

**INTERNATIONAL A-LEVEL
BIOLOGY (9610)**

BL03

Unit 3 Populations and Genes

Mark scheme

January 2024

Version: 1.1 Final



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Question	Marking guidance	Mark	Comments
01.1	1. Consumers feed on producers/plants and digest (large molecules); 2. (absorbed) molecules assimilated;	2	1. Accept 'breakdown' for digest 2. Accept description of assimilation e.g. made into named biological molecule containing phosphorus

Question	Marking guidance	Mark	Comments
01.2	1. Decomposers/saprophytic (microorganisms)/saprobionts hydrolyse/digest (phosphorus-containing) biological molecules; 2. Release phosphorus (into the environment) as ions or simple (inorganic) molecules; 3. (Ions or simple inorganic molecules) absorbed by plant roots (and incorporated into organic molecules);	3	1. Accept 'breakdown' for hydrolyse/digest 2. Accept phosphate as named ion 3. Accept 'taken up' for absorbed

Question	Marking guidance	Mark	Comments
02.1	Cytoplasm;	1	

Question	Marking guidance	Mark	Comments
02.2	(Substance X) glucose phosphate and (Substance Y) reduced NAD;	1	Accept for substance X: phosphorylated glucose glucose-6-phosphate fructose (-6-) phosphate fructose (-1,6-) biphosphate Accept NADH or NADH ₂ for substance Y

Question	Marking guidance	Mark	Comments
02.3	Correct label and arrow added between triose phosphate and pyruvate;	1	

Question	Marking guidance	Mark	Comments
02.4	(Two) more (ATP) produced than used;	1	Accept idea of 4 ATP produced and 2 ATP used

Question	Marking guidance	Mark	Comments
02.5	1. Standard error and 95% confidence limits; 2. As comparing means (of continuous data);	2	1. Allow t-test

Question	Marking guidance	Mark	Comments
02.6	1. (Standard) error bars overlap at some times so no significant difference or difference only significant at times when (standard) error bars do not overlap; 2. Only used one concentration of lactate; 3. Only used rat (muscle) or did not use other animal (muscle); 4. Used isolated muscles or might be different in living organism; 5. Muscles may be different types/sizes; 6. Other animal body temperature different/higher than 30 °C;	3 max	1. Accept correct time(s)

Question	Marking guidance	Mark	Comments
02.7	1. Correct use of data from Figure 4 ; 2. Aerobic energy supply increases as running distance increases; 3. Anaerobic energy supply remains fairly constant OR increases slightly (to 800 m) then plateaus; 4. Anaerobic (respiration) supplies more of energy at shorter distances;	3 max	Must have marking point 1 for full marks 4. Accept converse

Question	Marking guidance	Mark	Comments
02.8	(200 m) 0.3 (: 1); (800 m) 1.8 (: 1);	2	Award 1 mark for correct readings from graph (10 and 30, 90 and 50)

Question	Marking guidance	Mark	Comments
02.9	1. Respiration rate is high OR rate of muscle contraction is high OR muscle contraction force is high; 2. Oxygen cannot be supplied to muscle (cells/tissue) quickly enough (for aerobic respiration);	2	

Question	Marking guidance	Mark	Comments
03.1	3.25;	1	

Question	Marking guidance	Mark	Comments
03.2	(Chickens indoors) less heat loss so less energy loss due to <u>respiration</u> ; OR (Chickens indoors) less movement/muscle contraction so less energy loss due to <u>respiration</u> ;	1	

Question	Marking guidance	Mark	Comments
03.3	(Yes) 1. (Diet E) uses less land so less deforestation / less loss of biodiversity; (No) 2. Diet D has same land use OR diet C has similar land use; 3. Not everyone wants to eat a plant-only diet e.g. cultural reasons; 4. Diet E may have less protein/vitamins/minerals; 5. Cereal crops require more land than eggs OR same area of land as milk; 6. No information about area of land needed to produce plant crops other than cereals;	4 max	Must have marking point 1 for max marks 4. Accept may have less nutrients 4. Accept converse e.g. other diets may have more protein

Question	Marking guidance	Mark	Comments
04.1	The position of a gene/allele on a chromosome;	1	

Question	Marking guidance	Mark	Comments
04.2	aa EE and aa Ee;	1	

Question	Marking guidance	Mark	Comments
04.3	AE, Ae, aE, and ae;	1	

Question	Marking guidance	Mark	Comments
04.4	1. Cross should give 3 grey : 1 black; 2. Still got 1 black so gg survives; 3. 2 grey must be Gg so GG die;	3	

Question	Marking guidance	Mark	Comments
04.5	41.595 / 41.6 (%);;	3	Award 3 marks for correctly rounded answer (q = 0.295 so) p = 0.705 for one mark heterozygotes identified as 2pq for one mark (heterozygotes are 2pq so 2 x 0.705 x 0.295 =) 0.41595 for two marks

Question	Marking guidance	Mark	Comments
05.1	Intraspecific;	1	

Question	Marking guidance	Mark	Comments
05.2	Any 2 from: <ul style="list-style-type: none"> • variety/type of carrot (plants) • type of soil or soil pH or soil mineral content or amount of fertiliser • volume of water (added to each plot);; 	2	Accept species of carrot or age of (carrot) seeds Accept nutrients in soil Accept reference to light intensity if correctly linked to outdoor investigation e.g. shade from trees/hedges Accept reference to presence of pests / pest control

Question	Marking guidance	Mark	Comments
05.3	(fresh mass includes) water content that can vary;	1	

Question	Marking guidance	Mark	Comments
05.4	0.16; 0.12;	2	Award one mark for two correct answers not given to 2 dp e.g. 0.155, 0.123

Question	Marking guidance	Mark	Comments
05.5	1. Orientation and suitable scales; 2. Axes fully labelled including units; 3. All points correctly plotted; 4. Line of best fit;	4	2. 'population density / plants m ⁻² ' on x-axis and 'dry mass per carrot plant / kg' on y-axis 3. Using candidate's data from 5.4 4. Ignore extrapolation

Question	Marking guidance	Mark	Comments
05.6	1. (10 plants per square metre) gives highest recorded dry mass per (carrot) plant ; 2. Dry mass is same at population density of 5 plants per square metre or no intermediate planting density between 10 and 20; 3. No measure of carrot size or quality of carrots; 4. No statistical test so may be no significant <u>difference</u> (in dry mass); 5. Only one plot was used for each population density OR no repeats for each population density; 6. Only investigated for 12 weeks (competition will increase as plants get bigger); 7. Dry mass of whole plant is measured rather than crop yield; 8. (10 plants per square metre) does not give the highest dry mass per square metre ;	4 max	Must include marking point 1 for max marks 4. Accept significant correlation in correct context 4. Do not accept 'results due to chance'

Question	Marking guidance	Mark	Comments
06.1	1. Rate of respiration is greater than rate of photosynthesis; 2. Idea of net release of carbon dioxide;	2	

Question	Marking guidance	Mark	Comments
06.2	1. More CO ₂ available to combine with RuBP; 2. More glycerate-3-phosphate/GP formed; 3. More GP <u>reduced</u> to triose phosphate; 4. More triose phosphate converted to organic substances or used to regenerate RuBP (to fix more CO ₂);	4	'More' is needed at least once for full marks 4. Accept named organic substance Accept labelled diagram for all marking points

Question	Marking guidance	Mark	Comments
06.3	175 (%);;	2	Allow one mark for 22 and 8 OR one mark for 14 (22 – 8)

Question	Marking guidance	Mark	Comments
06.4	1. (At 100–200 ppm) CO ₂ is the limiting factor so increasing the concentration increases the rate of photosynthesis; 2. (At 800–900 ppm) temperature / light intensity is limiting the rate of photosynthesis so increasing CO ₂ concentration does not increase rate much;	2	2. Accept other named limiting factor

Question	Marking guidance	Mark	Comments
07.1	<ol style="list-style-type: none">1. Krebs cycle generates ATP by substrate-level phosphorylation;2. Krebs cycle generates reduced coenzymes/FAD/NAD;3. Reduced coenzymes/FAD/NAD transfer electrons to the electron transfer chain;4. Electrons pass down electron transfer chain and energy released;5. (Energy released used to) pump/actively transport protons/H⁺ into the intermembrane space;6. Protons/H⁺ diffuse across inner mitochondrial membrane / into matrix / through ATP synthase;	5 max	<p>4. Do not accept energy produced</p> <p>If marking points 3 to 6 not awarded allow oxidative phosphorylation for one mark.</p>

Question	Marking guidance	Mark	Comments
07.2	<ol style="list-style-type: none">1. (double membrane) allows high concentration of H⁺ in the intermembrane space;2. (So) H⁺ can diffuse back into the matrix / through ATP synthase OR so H⁺ do not diffuse out of mitochondria (through outer membrane);3. (Inner membrane highly folded) provides large surface area;4. For attachment of proteins/enzymes involved in electron transfer chain OR for more ATP synthase;5. (Pyruvate carrier proteins) so pyruvate can be transported into (matrix of) mitochondria;6. Because membrane is impermeable to pyruvate OR because pyruvate cannot diffuse across membrane OR because link reaction occurs in (matrix of) mitochondria;	6	<ol style="list-style-type: none">1. Accept description of high concentration e.g. so that a gradient can be established 6. Accept description of link reaction e.g. so that Acetyl CoA can be produced (from pyruvate)

Question	Marking guidance	Mark	Comments
07.3	<ol style="list-style-type: none">1. Mutation causes change to structure;2. Individuals with change to cytochrome c structure have a selective advantage;3. These individuals are more likely to survive and have offspring;4. Allele frequency changes over time;	4	