Assessment Schedule – 2019

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

Achievement Criteria

Evidence

Q	Expected Coverage	Achievement	Merit	Excellence
ONE (a)	Glucose and oxygen.	• Identifies glucose and oxygen / O / O_2 are produced by photosynthesis		
(b)	Water enters through the root by the process of osmosis. Osmosis is the movement of water through a semi-permeable membrane from an area of high concentration to an area of low concentration. Therefore, no energy is required. 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. Carbon dioxide enters through the stomata via the process of diffusion. Carbon dioxide gas moves from an area of high concentration to an area of low concentration inside the leaf. Therefore, no energy is required.	• Identifies water enters the plant via osmosis / roots. • Describes osmosis. • Identifies carbon dioxide enters the plant via diffusion / through the leaf / stomata. • Describes diffusion.	• Explains water enters the plant via osmosis in the roots. • Explains carbon dioxide enters the plants via diffusion through the stomata.	

(c)	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. Factors that affect the light-dependent phase include light intensity / wave length / number of chloroplasts / water concentration / chlorophyll concentration. The amount of water available to the plant will affect the amount of H^+ produced, because if there is not enough water, the plant will be deprived of H, so will be unable to construct a glucose molecule in the light-independent phase. Increased amount of water will increase the H^+ production. The light intensity / specific wave length / chlorophyll concentration will also affect the amount of H^+ produced because light energy is required to split the water molecule to produce H^+ and oxygen. The amount of H^+ produced in the light-dependent phase directly affects the amount of glucose produced, because in the light-independent phase, it is combined with carbon dioxide to produce the glucose molecule. Therefore, the concentration of carbon dioxide also affects the light-independent phase. The production of the glucose from the light-independent phase will always correspond to the factor that 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.	• Describes light-dependent phase as occurring in the thylakoid / grana. • Describes the light-independent phase occurring in the stroma. • Describes one factor that affects the light-dependent phase. E.g. light intensity / wave length / number of chloroplasts / water concentration / chlorophyll concentration / temperature. • Describes one factor that affects the light-independent phase. E.g. carbon dioxide concentration / number of chloroplasts / temperature.	• Explains the light-dependent phase at thylakoid and splits H and O from water to get the H for stage 2 (O leaves as a waste) • Explains the light-independent phase H joins with C and O to produce glucose • Explains how / why a factor affects the light-dependent phase, i.e. light / water. • Explains how / why a factor affects the light-independent phase, i.e. CO_2.	• Discusses photosynthesis showing clear knowledge of it including transport, and how factors affect the light-dependent phase and the light-independent phase. Some consideration of: • Discusses each phase will always correspond to the factor that is in least supply / where each of the C, O, H, to make $C_6H_{12}O_6$ comes from. / The carbon fixation process knowledge of root hairs and stomata / specific of thylakoid membranes (as chlorophyll there).

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.	Provides the criteria for Excellence for any ONE bullet point.	Provides the criteria for Excellence for any TWO bullet points.

Q	Expected Coverage	Achievement	Merit	Excellence
TWO (a)	Anaerobic respiration takes place in the cytoplasm of an animal / plant cell. Aerobic respiration takes place in the mitochondria of an animal / plant cell.	• Gives respiration equation / description for aerobic • Gives respiration equation / description for anaerobic • Describes where anaerobic respiration occurs as cytoplasm of cell • Describes where aerobic respiration occurs at mitochondria		• Anaerobic respiration takes place in the cytoplasm of an animal / plant cell. • Aerobic respiration takes place in the mitochondria of an animal / plant cell.

(b)	Anaerobic – 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 Disadvantage of anaerobic – is less efficient and lactic acid build-up causes cramps and stops muscles from working. If not removed from cell, it becomes toxic. Advantage is it produces ATP very quickly because does not require O_2. If O_2 is temporarily low in cell such as during a sprinting race, cells still get the energy they need to continue functioning. Aerobic respiration is when 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. it would be advantageous for a sprinter to anaerobically respire because (dissolved) oxygen concentration would become low during the race. Oxygen cannot be transported to all cells quickly enough. These sprinters' muscles temporarily produce ATP very quickly via anaerobic respiration so cells would not shut down. However, the amount of ATP is larger than for a marathon runner because there would be a build-up of lactic acid, which can be toxic. After the race, the sprinter would have to respire aerobically to eliminate the build-up of lactic acid. However, the marathoner carries out aerobic respiration because enough oxygen concentration can be transported to muscle cells to produce more (36 / 38) ATP / energy efficiently and eliminate the build-up of toxic lactic acid / not produce toxic lactic acid. However, this process occurs more slowly.	• Describes an advantage of anaerobic respiration e.g. energy in times of less (or no) O_2 / fast energy. • Describes a disadvantage of anaerobic respiration as little E gained / build-up of waste product. • Describes an advantage of aerobic respiration as lots of energy gained / can maintain sport due to minimal waste product. • Describes a disadvantage of aerobic respiration as always need oxygen / take longer.	• Explains anaerobic respiration and aerobic respiration (link to role of O_2 present). • Explains an advantage of anaerobic respiration get energy fast / without need for oxygen, explosive sports and a disadvantage of anaerobic respiration as little energy for use for the body / puts BP up too high/by product build up • Explains an advantage of aerobic respiration e.g. can have a lot of energy for use in running / efficient / can maintain energy for a long period of time and a disadvantage of aerobic respiration as needs oxygen • Explains why sprinters and marathon runners have different concentrations of lactic acid due to # of mitochondria / O_2 availability / training for eliminating lactic acid / amount of anaerobic respiration.	• Discusses each respiration and efficiency related to graph; noting where / why / when / how. Some consideration of : • Two refs to graph/links ATP to sport to lactic (lactate) /mentioned training or lungs → O_2 → less lactic acid in marathon / mentions specific sites for aerobic respiration (matrix, cristae).

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Q	Expected Coverage	Achievement	Merit	Excellence
THREE (a)	Diffusion is the net movement of a substance from an area of high concentration to low concentration. Diffusion takes place along a concentration gradient. A concentration gradient exists until the diffused substance is evenly distributed. Diffusion is passive / has no energy requirement. Small molecules are able to move through the phospholipid bilayer. Facilitated diffusion is the movement of large molecules from an area of high concentration to and area of low concentration through the protein channels in a semi-permeable membrane. The large molecules can only 'fit' through the protein channels. No energy is required so movement is passive.	• Describes diffusion across a cell membrane. • Describes facilitated diffusion across a cell membrane. • Annotated diagram, may be for section (a) or (b).	• Explains diffusion across a cell lipid bilayer membrane and link to lipids/some smaller molecules/uncharged • Explains facilitated diffusion across a cell membrane linked to ions/polar molecules/ larger molecules or linked to carrier protein/channel protein .	• Discusses transport and enzymes including diffusion and active transport and how enzymes become denatured, need for co-factor with consequences to the cell if DNA replication enzymes become denatured.
(b)	Enzymes are a biological catalyst / speed up biological reactions by lowering the activation energy. They are specific to a reaction and are not used up in the reaction. The structure of an enzyme is composed of a protein and possible nonprotein called a co-factor. It has an active site, which joins or breaks substrates. Active transport is the movement of substances across a membrane against a concentration gradient from low concentration to high concentration. It requires energy / ATP. It occurs through proteins in the cell membrane.	• Describe enzymes structure (labelled diagram accepted) showing protein and active site. • Describes enzymes purpose to speed up reactions / lower activation energy. • Describes active transport as transport requiring energy / against conc gradient.	• Explains active transport as transport requiring energy to run protein pump/ against conc gradient	Some consideration of : • Any extra key point e.g. denaturing is irreversible/ Change to 3D structure as bonds broken / disulphide bridges broken / clear on consequence to DNA replication / clear to consequence of cell cycle (or mitosis) / consequence of no Mg / fully discussed transport (see M 'or' section) / links enzyme → DNA → mitosis →, daughter cells needing DNA / knows uses of enzymes during replication and consequence.

(c)	A co-factor is a metal ion that completes an enzyme's active site. Some enzymes require certain metal ions / vitamins / minerals to complete the active site so substrates can 'fit'. Denaturation is when the temperature increases, causing the enzymes' 3D protein structure to change shape and alter the active site permanently (irreversible). Therefore, substrates can no long 'fit' the active site and the biological reaction slows / stops. Denaturation has negative consequences for the cell. Enzymes speed up the biological reactions involved in the DNA replication, so if DNA fails to replicate or could not replicate fast enough, it would slow or stop the process of mitosis. Growth and repair of an organism may be seriously affected, resulting in eventual death / negative survival.	• Describes denature. • Describes a co-factor as a factor needed for enzyme to work by changing shape / fitting into site. • DNA replication needed as mitosis requires it.	• Explains why a co-factor is required by some enzymes to enable the right conformation of the enzyme for the active site to be 'right'to fit substrate for reaction. • Explains denaturation as the (irreversible) change of shape of the folded protein (unravelling of amino acids) altering active site • Explains ONE consequence to the cell e.g. there would be no cell division as there would be no replicated DNA/the cell processes that needed Mg would not take place/specific mention related to an enzyme in DNA rep.	

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Cut Scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0 – 7	8 – 14	15 – 19	20 – 24