

Assessment Schedule – 2013

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

Assessment Criteria

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

Evidence Statement

	Expected Coverage <i>The following are examples only and not exhaustive coverage.</i>	Achievement	Merit	Excellence
ONE	<p>The purpose of aerobic respiration is to release energy from food. It is needed for metabolism, growth, movement and other cellular processes. Definition may be given as:</p> <p><i>‘To convert biochemical energy from nutrients into useable energy (ATP) and then release waste products.’</i></p> <p>$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + \text{Energy (ATP)}$. Can also state the reactants and products in words.</p> <p>(May mention that fats and proteins can also be consumed as reactants.)</p> <p>Aerobic respiration takes place in mitochondria. Mitochondria have an outer membrane, which regulates the passage of materials in and out of the organelle.</p> <p>The inner mitochondrial membrane is compartmentalised into numerous cristae, which expands its surface area, thereby enhancing its ability to produce ATP. Mitochondria from cells that have a greater demand for ATP, such as muscle cells, contain even more cristae.</p> <p>The matrix is the fluid-filled space enclosed by the inner membrane, containing many enzymes, which can function on the large surface area created by the cristae.</p> <p>The number of mitochondria in a cell varies widely by organism and tissue type. There are more in animal cells than plant cells. Many cells have only a single mitochondrion, whereas others can contain many more (muscles, glands, etc), even up to several thousand mitochondria (eg, liver cells). Variation in number is related to the energy requirements of the particular cells. The higher the energy demand, the greater the number of mitochondria.</p> <p>Etc.</p>	<ul style="list-style-type: none"> • Gives an account of the purpose of respiration. • Gives an account of the reactants and products of respiration. <p>OR</p> <ul style="list-style-type: none"> • Provides a word or symbol equation for respiration. • Describes the process of respiration (could include biochemical details). • Describes the characteristics of the structure of mitochondria. • Describes a location where mitochondrial numbers vary. • Describes another location. • Names the mitochondria as the organelle where R occurs. 	<ul style="list-style-type: none"> • Gives a reason relating the structure of mitochondria to its function. Eg, the inner membrane lining of the mitochondria has many in-foldings, which greatly increase the surface area. This provides increased space for more reactions to take place. • Gives another reason. • Uses an example to explain the reasons why mitochondria are more numerous in some cells than other cells, for example: <ul style="list-style-type: none"> (i) cells involved with active transport – cells lining the small intestine (ii) muscle cells to give more energy for movement / contraction / exercise (iii) cells involved with metabolic processes such as liver cells (iv) Cells that require fewer mitochondria eg bone cells. • Uses another example. 	<ul style="list-style-type: none"> • Compares AND contrasts the differences between cells (ie must include explanations of at least one cell type that has many mitochondria AND one cell type that has fewer mitochondria) to justify the fact that the cells are variable in terms of their ability to produce ATP. • Through discussion, links the type of cell and the number of mitochondria present to the functioning of the cells in terms of aerobic respiration. • Through discussion links structure and function of mitochondria to the functioning of cells in terms of aerobic respiration.

Not Achieved	N0	No response; no relevant evidence or partial evidence
	N1	Provides any ONE statement from Achievement.
	N2	Provides any TWO statement from Achievement.
Achievement	A3	Provides any THREE statements from Achievement.
	A4	Provides any FOUR statements from Achievement.
Merit	M5	Provides any TWO statements from Merit.
	M6	Provides any THREE statements from Merit.
Excellence	E7	Provides ONE criterion for Excellence.
	E8	Provides TWO criteria for Excellence.

	<p style="text-align: center;">Expected Coverage</p> <p><i>The following are examples only and not exhaustive coverage</i></p>	Achievement	Merit	Excellence
TWO (a)	<p>Enzymes are biological catalysts that speed up the rate of reactions or allow reactions to take place in conditions where it would not otherwise be possible.</p> <p>Enzymes function in specific conditions. Outside of these conditions, the enzymes will not function as well. (May refer to tropical vs temperate plants.)</p> <p>A temperature that is too low means that substrate/ enzyme collisions and interaction will be lower and therefore so will the rate of photosynthesis. As heat increases, there will be an optimum temperature for the functioning of the enzymes associated with photosynthesis in that particular plant. This will be the temperature at which the peak rate of photosynthesis occurs. Beyond (above) this temperature, the enzymes may become denatured, which makes them inactive. This latter reaction is irreversible.</p> <p>They are denatured because of a change in the shape/structure of the active site, which can no longer fit the substrate(s) involved in the process.</p> <p>Once the active site begins to distort, the rate of photosynthesis will decrease, as not as many interactions will be able to take place. If the enzymes become denatured, the rate of photosynthesis would decrease rapidly, and may stop altogether.</p> <p>etc</p>	<ul style="list-style-type: none"> • In (a) gives an account of the structure OR function of enzymes. • Describes the role of enzymes in photosynthesis. • In (a) gives an account of a model for enzyme action eg induced fit / lock and key. • In (a) gives an account of the fact that enzymes do not function as well outside of preferred tolerance range of temperature. • In (a) describes the affect of temperature on enzyme activity. • In (b) gives an account of the structure or location of ONE type of cell. • In (b) gives an account of structure or location of another type of cell. • In (b) describes and structure and function of the chloroplast (can be annotated / labelled diagram). • In (b) describes the biochem of photosynthesis. • In (b) describes the distribution / location of the chloroplasts inside the cells. 	<ul style="list-style-type: none"> • In (a) gives a reason how or why the structure of the enzymes enables them to work. • In (a) explains how the structure of an enzyme is affected by high temperatures. • In (a) gives a reason how OR why temperature affects the rate of photosynthesis. • In (b) gives a reason for the structure of at least ONE type of cell in relation to increased photosynthesis. • In (b) gives a reason for the location of at least ONE type of cell in relation to increased photosynthesis. • In (b) explains the relationship between the structure and the function of the chloroplast. • In (b) explains how the structure of the chloroplast helps to maximise the rate of photosynthesis. • In (b) gives reasons for the distribution of the chloroplasts in the cells in the leaf in relation to maximising the rate of photosynthesis. 	<ul style="list-style-type: none"> • Discusses how or why the structure of the enzymes enables them to work and how / why temperature affects the rate of activity of enzymes, and therefore the rate of photosynthesis. • Links ideas about the structure AND location of at least ONE type of cell AND the chloroplast, justifying both and relating these to how the plant leaf maximises the rate of photosynthesis.
(b)	<p>The epidermis is usually transparent (epidermal cells lack chloroplasts) and coated on the outer side with a waxy cuticle that prevents water loss which would decrease the rate of photosynthesis.</p> <p>The location of cells containing most chloroplasts are found near the top of the leaf in (palisade) long cylindrical cells, with the chloroplasts close to the walls of the cell. These factors combine and lead to more light being received where it can be used to maximize the rate of photosynthesis.</p> <p>The slight separation of the cells provides maximum absorption of carbon dioxide.</p> <p>Beneath the palisade layer is the spongy mesophyll. The cells of the spongy layer are more rounded and not so tightly packed. There are large intercellular air spaces. This maximizes the rate of diffusion of the gases during photosynthesis. (CO₂ entering the leaf and O₂ leaving it.)</p> <p>Specialised guard cells, mainly on the lower leaf epidermis, function to control the movement of gases and water loss.</p> <p>Chloroplast, as the organelle associated with photosynthesis and their structure also maximises the rate at which it can occur: flat stacks of thylakoids have an increased surface area for the absorption of light.</p>	<ul style="list-style-type: none"> • In (b) gives an account of the structure or location of ONE type of cell. • In (b) gives an account of structure or location of another type of cell. • In (b) describes and structure and function of the chloroplast (can be annotated / labelled diagram). • In (b) describes the biochem of photosynthesis. • In (b) describes the distribution / location of the chloroplasts inside the cells. 	<ul style="list-style-type: none"> • In (b) explains the relationship between the structure and the function of the chloroplast. • In (b) explains how the structure of the chloroplast helps to maximise the rate of photosynthesis. • In (b) gives reasons for the distribution of the chloroplasts in the cells in the leaf in relation to maximising the rate of photosynthesis. 	

	<p>Stroma is a clear fluid, which doesn't block the light.</p> <p>Chloroplasts have thin membranes/large surface area for absorption of light.</p> <p>The combination of the cell and organelle structure and location collectively helps to keep photosynthesis at its maximum potential rate.</p> <p>(Refer to candidate's diagram.)</p> <p>etc.</p>			
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Not Achieved	N0	No response; no relevant evidence.
	N1	Provides partial evidence towards one of the statements but does not fulfil any of the Achievement criteria completely.
	N2	Provides any ONE statement from Achievement.
Achievement	A3	Provides any TWO statements from Achievement.
	A4	Provides any THREE statements from Achievement.
Merit	M5	Provides any TWO statements from Merit.
	M6	Provides THREE statements from Merit.
Excellence	E7	Provides ONE criteria for Excellence
	E8	Provides TWO criteria for Excellence

	<p style="text-align: center;">Expected Coverage</p> <p style="text-align: center;"><i>The following are examples only and not exhaustive coverage</i></p>	Achievement	Merit	Excellence
THREE (a)	<p>Mitosis is the process where a single cell divides, resulting in generally two identical cells, each containing the same number of chromosomes and genetic content as that of the original cell.</p>	<ul style="list-style-type: none"> • In (a) gives an appropriate description of mitosis. • In (b) describes semi- 	<ul style="list-style-type: none"> • In (b) gives a reason why the process is called semi-conservative replication. 	<ul style="list-style-type: none"> • In (c), through discussion, links explanations of the factors that affect mitosis to show how / when / where / why the rate of mitosis changes in an organism.
(b)	<p>Semi-conservative replication is so named because each molecule of DNA that is created contains one new strand and one old strand.</p> <p>Process of replication <i>(Names of enzymes are not necessary but may aid judgement of candidate's understanding.)</i></p> <p>The two strands separate, exposing the bases (unwound by the enzyme helicase), which will act as the template.</p> <p>Two new polynucleotide chains are formed using the bases of the existing strands as a complementary template. (Carried out by DNA polymerase).</p> <p>Nucleotides join up following the base-pairing rule A-T and C-G.</p> <p>etc</p>	<ul style="list-style-type: none"> • In (b) describes semi-conservative replication as one old and one new strand of DNA being present in each new DNA molecule. • In (b) describes the structure of DNA (diagram and or description) • In (b) describes the process of DNA replication (diagram and or description) 	<ul style="list-style-type: none"> • In (b) explains how the stages of semi-conservative replication occur. • In (c) gives reasons for the factors affecting the rate of mitosis. • In (c) gives reasons for how OR why some stages of life of an organism have a higher rate of mitosis. 	<ul style="list-style-type: none"> • Makes links between 4 statements from Merit
(c)	<p>Identifies and describes factors affecting the rate of mitosis.</p> <p>Eg, temperature, pH, presence of mutagens such as alcohol or radiation, availability of raw materials in the cell, hormones, enzyme activity</p> <p>Mitosis is usually higher during periods of growth and repair during infancy/childhood/early development in animals following the breaking of dormancy, and during seasonal growth in plants following damage to the organism when repair of tissue is necessary.</p> <p>Mitosis occurs at a higher rate in areas where most growth or replacement of cells is occurring, such as:</p> <ul style="list-style-type: none"> • root/shoot tips • hair follicles • bone marrow • skin cells • mucous membranes etc. <p>Mitosis rates increase in areas of cellular repair, the site of damage. Mitosis rates increase in cancer cells. etc</p>	<ul style="list-style-type: none"> • In (c) describes the effect of ONE factor on the rate of mitosis. • In (c) describes the effect of another factor on the rate of mitosis. • In (c) gives an account of the stages of life when mitosis is higher / lower • In (c) gives an account of a location in an organism where the rate of mitosis is higher / lower • In (c) gives an account of another location where the rate of mitosis is higher / lower. 	<ul style="list-style-type: none"> • In (c) gives ONE reason how or why some cell types or locations in an organism have a higher rate of mitosis. • In (c) gives another reason how or why some cell types or locations in an organism have a higher rate of mitosis. 	

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Achievement	A3	Provides any THREE statements from Achievement.
	A4	Provides any FOUR statements from Achievement.
Merit	M5	Provides any TWO statements from Merit.
	M6	Provides any THREE statements from Merit.
Excellence	E7	Provides links between any THREE statements from Merit
	E8	Provides any ONE statement from Excellence

Judgement Statement

	Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
Score range	0 – 7	8 – 13	14 – 18	19 – 24