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BIOLOGY (9610)

BL03

Unit 3 Populations and Genes

Mark scheme

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Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Examiner.

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Question	Marking guidance	Mark	Comments
01.1	$RQ = \frac{carbon\ dioxide\ given\ out}{oxygen\ taken\ in}$	1	

Question	Marking guidance	Mark	Comments
01.2	As temperature increases RQ value decreases **or** negative correlation;	1	

Question	Marking guidance	Mark	Comments
01.3	1. At higher temperatures (8–0°C) fats are main respiratory substrate; 2. As temperature falls/ below ⁻4°C proteins being respired/ mixture of substrates; 3. (Hibernation will have to end) as no more stored energy/more food needed 4. (idea of) if temperature very low more energy needed for keeping warm (so hibernation shorter)	3 max	

Question	Marking guidance	Mark	Comments
01.4	Krebs cycle;	1	Accept TCA cycle / Tricarboxylic acid cycle / Citric acid cycle

Question	Marking guidance	Mark	Comments
01.5	1C = carbon dioxide/CO_2 and 2C = acetate/acetyl coenzyme A/acetyl CoA;	1	Both correct for 1 mark

Question	Marking guidance	Mark	Comments
01.6	<table><tr><th></th><th>Use of this molecule</th></tr><tr><td>ATP</td><td>Energy (source) Phosphorylation / add phosphate group Glucose activation (in glycolysis)</td></tr><tr><td>Reduced NAD</td><td>Hydrogen/proton/electron carrier Production of ATP;</td></tr></table>	1	Both correct for 1 mark Reject energy production Accept reduced NAD can be used to reduce other molecules eg pyruvate reduced to lactate

Question	Marking guidance	Mark	Comments
02.1	(Process that can) convert nitrogen (gas)/N_2 into ammonia/ammonium;	1	Accept N-containing compounds or named examples – eg amino acids / other organic N-compound Ignore NO_3^-

Question	Marking guidance	Mark	Comments
02.2	1. Line graph, orientation and suitable scale; 2. Axes labelled including units; 3. All points correctly plotted ± half square; 4. Smooth curve of best fit/point to point with ruler;	4	 3. Reject if non-linear scale

Question	Marking guidance	Mark	Comments
02.3	1. Higher heavy metal concentration means fewer nodules so fewer N-fixing bacteria (so less N-fixed); 2. (Less N-fixed) so less N available to make amino acids/proteins/DNA; 3. (Less amino acids/protein) so less growth/cell production resulting in lower dry mass;	3	 2. Allow less ammonium/nitrate available 2. Allow other named N-containing biological molecule

Question	Marking guidance	Mark	Comments
02.4	For natural fertilisers accept any 1 from: cheaper; less leaching/eutrophication; use of animal waste from farm; may be able to sell food as organic; adds bulk **or** better crumb to improve soil structure; slower release of ions **or** longer-lasting; (may) contain microorganisms;	1 max	Accept converse for artificial fertiliser If candidate refers to 'it' or 'they' assume natural fertiliser

Question	Marking guidance	Mark	Comments
03.1	1. Labradors with mutations weigh more (so are over 32kg); 2. Labradors with 2 mutant alleles/homozygotes are heaviest/most overweight; 3. (Standard deviation) bars of mutants don't overlap with no mutation so indicate that the mutants are significantly heavier than normal/no mutation; 4. Large sample so representative;	3 max	

Question	Marking guidance	Mark	Comments
03.2	1. POMC mutation (significantly) reduces β-endorphin release; 2. (If not enough β-endorphin) don't feel full/feel hungry; 3. Labradors that eat more become heavier;	3	

Question	Marking guidance	Mark	Comments
03.3	1. Labradors that are interested in food are more likely to have the POMC mutation; 2. Interest in food makes it easier to train the Labradors; 3. If used in breeding, the allele/mutation may be passed on to their offspring/their offspring more likely to also be interested in food; 4. (Increased) interest in food/having mutation could lead them to become overweight; 5. Idea that joint problems will restrict their role; 6. Any valid point about other health issues;	5 max	

Question	Marking guidance	Mark	Comments
04.1	1. CO_2 + RuBP form GP; 2. Catalysed by rubisco; 3. ATP + reduced NADP (from light dependent) reduce GP to TP; 4. Some of TP used to regenerate RuBP and rest for making sugars/amino acids;	4	 3. Allow produce TP 3. Reject reduced NAD 4. Allow GP used 4.Ignore other organic substances

Question	Marking guidance	Mark	Comments
04.2	1. Temperature; 2. Light intensity; 3. Species/variety of flower; 4. Water supply; 5. Soil/compost/nutrients; 6. Planting density;	2 max	

Question	Marking guidance	Mark	Comments
04.3	To remove bias; Collect valid data; Representative sample;	1 max	Reject accurate

Question	Marking guidance	Mark	Comments
04.4	9.31 (%);	1	

Question	Marking guidance	Mark	Comments
04.5	(Change in) number significant as P value less than 0.05 (so change not due to chance) **AND** (Change in) flower diameter not significant as P value is more than 0.05 (so difference due to chance);	1	

Question	Marking guidance	Mark	Comments
04.6	Spearman (rank correlation test)/correlation coefficient;	1	Allow other correlation tests

Question	Marking guidance	Mark	Comments
04.7	1. (Significantly) more leaf area so more photosynthesis; 2. Increased sugar/TP production; 3. (So) more cellulose, protein, DNA or other named polymer **OR** more energy (for growth of flowers);	3	

Question	Marking guidance	Mark	Comments
04.8	Lack of chlorophyll;	1	Accept suitable plant disease Accept other suitable ions eg iron, nitrate Accept lack of magnesium ions (in soil)

Question	Marking guidance	Mark	Comments
05.1	1. (Female) Z^BW **AND** (Male) Z^BZ^B; 2. (Female) Z^B and W **AND** (Male) Z^B (and Z^B); 3. Correct (Punnett square or crossing lines to give) genotypes of offspring from given gametes; 4. Z^BW = female, dark stripe (on head and back) **AND** Z^BZ^B = male, pale stripe (on back, no head stripe);	4	Allow ecf for mp2 and mp3 from incorrect parents

Question	Marking guidance	Mark	Comments
05.2	N = I–(F+U+R); **OR** Net production = chemical energy stored in ingested food – (chemical energy stored in faeces + chemical energy stored in urine + respiratory losses);	1	

Question	Marking guidance	Mark	Comments
05.3	213.84/213.8/214;;	2	Allow 11.88 (15 chickens for 1 week) for 1 mark Allow 14.26 (1 chicken for 18 weeks) for 1 mark Allow $\frac{60}{100}$ x 15 x 18 x 1.32 (but wrong ans) for 1 mark

Question	Marking guidance	Mark	Comments
05.4	1. Keep chickens warm / indoors at higher temperature; 2. (So respiratory losses reduced) so less energy needed to maintain body temperature; OR 3. Keep chickens indoors / in (small) cages; 4. (So respiratory losses reduced) so less energy used for movement; OR 5. Chemical treatments, e.g. hormones/antibiotics/pesticides; 6. Description of why improves efficiency; OR 7. Controlled diet; 8. Description of how improves efficiency;	2	Mark in pairs 1 and 2 **OR** 3 and 4 **OR** 5 and 6 **OR** 7 and 8 Mark for explanation can only be given if suitable method identified 7. e.g. high protein/more easily digested

Question	Marking guidance	Mark	Comments
06.1	Positives 1. Higher density of wheat results in less black-grass weeds; 2. (Increasing to 300 per m^2) could reduce weeds by around a third/to about 68% compared with 100 per m^2; 3. Reduced interspecific competition increases wheat yield; Negatives 4. Higher density of wheat would cost more money in seeds; 5. Higher density of wheat/increased intraspecific competition may decrease wheat yield per plant/don't know effect on wheat yield; 6. Confidence intervals means reduction in weeds might only be about a quarter/24% (so not worth extra cost) **OR** Density of 300m^{-2} overlaps with density of 250m^{-2} (so not worth extra cost);	3	Must give at least one positive and one negative for full marks 3. Allow description of intraspecific competition

Question	Marking guidance	Mark	Comments
06.2	1. Name at least 2 control variables; 2. (Set up a control with) only wheat seeds; 3. Oat seeds and wheat seeds together; 4. Measure length of wheat seedlings/measure with a ruler every day/suitable intervals or after set time; 5. Replicates / three pots per treatment and calculate mean;	4 max	1. e.g. light intensity, water, temperature

Question	Marking guidance	Mark	Comments
06.3	1. (Idea of) growth other than length; 2. Water content of seedlings varies; 3. (Dry mass is) measure of production of organic material;	2	1. e.g. number of grains/leaves/roots

Question	Marking guidance	Mark	Comments
07.1	A population is all the members of <u>one</u> species within a given area, whereas a community is <u>all</u> the populations of <u>all</u> the different species (in the same area)	1	

Question	Marking guidance	Mark	Comments
07.2	1. (Decreasing hen harrier numbers results in) increased grouse and vole (because of less predation); 2. Golden eagle would still kill grouse; 3. Grouse numbers will not increase as much as vole numbers; 4. Increased competition (between grouse and voles) for heather/insects/food so numbers may drop;	4	

Question	Marking guidance	Mark	Comments
07.3	1. (Genetic bottleneck involves) small population; 2. (Small population) reduces gene pool/variety of alleles/genetic diversity; 3. Captive breeding programme will also produce population with low/reduced genetic diversity; 4. (In future) hen harrier population may not be able to adapt to changes in environment/ suitable example of a lack of adaptation, eg not resistant to a particular disease / not resistant to changes in climate;	4	

Question	Marking guidance	Mark	Comments
07.4	Similarities: 1. Changes to environment/becomes less hostile over time still occur; 2. Biodiversity increases; 3. Will still lead to climax community (although it might contain different species) (unless succession is prevented again); Differences: 4. Area already has soil/seeds in soil (unlike in primary succession); 5. (So) pioneer/first species different; 6. Process is faster/plants or animals in nearby areas quicker to move in;	6	5. Allow named examples, e.g lichen/moss for primary or grasses/heather for secondary 5. Allow secondary succession does not start from a pioneer species