OXFORD
INTERNATIONAL
AQA EXAMINATIONS

International AS
Biology

BL03-Populations and genes
Mark scheme

9610

June 2018

Version/Stage: 1.0 Final

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 Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this mark scheme are available from aqa.org.uk

Question	Marking guidance	Mark	Comments
01.1	Population: All of the organisms/a group of the organisms of one species in a habitat/place/area/ecosystem; Ecosystem: Populations of different species **and** the non-living components / all the (interacting) biotic **and** abiotic factors	1 1	Must have idea of **one** species/single species/same species Accept reference to community instead of 'populations of different species' e.g. Ecosystem = Habitat + Community
01.2	A large range of values/numbers;	1	Accept 'to reduce the range of values' Ignore 'large numbers'
01.3	1. Number of lemmings is (always) higher than the number of stoats; 2. Number of lemmings increases (then) number of stoats increases / number of stoats increases (then) number of lemmings decreases; 3. 4 year cycles / use of figures from graph;	1 1 1 2 max	1. Candidates need to show understanding of logarithmic scale. Do not accept 'number of lemmings is usually higher than the number of stoats' as it shows a lack of understanding. 2. The idea of link between lots of predators and decrease in prey or lots of prey and increase in predators.

01.4	(Yes) 1. (Graph shows that) lemming population starts to decrease (one year) before stoat population peaks; (No) 2. Graph shows some years (89-90, 93-94, 97-98) when both populations are increasing; 3. There is a correlation, but does not mean cause; 4. (Lemming population could decrease due to) lack of food; 5. (lemming population could decrease due to) disease; 6. (Lemming population could decrease due to) (increase in) other predator;	1 1 1 1 1 1 4 max	Max 3 if only 'No'

Question	Marking guidance	Mark	Comments
02.1	Allow comparison;	1	Accept converse e.g. would not be able to compare if new techniques used. Do not accept 'avoid bias'. Idea of 'fair test' is insufficient.
02.2	1. (Rises when) lower rate of photosynthesis; 2. less vegetation/lower temperature/shorter days/less light **OR** 3. Rises when weather is cold/rises in winter; 4. More fuel used (producing more CO_2);	1 1 1 1 2 max	1. Context of CO_2 levels rising or less CO_2 taken in. Mark as pairs Accept converse
02.3	(Yes) 1. Both show an overall increase; (No) 2. Considerable fluctuation in temperature; 3. Temp increase could be due to chance/other named factor; 4. CO_2 only recorded at one location; 5. Comment on quality of data – mean temperature increase is very small/no SD/no statistical test;	 1 1 1 1 1 3 max	 2. Idea that temperature drops while CO_2 concentration continues to rise 3. Methane/named greenhouse gas 3. Accept reference to correlation does not mean causation.

Question	Marking guidance	Mark	Comments
03.1	(recessive) epistasis; gene (A) allows the expression of another gene (B);	1 1	 Allow both gene and allele. If 'allele' is used, it must be clear that the 'allele' A allows expression of the 'allele(s)' of a different gene. A (not a) allows expression of B/b.
03.2	AAbb **and** Aabb;	1	
03.3	(Parental genotypes AaBb aabb) 1. Gametes AB, Ab, aB, ab ab; 2. Offspring genotypes AaBb Aabb aaBb aabb; 3. Offspring phenotypes Purple Pink White White;	 1 1 1	 1. Allow ecf from dihybrid parental genotypes 2. Allow ecf from gametes with A/a and B/b 3. Phenotypes must be linked to correct genotype and must give expected phenotype purple:pink:white as 1:1:2
03.4	Critical value correctly identified; No significant difference (between observed and expected ratio) / difference due to chance **because** (calculated value of chi squared is) less than critical value; OR Nearest value (to calculated value of chi squared of 4.73) = 4.61; Difference due to chance **because** p = 0.1 / p > 0.05;	1 1	Either stated as 5.99 or identified as the value for 2 degrees of freedom for p = 0.05); Significance must be linked to critical value Allow mp2 if incorrect number of degrees of freedom (e.g. 3 from 4 genotypes and e.g. P≅0.2), but correct statement that no significant difference for this value.

03.5	42%;;	2	0.42 = 1 mark Award one mark for: q^2 = 0.49 / q = 0.7 / p = 0.3

Question	Marking guidance	Mark	Comments
04.1	oxygen concentration/reading on oxygen meter and time;	1	Accept ‘ amount’ of oxygen in a given time
04.2	Light intensity/distance between light and flask; Mass/volume/number of algae/photosynthesising cells;	1 1	
04.3	Electrons/e^- (from chlorophyll) excited / reduced NADP formed; hydrogen/electrons (from water/chlorophyll) change dye colour;	1 1	Reject NAD
04.4	Any **three** from four 1. (hydrogen sulfide is) source of hydrogen/protons/H^+ and electrons/e^-; 2. (hydrogen/protons/H^+ used for) reduction of NADP/electron carrier; 3. (electrons) replace electrons lost from chlorophyll/pigment; 4. (protons) generate ATP;	 1 1 1 1 3 max	 2 Reject NAD 2. Accept production of NADPH/$NADPH_2$/reduced NADP
04.5	Sulphur/S produced (instead of oxygen);	1	Reject SO_2/SO_3

Question	Marking guidance	Mark	Comments
05.1	[Growth rate (g day^{-1}) ÷ mass of food (g day^{-1})] ×100	1	Allow 'weight' for mass Accept 'increase in mass as ratio of food eaten'
05.2	(Yes) Highest mean growth rate and highest efficiency of conversion (to biomass);	1	Accept converse
	(No) No intermediate temperature (between 10 and 20, or between 20 and 30);	1	Do not accept temperatures below 10 or above 30
05.3	(at 20 °C) less energy lost as heat/less energy required to maintain constant body temperature;	1	Must be comparative statement Accept converse: (at 5°C) more energy lost as heat;
	(so) more (energy available for production of) biomass;	1	(so) less conversion to biomass;
05.4	Growth rate decreases above 20 °C / efficiency of conversion is the same at 30 and 35 °C;	1	
	(so) higher temperature would not increase growth rate/efficiency of conversion;	1	Accept idea that temperature above 35 °C would be a waste of time and resources Allow harmful to chickens

Question	Marking guidance	Mark	Comments
05.5	1. Temperature kept at optimum for maximum efficiency of conversion of food to biomass;	1	1. Accept 'warm environment so less heat loss/so less energy needed to keep body warm.'
	2. Reduced movement/less muscle use so more energy available for production of biomass;	1	
	3. Use of data to show that 750cm^2 is insufficient space (e.g. Minimum length 30 cm and minimum wingspan 45 cm so need at least 1350cm^2);	1	
	4. Animal welfare – prevents natural behaviour / causes stress / debeaking to prevent pecking and cannibalism / lack of movement cause joint pain/problems;	1	4. Do not accept unqualified reference to cruelty / ethics 4. Accept psychological effect on chickens described e.g. having adverse effect on growth rate 4. Accept cages protect against predators
	5. Disease – (chickens are) close together so disease can spread easily/so have to add antibiotics to food;	1 3 max	

Question	Marking guidance	Mark	Comments
06.1	(36/51 =) 0.7/0.71; 0.7 : 1;	1 1	Calculation mark $\frac{36}{51}$ 1 mark for: 0.72 : 1 / 1 : 0.7 / 12 : 17
06.2	Mixture of substrates used / (some aerobic and) some anaerobic;	1	Ignore reference to products Allow RQ could be same for different substrates
06.3	1 More H in lipid/12H (in glucose) **and** 34H (in oleic acid); And any **two** from: 2 (More protons so) more reduced NAD/FAD / (more protons) move across inner mitochondrial membrane; 3 More ATP produced; 4 More electrons moving down the ETC;	1 1 1 1 3 max	Idea of 'more' needed once in whole answer 3. Must be in context of more reduced FAD/NAD or more protons moving
06.4	Mass of glucose/sample (in g); Temperature change (of water);	1 1	Accept 'weight' of glucose Do not accept 'amount' of glucose Do not accept temperature change of glucose

Question	Marking guidance	Mark	Comments
07.1	drop of coloured liquid would not move; (because) pressure/volume inside the boiling tube would not decrease;	1 1	 Accept idea that oxygen = carbon dioxide Ignore effect of CO_2 on snail
07.2	20.2;;;	3	Accept 20 / 20.1 / $\frac{\pi \times 3 \times 6}{4 \times 7}$ for 2 marks If incorrect answer, max 2 marks for: 1. Volume of oxygen calculated ($3.14 \times 0.5^2 \times 30$) = 23.55/23.56; 2. Volume per gram calculated (answer 1 ÷ 7) = 3.36/3.37 3. Volume per gram per hour calculated (answer 2 × 6) = 20.186/20.196; Volume calculated using $3.14 \times 0.5^2 \times 30$ or $3.14 \times 1^2 \times 30$ **and** divided by 7 = 1 mark

07.3	(Yes) Oxygen uptake (significantly) higher in moist air at 25 °C than at 20°C; (No) oxygen uptake is not highest at 25 °C in seawater No significant difference between 25, 30 and 35 °C in either experiment;	 1 1 1	 Accept that temperatures between 20 and 25 / 25 and 30 not tested Accept converse e.g. oxygen uptake is highest at 30°C in sea water Accept comparative use of figures from table Must give all three temperatures Ignore ‘standard deviations overlap’ if no temperatures given

Question	Marking guidance	Mark	Comments
08.1	1. (Colonisation by) pioneer (species);	1	1. accept reference to correct example of pioneer species e.g. moss, lichen
	2. (Pioneer species cause) change in environment/(cause) change in abiotic conditions;	1	2. Accept an example of change caused by pioneer species eg produce soil
	3. Environment becomes less hostile / abiotic conditions become more favourable;	1	
	4. (Change to environment/abiotic conditions allow) new species colonise / pioneer species outcompeted;	1	
	5. Change in biodiversity (during succession);	1	5. Accept increase in biodiversity (early to mid succession) and decrease in biodiversity (mid succession to climax community) as long as correct context
	6. (Final stage of succession is) climax community;	1	

Question	Marking guidance	Mark	Comments
08.2	1. genetic variation present (in original population) OR (Random) mutation	1	
	2. (copper) tolerant individuals more likely to survive/to reproduce;	1	2. Answer must refer to tolerance, not just a generic answer
	3. (these reproduce and) pass on (tolerance) allele(s)/gene(s) (to next generation/to offspring);	1	3. Do not accept 'pass on traits', must be in context of genes/alleles
	4. more/increase (in frequency) of copper tolerance allele(s)/gene(s);	1	4. Must be linked to allele(s)/gene(s) for copper tolerance, not a generic response

Question	Marking guidance	Mark	Comments
08.3	1. (populations are) reproductively isolated/no interbreeding (due to different flowering times);	1	1. Accept description of reproductive isolation
	2. (so) no flow of alleles/genes between the populations / separate gene pools / different (random) mutations in each group;	1	
	3. different selection pressures;	1	
	4. type/frequency of alleles will change/gene pools will change;	1	
	5. (genetic differences lead to) members of populations become unable to (interbreed and) produce fertile offspring;	1	5. Accept converse e.g. interbreeding produces infertile offspring