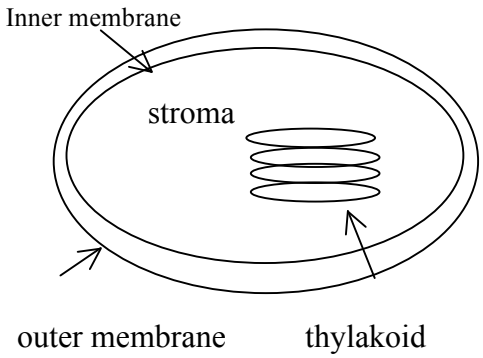
Assessment Schedule – 2017

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

Assessment Criteria

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding involves defining, using annotated diagrams or models to describe, and describing characteristics of, or providing an account of, life processes at the cellular level.	*Demonstrate in-depth understanding* involves using biological ideas to give reasons how or why life processes occur at the cellular level.	*Demonstrate comprehensive understanding* involves linking biological ideas about life processes at the cellular level. The discussion of ideas may involve justifying, relating, evaluating, comparing and contrasting, and analysing.

Evidence

Q	Expected Coverage	Achievement	Merit	Excellence
ONE (a)	**Osmosis** is the diffusion of water across a semi-permeable membrane from an area of higher water concentration to an area of lower water concentration. Osmosis requires no energy. Water in the soil is drawn in (capillary action) through tiny root hairs. The soil must have a high concentration of water to move into the root cell semi-permeable membrane and into the root cell which would have a low water concentration.	• Describes / defines osmosis. • Word or unbalanced symbol equation for photosynthesis. • Labelled diagram of a chloroplast showing outer membrane, inner membrane, thylakoid, stroma. • Describes the purpose of photosynthesis as a process to make organic molecules / food / sugar / glucose / starch. • Describes where light independent takes place. • Decribes where dependent phase takes place. • Describes light dependent. Light energy splits the water molecule into oxygen and hydrogen. • Describes it is light independent. • Graph of substrate and rate / or description of substrate. • Water is needed as it has the H needed for glucose. • Description of one	• Explains how osmosis occurs in root cells / correct definition and mentions where high and low concentration / solute. • Explains light dependent reaction and where it occurs. Light energy absorbed by chlorophyll and splits water molecule into oxygen and hydrogen. Occurs in grana / thylakoid membrane. • Explains light independent reaction and where it occurs. • Light independent reaction takes place in the stroma of the chloroplast. The hydrogen is combined with carbon dioxide through a series of reactions to form a glucose molecule. • Explains how water affects rate	• Discussion of photosynthesis includes an explanation of the light independent and light dependent reactions and how water (including transport) and one other factor affects the rate of photosynthesis. • Discusses how the rate of photosynthesis will always correspond to the factor that is in least supply / good **linkage** to light dependent and independent / where each of the C O H to make $C_6H_{12}O_6$ comes from.
(b)	light carbon dioxide + water → glucose + oxygen (Accept non-balanced symbol equation / mixture of symbol and word equation.)			
				
(c)	Photosynthesis is the process in which plants use sunlight to produce glucose. Light dependent reaction takes place in the thylakoid membrane within the chloroplast. Light energy is absorbed by the pigment chlorophyll. This light energy splits the water molecule into oxygen and hydrogen. Hydrogen 'goes to the' light independent process while oxygen is excreted as a waste product (via stomata on leaves). Light independent reaction takes place in the			

	stroma of the chloroplast. The hydrogen is combined with carbon dioxide through a series of reactions to form a glucose molecule. The amount of water available to the plant will affect the rate of photosynthesis, because if there is not enough water, the plant will be deprived of H so will be unable to construct a glucose molecule, and thus lower the photosynthesis rate. Increased amount of water will increase the rate of photosynthesis to a certain limit, after which a further increase in its amount will no longer increase the rate any further. This is when the other factors necessary for photosynthesis, such as light, become "limiting factors"; that is, those other factors also need to increase to bring about a further increase in the rate. The rate of photosynthesis will always correspond to the factor which is in least supply. Other factors that affect the rate are light intensity / availability / quality, wave length of light, amount of chlorophyll / chloroplast number, temperature, enzyme concentration, nutrients / CO_2 concentration. Examples, but could discuss other factors: • Generally warmer temperatures are better than cooler temperatures for photosynthesis. This means enzymes can collide more with substrates and more chemical reactions can occur. However, if the temperature increases too much, the enzyme may denature, resulting in the active site changing shape (no longer fitting the substrate), in which case the chemical reactions would stop, and photosynthesis rate decrease / stop. • Different intensities of light provide different amounts of energy / photons. • Different wavelengths / colours of light provide different amounts of energy / photons. Least energy from green light as it is reflected. • Plant nutrient exposure will affect the production of enzymes. As amino acids are required for enzyme construction / protein synthesis, if essential amino acids are not taken up by the plant, the plant may not be able to construct the enzymes necessary for photosynthesis to occur (thus decreasing the plant's rate of photosynthesis). As well as this, the amount of nutrients, such as potassium and nitrates, also affects the rate of photosynthesis. These nutrients could be used by enzymes as co-factors. If the co-factors / nutrients are limited, this would limit chemical reactions and the rate of photosynthesis.	of temp / light intensity / number of chloroplasts / CO_2. • Description of another of temp / light intensity / number of chloroplasts / CO_2.	of pht explains increase then stabilisation of rate. • Explains how one other factor affects rate of photosynthesis / linked to active site etc	

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

Q	Expected Coverage	Achievement	Merit	Excellence
TWO	**Anaerobic respiration** takes place in the cytoplasm of an animal cell. Glucose is broken down into lactic acid and ATP (energy); no oxygen is present therefore less energy (2 ATP) is produced compared to aerobic. glucose → lactic acid + (2) ATP Anaerobic is less efficient and lactic acid build-up causes cramps and stops muscles from working. If not removed from cell, it becomes toxic. However, it produces ATP very quickly because does not require O_2. If O_2 is temporarily low, cells still get the energy they need to continue functioning so the body does not shut down. (Accept anaerobic in plants for Achievement only glucose → ethanol + carbon dioxide + ATP.) **Aerobic respiration** takes place in the mitochondria. Glucose is broken down in the presence of oxygen to form carbon dioxide, water and ATP. glucose + oxygen → carbon dioxide + Water + (36) ATP Oxygen is present so more energy (36 ATP) is produced compared to anaerobic. Therefore, aerobic is more efficient. Lactic acid / ethanol (which can be toxic) is not produced. However, aerobic requires oxygen so ATP is produced more slowly. E.g. at low tide it would be advantageous for blue mussels to anaerobically respire because (dissolved) oxygen concentration would become low (because sea water is not mixing / mussel not covered by sea water). These mussels could temporarily produce ATP very quickly via anaerobic respiration so cells would not shut down. However, the amount of ATP is low so would only be temporary because there would be a build-up of lactic acid, which can be toxic. Eventually the mussels would have to respire aerobically to eliminate the build-up of lactic acid – this would occur on the incoming tide / high tide / when (dissolved) oxygen concentration increases. On the incoming tide the mussels' oxygen concentration would increase and mussels would be able to respire aerobically, which means they could produce more ATP / energy efficiently and eliminate the build-up of toxic lactic acid / not produce toxic lactic acid. However, this process occurs more slowly.	• Describes respiration general description. • Describes anaerobic / word equation. • Describes aerobic / word equation. • Describes where anaerobic (cytoplasm) AND aerobic respiration take place (mito). • Describes one advantage / disadvantage of anaerobic respiration. • Describes one advantage / disadvantage of aerobic respiration. • Described plant anerobic.	• Explains anaerobic and products produced. (in cytoplasm, no O, lactic acid and less ATP). • Explains aerobic and products produced.(mito, has O and lots of ATP). • Explains one advantage of anaerobic. Eg quick or all day linked to continual cell function. • Explains one disadvantage of anaerobic. Less ATP so less E for reproduction or toxic link to efficiency. • Explains one advantage of aerobic. Lot of ATP, harmless byproducts linked to energy use and continued efficiency. • Explains one disadvantage of aerobic. Needs O2 and slow linked to tides / linked to enzyme requirement.	• Discussion that includes an explanation of anaerobic and aerobic respiration AND one advantage and disadvantage for aerobic AND anaerobic respiration, using the context of blue mussels. • Discussion that includes link to needing diffusion of O2 through water, so shut shell when tide out through part of day.

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	Expected Coverage	Achievement	Merit	Excellence
THREE (a)	Mitosis is to replicate genetically identical cells for growth / repair / asexual reproduction / same function as parent cell in body (somatic) cells. Describes process – replicated chromosomes separate, 2 new nuclei form, cell splits in two. Explains process – DNA replicates / chromosomes replicate, replicated chromosomes condense and move to equator of cell while spindle fibres attach to centromere, spindle fibres pull replicated chromosomes to poles of cells and cell membrane forms around chromosomes. Mitosis occurs during periods of growth and repair following damage to the organism when repair of tissue is necessary e.g. intestinal lining is repaired quickly because the process of digestion is abrasive and cells are 'rubbed' away when food is moved through the intestine. In the same way, skin cells are exposed to the elements and wear and tear of outside environment so will also need replacing at a fairly high rate. Liver cells are not exposed to wearing, but are exposed to a wide range of chemicals that could damage them, but at a slow rate. Therefore, they need replacing only every 300–500 days. During periods with limited growth or replacement of cells, the rate of mitosis is not likely to be so high e.g. intestinal muscle is not replaced at a high rate because it is not exposed to the wear that the intestinal lining or skin cells are exposed to.	• Describes purpose of mitosis (for growth / repair). • Describes process of mitosis. May be a weak drawing showing double chromosomes splitting into two cells. • Describes a reason for mitosis differences.eg low turnover has lower rate. • Rate is quicker in young as need more cells / vice versa. • Slower rate if longer cell cycle. • If cells are damaged we need new cells.	• Explains purpose of mitosis being identical cells for growth / repair • Explains how mitosis occurs, double (key idea) chromsomes, equator, split, two cells. • Explains link to position in cell cycle (before and after). • Provides one reason why the rate of mitosis varies in different cells. E.g. growth / damage / Sa:V. • Provides another reason why. Growth / damage to any one cell type.	• Discussion of Rate of mitosis due to growth and repair due to damage. Includes purpose and process with why we see differences from table due to need for replacement / function. • Link to cell cycle phases / growth of organs or people / mention all types.

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Cut Scores

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