plant cells need water to survive, water molecules are small enough to travel through the cell wall of a plant cell. No energy is used in this.

- (b) Write the word equation for photosynthesis AND draw a labelled diagram of a chloroplast showing the inner membrane, outer membrane, stroma, and thylakoid stacks.



- (c) Discuss how photosynthesis occurs, and the factors that affect it.

In your answer:

- explain light-independent AND light-dependent reactions
- indicate on your chloroplast drawing (previous page) where these reactions occur
- discuss how water AND one other factor can affect the rate of photosynthesis.

Light dependent reactions are the first reactions to happen in photosynthesis. There are two parts to the light dependent reaction which happen in the stroma of the chloroplast. First is photolysis which splits the water molecule to give the H⁺ ion. The second is electron excitation in which the H⁺ ion is turned into a hydrogen atom and is taken to the light-independent reaction to be used via an NADP molecule. Light-independent reactions happen in the grana thylakoid discs in which oxygen and glucose are produced. Oxygen is a waste product.

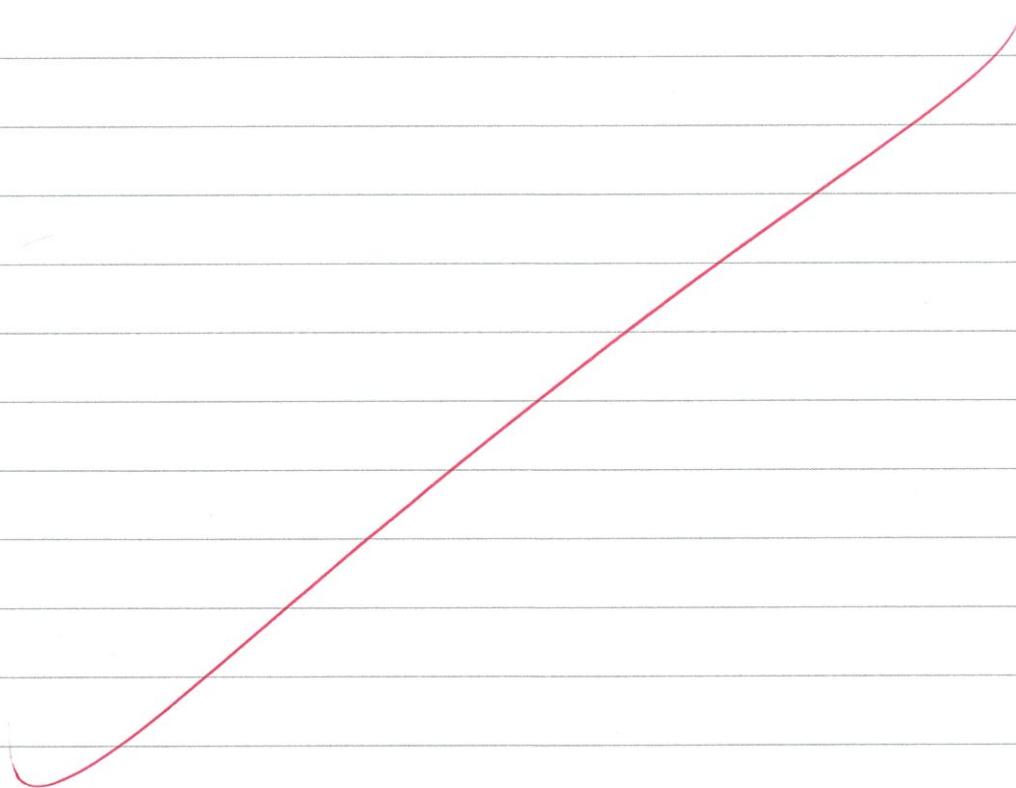
www.behance.net/gallery/13665729/Corn-Plant-Root-Systems

Water is a factor which affects the rate of photosynthesis, if a plant has enough the optimal amount of water it will produce glucose and oxygen at a higher rate at which it normally does. However once this optimal point is reached the plant will stop increasing its rate of photosynthesis, if more water was added the plant would not be able to use it up and would start to die because of the buildup in its H₂O.* Another factor which can affect the rate of photosynthesis is the increased level of CO₂. Once an increased level of CO₂ is present has

reached its optimal level the plant will have peaked its increased rate of photosynthesis and the maximum level of ~~photosynthesis~~ carbon dioxide used has been reached.

If more carbon dioxide is added the plant is unable to use it up and so the rate of photosynthesis will not increase and will stay the same. If ~~photosynthesis~~^{the level of CO₂} is decreased the rate of photosynthesis will also decrease and glucose and oxygen will not be produced as much, if the level of CO₂ is too low then the plant will die as not enough glucose is being produced.

* If the plant does not have enough water it will also die as glucose is not being produced.



QUESTION TWO: CELL RESPIRATION

<http://taputeranga.org.nz/the-marine-life/molluscs/why-are-mussels-absent-from-the-wellington-south-coast/>

<http://naturewatch.org.nz/taxa/117650-Mytilus-edulis>

Intertidal animals such as the blue mussel, *Mytilus edulis*, rely on seawater to get dissolved oxygen for aerobic respiration. At low tide the mussels are exposed to the air and tightly close their shells to prevent desiccation (drying out). During low tide they rely on anaerobic respiration to maintain essential life processes.

Compare and contrast anaerobic and aerobic respiration in intertidal blue mussels.

In your answer include:

- an explanation of anaerobic respiration that includes where it takes place in the cell, and the products formed
- an explanation of aerobic respiration that includes where it takes place in the cell, and the products formed
- a discussion of one advantage and one disadvantage for BOTH anaerobic AND aerobic respiration in blue mussels.

Aerobic respiration occurs in the mitochondria in various places. Aerobic respiration produces ATP which can allow cells to function. There are 3 steps in Aerobic respiration: Glycolysis, Krebs cycle and Electron transport chain. In Glycolysis (which occurs in the cytoplasm) glucose is used to create pyruvic acid and a little bit of ATP. The pyruvic acid from glycolysis is then used in the Krebs cycle (matrix of the mitochondria) to convert ~~and O₂~~ CO₂ and H⁺ atoms which are then taken by the NADP carrier to the electron transport chain (in the cristae of the mitochondria) where it is used.

by enzymes to make ATP for our cells. After the Krebs cycle and electron transport chain can only happen if there is oxygen otherwise anaerobic respiration takes place. Anaerobic takes place in the cytoplasm of the mitochondria like glycolysis but produces a small amount of ATP and lactic acid from glucose and nothing else. For blue mussels an advantage of being able to use aerobic respiration is that it produces a lot of ATP for their cells to use in many functions. However one disadvantage of this is that they are vulnerable to predators as they are in the water opening their shells which makes them less protected from predators. An advantage of anaerobic respiration is that the mussels are able to withstand long periods of no sea water at high levels and survive as it maintains essential life processes. A disadvantage is that anaerobic respiration is temporary and cannot last forever so mussels still have the danger of running out of air to carry on.

→ Because they are not opening their shells as well they are better protected against predators unlike aerobic respiration.

* Another disadvantage is that they have to rely on sea levels being a lot of the time as anaerobic respiration is temporary not permanent solution.

QUESTION THREE: MITOSIS

The table below shows how mitosis occurs at different rates in different types of human cells.

Cell Type	Mitosis Rate (How often cells are replaced)
Skin cell	2 weeks
Liver cell	300 – 500 days
Intestinal – internal lining	4 – 5 days
Intestinal – muscle and other tissues	16 years

Discuss why the rate of mitosis varies in different human cells, using examples from the table above.

In your answer:

- explain the purpose of mitosis AND how it occurs
- provide reasons why the rate of mitosis varies in different types of human cells
- compare and contrast ALL the different types of cells in the table AND justify the mitosis rate in terms of cell function.

You may use diagrams in your answer.

Mitosis is the process when a somatic cell in the human body replicates and divides into two daughter cells so it can lead apart of the body. Mitosis rates vary across different human cells with liver cells and skin cells having to be replaced more frequently than skin cells or muscle cells, as liver cells are more frequently damaged through food we eat and so will have to go through mitosis more frequently so its cells replicate to stop it being repeatedly damaged by what we eat. Internal lining cells are also replaced more frequently than skin cells or muscle cells. Your internal lining can be damaged easily (every 4 to 5 days) so mitosis is needed to replace the damaged cells, but it is not as frequently needed as our liver cells. Skin cells are replaced every 2 weeks as we can damage our skin easily by cutting or scraping it, so skin cells need to go through mitosis in order to lead properly. Muscle cells don't need to go through mitosis very often.

as it is harder to damage your muscle cells due to them being protected by your skin, which is why skin cells are replaced more often than muscle cells. Muscle cells only need to be replaced every 16 years, ^{when} as we grow older our muscles start to change and become damaged easier resulting in meiosis. Mitosis varies because some cells can be more easily damaged than others and therefore require more mitosis/~~cell replication~~ in that area. Stomach cells need to be replaced more often than brain cells as they are damaged easier by stomach acid and food.

* Which is why we need it ~~every~~ 300-500 ~~times~~ days

A3

Subject:	Biology	Standard:	91156	Total score:	12
Q	Grade score	Annotation			
1	A4	This student does not offer any explanations at a Merit level on photosynthesis and the factors affecting it. They do however describe some content correctly such as the need parts of a chloroplast and the general description of photosynthesis. Osmosis is not clear enough at this level of biology.			
2	M5	This is a low M5. Respiration, both anaerobic and aerobic appear to be clearly understood however the term glucose has not been used. The student does explain the benefit of being able to use anaerobic respiration when there is low tide and the advantage of aerobic when the tide is high.			
3	A3	A low Achieved this student has described the requirement to have DNA replication prior to mitosis but has not clearly described mitosis. They know that cells may be damaged and therefore need replacing but have not explained the link between damage and the replacement of daughter cells with the same genetic complement.			