Assessment Schedule – 2020

Biology: Demonstrate understanding of life processes at the cellular level (91156)

Achievement Criteria

Evidence

Q	Expected Coverage	Achievement	Merit	Excellence
ONE (a)	oxygen + glucose → carbon dioxide + water + **ATP (energy)**	• Respiration word or non-balanced chemical equation **includes ATP / energy.**		
(b)	Enzymes are made of protein and have an active site where the substrate binds. Their function is to speed up life reactions / biological catalyst. An enzyme works by lowering the energy needed for a reaction to occur. Its active site is specific to its substrate. Once the enzyme-substrate complex has formed, the active site changes shape to either break apart, or form chemical bonds needed for the reaction. An inhibitor would stop the enzyme from binding with its substrate by changing the shape of / binding to its active site. This would therefore slow or stop biological reactions. Since the majority of ATP is produced by aerobic respiration, cyanide would prevent large amounts of ATP from being produced. Only a small amount of ATP could be produced in anaerobic respiration, since cyanide does not affect this process.	• Describes function of enzymes as speeding up reactions / biological catalysts • Enzyme structure described as having an active site AND made of protein. • Names induced fit / lock and key enzyme function. • Describes anaerobic respiration as **not** needing oxygen. • Inhibitors / cyanide stop / slow enzyme function / reactions.	• The enzyme's active site allows it to bind with its substrate. Once the substrate-enzyme complex has formed, the active site changes shape. • An enzyme lowers the energy needed for a reaction to occur. • Inhibitors affect the active site of enzymes / prevent substrate from binding and slow / stop reactions. • Cyanide stops / slows aerobic respiration AND has no effect on **anaerobic** respiration. • Cyanide / inhibitors would result in less ATP being made.	• Discusses inhibitors effect on enzyme function: An inhibitor would stop the enzyme from **binding with its substrate** by changing the shape of / binding to its **active site**. This would therefore, slow or stop **aerobic respiration** (change active site AND prevent substrate binding). • *Discusses inhibitors effect on biological reactions:* Since the majority of **ATP** is produced by **aerobic respiration**, cyanide would prevent large amounts of ATP from being produced. Only a small amount of ATP could be produced in **anaerobic respiration**, since cyanide does not affect this process.

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	Describes any ONE statement from Achievement.	Describes any TWO statements from Achievement.	Describes any THREE statements from Achievement.	Describes any FOUR statements from Achievement.	Explains any TWO statements from Merit.	Explains any THREE statements from Merit.	Discusses ONE Excellence point.	Discusses TWO Excellence points.

Q	Expected Coverage	Achievement	Merit	Excellence
TWO (a)	Water enters the cell by osmosis, which is the movement of water from an area of high water concentration / water potential to an area of low concentration / water potential through a cell / semi-permeable membrane. This is a passive process because no ATP / energy is needed and the water moves along a concentration gradient / from high to low.	• Describes osmosis with the mention of a cell membrane. • Describes osmosis as passive / requires no energy.	• Describes osmosis AND explains that osmosis is **passive** because no energy / ATP is needed AND no energy / ATP is needed because the water moves **down a concentration gradient**.	• Identifies the cell wall of plant cells as preventing bursting / lack of cell wall in animal cells leads to bursting.
(b)	Plant cells have a cell wall, which provides a pressure, which prevents the cell from bursting due to osmosis. Animal cells don't have a cell wall therefore can burst during osmosis. Since osmosis is a passive process, it will continue as long as the water concentration outside the cell is greater than the water concentration inside the cell, thus bursting animal cells.	• Identifies the cell wall of plant cells as preventing bursting / lack of cell wall in animal cells.	• Explains that a cell wall provides strength / stability / support to maintain turgor pressure and prevent excess water absorption. • Explains that since osmosis is passive, it will continue as long as water content outside the cell is higher than inside, thus bursting the animal cell.	- Light reaction happens in grana / thylakoids / grana capture light energy.

(c)	In the presence of light: water + carbon dioxide → glucose + oxygen The central vacuole ensures the chloroplasts are near the outer edge of the cell. Being near the outer edges of the cell allows the chloroplasts to absorb more light AND creates a shorter distance for water and CO_2 to travel from outside the cell to the chloroplasts, therefore allowing P / S to occur at a faster rate. The faster the CO_2 and water that can be absorbed by diffusion and osmosis, the faster the P / S rate / more photosynthesis can take place. If the chloroplasts can move in relation to light, this will allow the chloroplasts to remain in the light / have all sides exposed to the light / prevent shading, as light changes throughout the day, increasing the rate / number of light reactions possible, which will allow the chloroplasts to carry out more photosynthesis / P / S at a faster rate (can mention cytoplasmic streaming). The outer membrane of the chloroplast is clear, allowing light to pass through it to the thylakoid membranes / grana stacks where the light dependent phase takes place. These membranes are filled with chlorophyll which is needed to drive the light phase break down of water into H^+ and oxygen. The large surface area of the grana increases the amount of light reactions that can happen, producing more H^+ / NADPH and allowing the next phase to occur. The light phase provides the energy / ATP and H^+ / NADPH to drive the next phase of the reaction, so without the light phase, no photosynthesis can occur. The stroma is where the CO_2 is captured in the light-independent phase, and this carbon dioxide will eventually be used to synthesise glucose.	• Word equation or unbalanced chemical equation. **Light** must be included. • Describes chloroplast's **location** near the outer edge / surface / at the top of cell are exposed to more light / faster diffusion of CO_2 / water. • Describes **movement** as needed to expose chloroplasts to more light / CO_2 / water. • Describes functions of TWO named chloroplast structures, e.g. - Membrane controls in / out of materials / lets light into chloroplast. - Light reaction happens in grana / thylakoids / grana capture light energy. - Dark reaction happens in stroma / stroma fixes CO_2. - Grana contains chlorophyll which is needed to capture light.	• Explains chloroplast **location** terms of decreased diffusion distance for CO_2 / water **and** increased light absorption (2 points). • Explains the structure of the chloroplasts by linking products of light / dark / stages OR connection between parts of the chloroplast e.g: - Clear membrane allows light to pass through to the grana to drive light reaction. - Membrane allows CO_2 to pass into the stroma for carbon fixation of dark rxn. - The light reaction produces the H^+ / ATP needed for the dark rxn to occur. - More light reactions occur on thylakoids which provide a large surface area for photosynthesis - The carbon is fixed in the stroma during the dark rxn, and will join with the H^+ to produce glucose. *Each bullet point above can receive an M point to a maximum of 2M points.* • Explains one cell part in relation to photosynthesis. E.g. cell membrane lets CO_2 / water in for photosynthesis (not linked to chloroplast).	• A full discussion of chloroplast structure, which **links** products of light reaction as needed for dark rxn, and the production of more glucose / faster photosynthesis / more photosynthesis. • Discusses **three** or more parts of the chloroplast **<u>linked</u>** to increasing the rate of photosynthesis. • A full discussion that links TWO **cell parts** to photosynthesis. E.g.: - **Central vacuole** works to keep **chloroplast** in outer location for light absorption and decreased diffusion distance and an increase photosynthesis rate. - **Cytoplasm** can move **chloroplasts** to location in cell where more light is available, thus increasing rate of photosynthesis. - **Cell membrane** allows entry of CO_2 / water into cell then to **chloroplasts** to be used in the dark rxn / photosynthesis.

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Q	Expected Coverage	Achievement	Merit	Excellence
THREE	The purpose of DNA replication is to produce two identical copies of the cell's DNA. The purpose of mitosis is to produce two identical cells for growth of the organisms AND the repair of tissues / replacement of cells. DNA must be replicated before mitosis, so that the new cell has the correct **amount** of DNA, and has ALL of the genetic information needed to **carry out its function** / life activities. For example, a new intestinal cell must have the DNA information needed to produce the digestive enzymes needed to do its job. Without the DNA information required to carry out their function, these cells will die and the organism can't grow. The cell cycle involves both the production of new cells and the growth of these cells. Therefore, the organism grows as more new cells are produced through mitosis. When these new cells get larger, this also causes growth. For example, at the root tip, mitosis produces new cells and the enlargement of these cells causes the root to grow. The new cell, however, can only grow to a certain size before the SA:V ratio becomes **too small** to support rapid transport of materials throughout the cell. Therefore, after the cell reaches a certain size, it must carry out mitosis to produce two new smaller cells that have a larger SA:V ratio and can transport materials at a fast-enough rate to support cellular function. For example, oxygen must be able to diffuse into the cell fast enough to support respiration. Therefore, by keeping cells small enough to have the correct SA:V ratio for transport of materials, mitosis helps each new cell to function better.	• Describes purpose of DNA replication to create **identical copies of the cell's DNA**. • Describes purpose of mitosis **as creating identical cells** . • Describes mitosis as the mechanism for **growth / repair**. • Describes DNA replication is needed so new cells have correct information / correct amount of DNA in each cell. • Describes SA or Vol effect on the cells • Describes that growth as new cells / cells getting bigger. • Gives an example of where cell growth occurs (e.g. root or shoot tip in plants).	• Explains purpose of mitosis as both producing **two identical cells** for **growth AND repair** / replacement or tissues. • Explains purpose of DNA replication is to be sure new cells made by mitosis have the information to **carry out their function** without example. • Links mitosis to SA:V ratios without examples. • Links cell cycle to growth due to new cells **and** cells getting larger without examples.	• **Discusses cell cycle and growth with example:** E.g. The cell cycle involves both the production of new cells and the growth of these cells. Therefore, the organism grows (e.g. during childhood) as more new cells are produced through mitosis. When these new cells get larger, this also causes growth. • **Links mitosis to proper functioning of cell due to increased SA:V ratios** for transport of materials with example. • **Links DNA replication to growth**, since new cells will die without correct instructions, therefore no growth can occur with example. • **Links DNA replication to proper functioning of cells** with example.

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Cut Scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0 – 6	7 – 13	14 – 18	19 – 24