INTERNATIONAL A-LEVEL

BIOLOGY

BL03 (9610)

Unit 3 Populations and Genes

Mark scheme

January 2021

Version: 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 Examiner.

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 oxfordaqaexams.org.uk

Question	Marking guidance	Mark	Comments
01.1	Allele always expressed (in phenotype) **OR** allele expressed in the presence of other alleles **OR** allele expressed even if only one copy present;	1	Accept 'shown' or 'seen' Ignore gene

Question	Marking guidance	Mark	Comments
01.2	$F^{VL} > F^L > F^E > F^{VE}$;	1	Accept VL > L > E > VE or very late > late > early > very early

Question	Marking guidance	Mark	Comments
01.3	1 Parent genotypes $F^{VE} F^L$ <u>and</u> $F^{VE} F^E$ **OR** gametes F^{VE}, F^L <u>and</u> F^{VE}, F^E; 2. Offspring genotypes: $F^{VE} F^{VE}$, $F^{VE} F^E$, $F^{VE} F^L$, $F^E F^L$; 3. Offspring phenotypes: Very early, Early, Late, Late;	3	2. Accept correct offspring genotypes from incorrect parent genotypes or gametes 3. Offspring phenotypes must be associated with correct genotypes from mp2 **and** include very early offspring

Question	Marking guidance	Mark	Comments
01.4	1. Chi-squared (test); 2. Looking for a significant difference between expected (genetic ratios) and observed (ratios); **OR** to test null hypothesis (no significant difference between O and E); **OR** to test the hypothesis that any difference between O and E is due to chance;	2	

Question	Marking guidance	Mark	Comments
01.5	1. There is no significant <u>difference</u> (between observed and expected); 2. Because P value is greater than 0.05/5%;	2	1. Accept <u>difference</u> is due to chance **or** that null hypothesis / H_0 is accepted 1. Reject results are due to chance 2. Accept appropriate reference to 0.95/95%

Question	Marking guidance	Mark	Comments
02.1	(Allele frequency is) the fraction/proportion/percentage of an allele in the gene pool/population;	1	

Question	Marking guidance	Mark	Comments
02.2	25.8 (%);;;	3	Award 1 mark for (q =) 0.152 **and** (p =) 0.848 Accept q = 0.15 **and** p = 0.85 Award 1 mark for heterozygotes = 2pq Award 2 marks for 2 x 0.152 x 0.848 / 0.257792 / 0.2577 / 0.2578 / 0.258 / 25.7792 / 25.779 / 25.78 Accept 25.5(%) (from q = 0.15 **and** p = 0.85)

Question	Marking guidance	Mark	Comments
02.3	Any **two** from: no mutation; no selection **OR** (idea of) all genotypes have equal reproductive success; population large; population genetically isolated **OR** no emigration/immigration; mating is random;	Max 2	

Question	Marking guidance	Mark	Comments
02.4	16;;	2	Allow 1 mark for 0.064 Allow 1 mark for correct readings from graph 0.088 **and** 0.152 Allow 1 mark for answer correctly derived from approximately correct figures from graph

Question	Marking guidance	Mark	Comments
02.5	1. Heterozygotes are more likely to survive (malaria/thalassaemia) and reproduce; 2. Pass on the thalassaemia/recessive allele/gene to their offspring;	2	1. Accept converse – Homozygous (people are) more likely to die (of malaria/thalassaemia)

Question	Marking guidance	Mark	Comments
03.1	(So that insect can) equilibrate/acclimatise;	1	Allow (so insect can) adjust to temperature/conditions

Question	Marking guidance	Mark	Comments
03.2	Any **two** from: wash hands after handling **or** wear gloves **or** use forceps; minimise handling (to reduce stress/injury to animal); wear mask/ventilate room (to reduce inhalation of allergens);	Max 2	

Question	Marking guidance	Mark	Comments
03.3	(Lower than 18°C) insect inactive **OR** insect has low rate of respiration **OR** chemical reactions are slower **OR** enzyme activity reduced; (Higher than 38°C) insect killed **OR** enzymes/proteins denatured;	2	Ignore reactions stop / insect dies Allow too much water loss

Question	Marking guidance	Mark	Comments
03.4	(Straight lines because) cannot be certain of intermediate values;	1	

Question	Marking guidance	Mark	Comments
03.5	Comparing means of continuous data;	1	Accept reference to spread of data Accept reference to whether there is a significant difference between means or to identify whether error bars overlap

Question	Marking guidance	Mark	Comments
03.6	1. 0.00075 / 7.5 x 10^{-4}; 2. $mm^3\ s^{-1}\ °C^{-1}$;	2	1. Accept 0.0008 / 8 x 10^{-4} 2. Accept correct alternatives

Question	Marking guidance	Mark	Comments
03.7	(Yes) 1. This range gives highest rates of CO_2 release; 2. Error bars in this range overlap so cannot be more precise; (No) 3. Error bars at stated temperatures also overlap with temperatures outside stated range; 4. Results may be different for different species/sizes/ages of insect **OR** results may be different in different environments; 5. Only 12 insects / small sample size (so may not be representative); 6. No intermediate values / data only at 2°C intervals / 23°C and 35°C not actually tested;	Max 4	Must have at least one 'yes' for full marks 2. Accept 'so no significant difference'

Question	Marking guidance	Mark	Comments
04.1	1. Absorbs light <u>and</u> releases electron(s)/electrons excited; 2. Electrons used to generate ATP or reduce NADP; 3. Accepts electrons from (photolysis of) water/OH⁻;	3	Accept e⁻ for electron(s) 2. Reject NAD

Question	Marking guidance	Mark	Comments
04.2	1. More bacteria in red and violet/indigo because more oxygen **OR** less bacteria in green/yellow because less oxygen; 2. (More oxygen because) more photosynthesis/photolysis **OR** (less oxygen because) less photosynthesis/photolysis; **OR** 2. Bacteria use oxygen for (aerobic) respiration;	2	1. Accept correct use of approximate wavelengths

Question	Marking guidance	Mark	Comments
04.3	1. Repeat with no prism **OR** repeat with just white light **OR** repeat with algae in the dark; 2. Keep all other conditions same;	2	1. Accept 'normal light' 2. Accept suitable named conditions

Question	Marking guidance	Mark	Comments
04.4	Same volume of water (in each sample) **OR** same number of samples (at each depth) **OR** (take samples at) same time of day;	1	Ignore (take samples from) same area

Question	Marking guidance	Mark	Comments
04.5	Any **one** from: No green algae because they (contain pigments that) need red light (for photosynthesis) **OR** no green algae because they cannot absorb blue light; More red/brown algae because they (contain pigments that) can absorb blue light (for photosynthesis);	Max 1	

Question	Marking guidance	Mark	Comments
05.1	1. Wood groundsel is pioneer species;	4	1. Accept clear description of a pioneer species one that can survive in initial/harsh conditions
	2. (Wood groundsel) changes abiotic conditions;		2. Accept named abiotic condition e.g. nitrate concentration, soil depth
			2. Accept (Wood groundsel) changes environment
	3. (Abiotic conditions) more favourable/suitable for rough bentgrass/prairie lupine **OR** (Abiotic conditions) less hostile for rough bentgrass/prairie lupine;		
	4. Red alder/Douglas fir is climax community;		

Question	Marking guidance	Mark	Comments
05.2	(1 :) 0.5; (1 :) 12;	2	

Question	Marking guidance	Mark	Comments
05.3	Any **one** from: 1. wood groundsel outcompeted; 2. wood groundsel adaptations no longer an advantage **or** wood groundsel is less well adapted (to new conditions) **or** red alder better adapted (to new conditions); 3. trees produce shade so groundsel cannot get enough light for photosynthesis; 4. groundsel can only get enough light in clearings in the forest; 5. alder changes the environment to make it less suitable for groundsel;	Max 1	

Question	Marking guidance	Mark	Comments
05.4	Any **two** from: More niches; More different food sources; More nesting sites/shelter;	Max 2	Accept more types of 'habitat' Ignore 'more food'

Question	Marking guidance	Mark	Comments
06.1	1. Decomposers/saprophytic microorganisms (break down dead organic matter); 2. (Carbon-containing substances broken down during) respiration; 3. Increasing concentration of CO_2 in air **OR** increasing temperature;	3	3. Allow CO_2 production (by microorganisms/respiration)

Question	Marking guidance	Mark	Comments
06.2	1. Increased CO_2 and decreased rainfall P values less than 0.05 **so** significant increase (in risk of death); 2. Increased temperature P value above 0.05 **so** no significant increase (in risk of death); 3. Increased CO_2 most/more significant;	3	Mp1 and mp2 only need one correct reference to 0.05 to gain both marks If neither mp1 and mp2 awarded, allow 1 mark for increased CO_2 and decreased rainfall significant **and** increased temperature not significant

Question	Marking guidance	Mark	Comments
06.3	Any **four** from: (Pro) 1. Increased CO_2 and decreased rainfall (much) lower mass; 2. Large number of beetles (in each condition) **so** valid/reliable results; (Con) 3. No difference (in mass) with increased temperature **OR** (slight) increase in mass with increased temperature; 4. Climate change could increase rainfall; 5. Investigation only 4 weeks; 6. Only one species investigated **OR** only heather beetle investigated; 7. Artificial conditions / no predators / no disease; 8. No statistical test;	Max 4	Must have (at least) one Pro and one Con point for full marks 7. Allow correlation does not mean causation **or** other factors may be involved

Question	Marking guidance	Mark	Comments
07.1	1. Concentration (of carbon dioxide) higher at night as respiration produces CO_2; 2. Concentration (of carbon dioxide) higher at night as no photosynthesis to use CO_2 **OR** Concentration (of carbon dioxide) lower during day as photosynthesis; 3. Concentration (of carbon dioxide) decreases when rate of photosynthesis is higher that rate of respiration; 4. Concentration (of carbon dioxide) higher at greater depth as less light; 5. (Less light at greater depth) so less photosynthesis;	5	4. Accept converse 5. Accept converse

Question	Marking guidance	Mark	Comments
07.2	1. (Reduces) GP to TP (in light-independent reaction);	6	
	2. So useful organic substances are produced;		2. Accept any correct named example of an organic substance
	3. Regenerates RuBP;		
	4. So (Calvin) cycle can continue;		
	5. Phosphorylates glucose (in glycolysis);		
	6. So glucose is more reactive **OR** to activate glucose **OR** because glucose is stable;		

Question	Marking guidance	Mark	Comments
07.3	1. Movement restricted **so** less energy used (in muscle contraction);	4	
	2. Feed controlled **so** salmon grow well **OR** Feed controlled **so** less food wasted;		2. Accept description of how less food is wasted
	3. Predators excluded **so** no loss to other organisms **OR** Predators excluded **so** energy not wasted escaping;		
	4. Pesticides used **so** no loss to other organisms **OR** antibiotics added to food **so** disease is prevented;		4. Allow 'control stocking densities to prevent disease'