Assessment Schedule – 2024

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; discussion of ideas may involve justifying, relating, evaluating, comparing and contrasting, analysing.

Cut Scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0 – 6	7 – 12	13 –18	19 – 24

Evidence

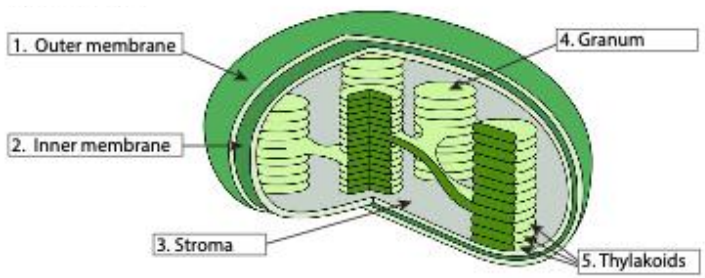
Question One

Expected Coverage	Achievement	Achievement with Merit	Achievement with Excellence
(a) $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$ + energy (adenosine triphosphate (ATP)). Glucose + oxygen → carbon dioxide + water + energy / ATP. (*Accept non-balanced symbol equation / mixture of symbol and word equation.*) **(b)** **Anaerobic respiration** takes place in the cytoplasm of the spider's cells. Glucose is broken down into lactic acid and ATP; there is no oxygen involved and less energy (2 ATP per glucose) is produced, compared to aerobic respiration. Anaerobic respiration is less efficient, and lactic acid can build up in the muscles of the spiders, preventing them from working efficiently, so it cannot be sustained. However, an advantage is that it produces ATP very quickly because does not require O_2. If O_2 is temporarily low, such as during the attacking or escaping (*may say fight or flight*), the cells still get the energy they need for a limited / short period of time. **Aerobic respiration** takes place in the mitochondria. An advantage of aerobic respiration is that oxygen is used and allows complete breakdown of glucose, so more energy (36 ATP) is produced compared to anaerobic. Aerobic is more efficient and can be sustained so long as there is sufficient glucose and oxygen available. There is no production of lactic acid. It is a slower process than anaerobic respiration, so a disadvantage is that ATP is not produced as quickly as anaerobic, which is almost instant. It is advantageous (necessary) for the spider to use both systems of respiration. They anaerobically respire because they need rapid, available energy for a short duration. Oxygen cannot be transported to all cells quickly enough. The spider's muscles temporarily produce ATP very quickly via anaerobic respiration so that cells can be highly active. This can't be sustained, because of the build-up of lactic acid, which can be toxic. After escaping or attacking, the spider would respire aerobically to eliminate the build-up of lactic acid. Between these types of high-speed events, the spider uses mostly aerobic respiration because enough oxygen can be transported to muscle cells to produce much more ATP, is energy efficient, and sustainable for slower-paced movements and metabolism.	Describes/defines: • aerobic respiration (text or word / non-balanced symbol equation) • anaerobic respiration (text or word / non-balanced symbol equation) • where anaerobic respiration (cytoplasm) AND aerobic respiration (mitochondria) take place • an advantage of anaerobic respiration • an advantage of aerobic respiration • both types of respiration are useful because they work with each other (no detail) • a disadvantage of anaerobic respiration • a disadvantage of aerobic respiration.	Explains: • anaerobic respiration, making links to the role of O_2 being absent and the location in the cells • an advantage of anaerobic respiration (e.g. get energy fast without need for oxygen; explosive energy for attacking or escaping at high speed / for short duration) AND a disadvantage (e.g. short-term, low ATP per glucose, creates toxin / lactic acid build up) • an advantage of aerobic respiration (e.g. more energy produced (ATP) and can sustain energy for a long period of time) AND a disadvantage (e.g. requires oxygen getting to all the cells, which takes time) • why there is a need for both systems / forms of respiration • aerobic respiration, making links to the role of O_2 being present and the location(s) in the cells.	Discusses: • where and when anaerobic and aerobic respiration occurs, making links to when the spider is moving quickly / attacking / escaping vs steady / resting / prolonged movement • the advantages and disadvantages of aerobic **and** anaerobic respiration to the spider.

Not Achieved		Achievement		Achievement with Merit		Achievement with Excellence	
N1	**N2**	**A3**	**A4**	**M5**	**M6**	**E7**	**E8**
Describes ONE evidence point at Achievement.	**Describes** TWO evidence points at Achievement.	**Describes** THREE evidence points at Achievement.	**Describes** FOUR evidence points at Achievement.	**Explains** TWO evidence points at Merit.	**Explains** THREE evidence points at Merit.	**Discusses** ONE evidence point at Excellence.	**Discusses** TWO evidence points at Excellence.

N0 = No response; no relevant evidence.

Question Two

Expected Coverage	Achievement	Achievement with Merit	Achievement with Excellence
(a)  **(b)** Photosynthesis is the process in which plants use sunlight, water, and carbon dioxide to produce glucose and oxygen. $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$ (*Accept unbalanced symbol equation / mixture of symbol and word equation.*) In the chloroplast's thylakoid membranes, light energy is absorbed by the pigment chlorophyll. This light energy causes the water molecule to be split into oxygen and hydrogen. Oxygen is given off as a waste product, and the hydrogen is used in the light-independent phase in the stroma, where it combines with the carbon dioxide to create the glucose molecule. Leaves exposed to direct sunlight adapt to process plentiful sunlight at high intensity. They require less chlorophyll and have smaller and fewer chloroplasts, because the intensity of light makes it easier to capture the energy required for photosynthesis. Leaves that are found in the shade (e.g. on the forest floor) receive far less sunlight than the leaves of plants, such as the canopy trees. With less available sunlight, there is less energy to absorb, so to maximise rates of photosynthesis, these plants have adapted to be as efficient as possible. The larger and greater number of chloroplasts have the combined effect of trapping as much light as possible. Leaves exposed to sunlight deal with more heat and drying wind in their locations, but rapid photosynthesis and small chloroplasts allow for a smaller leaf, and the smaller surface area protects against drying too. Shade plants have leaves generally larger in size	Describes: • three out of five labels correct. • the process of photosynthesis / provides the correct word equation / provides unbalanced symbol equation • part of the light-dependent reaction (e.g. the light-dependent reaction uses light energy absorbed by chlorophyll) • part of the light-independent reaction (e.g. the light-independent reaction uses carbon dioxide) • the light-dependent phase as occurring in the thylakoid / grana • the light-independent phase as occurring in the stroma • the difference in light intensity between shade leaves and sun leaves • that more (larger) / less (smaller) chloroplasts will mean more / less photosynthesis (no explanation given) • stomata function / location / density.	Explains: • the light-dependent phase and where it occurs, for example: – light energy is absorbed by chlorophyll and splits the water molecule into oxygen and hydrogen, and produces NADH and ATP and – occurs in grana / thylakoid membrane • the light-independent phase and where it occurs, for example: – the stored energy from the light-dependant phase is used to fix carbon from carbon dioxide, which combines with the H+ to produce glucose and – occurs in the stroma • why sun leaves will have fewer and smaller chloroplasts • why shade leaves will have more and larger chloroplasts • how / why water loss occurs in sun leaves / shade leaves.	Discusses: • the key phases of photosynthesis and why the availability of light is important • sun leaves vs the shade leaves with respect to their chloroplast number and size, linking to photosynthesis • the difference in water loss rates for sun leaves and shade leaves, making comparisons and contrasts.

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to collect as much light as possible. Their sheltered locations guard against water loss. Sun and shade leaves also differ in their stomata distribution, usually concentrated on the protected underside of the leaves. The stomata are smaller in sun leaves, but are compensated by being denser. Shade-leaf stomata are larger and fewer in number. If a shade leaf is exposed to the same temperature and humidity, they will lose more water because the cuticle is thinner, and the larger stomata provide a greater potential for water loss.			

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N0 = No response; no relevant evidence.

Question Three

Expected Coverage	Achievement	Achievement with Merit	Achievement with Excellence
Diffusion is the movement of molecules from a region of higher concentration to a region of lower concentration on the concentration gradient until they are equal. It is a passive process and requires no energy input from the organism. Diffusion can occur across partially (semi) permeable membranes, such as those surrounding cells. Therefore, diffusion is involved in the movement of important molecules in to and out of cells. It is important for the uptake of substances needed by cells, and the removal of waste products produced by the cells. The production of new cells and the growth of these cells occurs in all living things. As more cells are added and as those cells grow, an organism will grow. As a new cell grows the SA:V ratio changes, the ratio gets increasingly smaller as the volume increases. Eventually, this ratio becomes too small to support effective transport of materials in o or out of the cell. Sufficient diffusion can no longer occur to meet the needs of a larger cell. Smaller cells have a larger SA:V ratio and can transport materials at a fast enough rate to support their cellular function. After the cell reaches a certain size, it must undergo cell division to produce two new smaller cells that have a larger SA:V ratio and can carry out effective transport of materials. For example, carbon dioxide must be able to diffuse into the cells of plant leaves fast enough to support photosynthesis. With an appropriate SA:V ratio for transport of materials, cells and therefore organisms function well, which is why cells are as small as they are. Cell division rates are high when organisms are going through periods of growth or repair, for example: the developing foetus in the womb, adolescent growth spurts, leaves and flowers budding in spring, following an injury to an animal, damage to a plant.	Describes / defines: • the process of diffusion as the movement of particles from a region of higher concentration to a region of lower concentration / down the concentration gradient • diffusion as a passive process / requires no energy • that diffusion occurs across a (semi-permeable) membrane and is involved in the movement of important molecules into / out of cells • a way that SA:Vol ratio changes (cell growth / division) • that smaller cells / cells with higher SA:Vol ratio have more effective diffusion OR that larger cells / cells that have lower SA:Vol ratio have less effective diffusion • an example of high cell division rate in an animal / plant.	Explains: • the purpose of diffusion • changes to the SA:Vol ratio as a cell grows • why SA:Vol ratio affects the movement of materials into/out of a cell • why cells must divide once they reach a certain size • an example of cell type / system (e.g. tracheal system in insects), linked to cell division rates/diffusion.	Discusses: • the proper functioning of cells, showing linked ideas, for example: – increased SA:Vol ratios affect diffusion – effective transport of materials into / out of cells – smaller SA:Vol ratios are not effective at transporting key materials – carbon dioxide for photosynthesis / oxygen for respiration • appropriate examples of high cell division rates, including animal / plant examples to support their discussion.

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