OXFORD

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INTERNATIONAL A-LEVEL

BIOLOGY

BL03 (9610)

Unit 3 Populations and Genes

Mark scheme

June 2023

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2 3 6 X B L 0 3 / M S

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.

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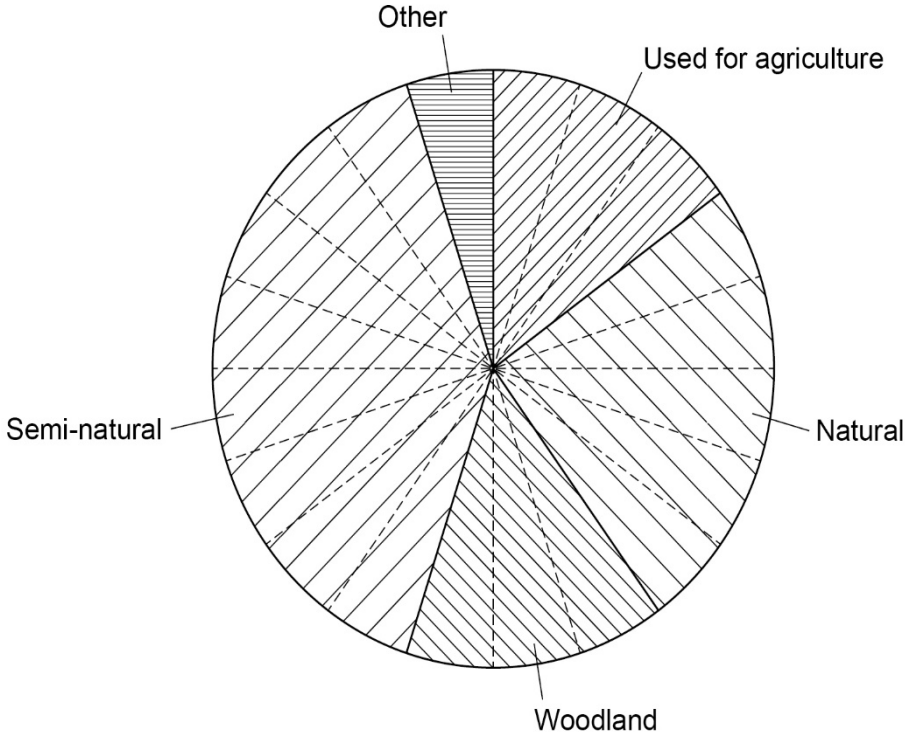
Question	Marking guidance	Mark	Comments
01.1	Correct number of segments for each percentage and correct labels;; *Used for agriculture – 3 , Natural – 5, Woodland – 3, Semi-natural – 8, Other – 1*  	2	Accept key Award 1 mark for unlabelled/mis-labelled (otherwise correct) pie chart

Question	Marking guidance	Mark	Comments
01.2	1. Air (in soil) so (more) <u>oxygen</u>; 2. Decomposers/saprophytes/microorganisms break down (organic) substances in (plant) material; 3. (Aerobic) respiration releases carbon dioxide;	3	3. Reject anaerobic respiration

Question	Marking guidance	Mark	Comments
01.3	1. (Removing trees) prevents a change in abiotic/environmental conditions; 2. (So) prevents succession **or** prevents climax community developing; **OR** 3. (Removing trees) reduces water loss from the soil; 4. (So) plant material cannot decompose fully;	2	1. Accept named abiotic condition eg trees compete for light 1. Ignore carbon dioxide 2. Accept description of succession Mark as pairs.

Question	Marking guidance	Mark	Comments
02.1	(So) leaf discs all sink (at start);	1	Accept converse

Question	Marking guidance	Mark	Comments
02.2	(Yes) 1. Data shows positive correlation **or** as concentration of CO_2 increases rate of photosynthesis increases; 2. Repeated (five times for each concentration); 3. Points are all close to the line of best fit; (No) 4. Temperature/light intensity/colour of light (affects rate of photosynthesis); 5. (Idea of) plateau/level off at high(er) carbon dioxide concentration; 6. No statistical test;	4 max	1. Accept (directly) proportional

Question	Marking guidance	Mark	Comments
02.3	1. No photosynthesis only respiration; 2. No net gain of oxygen **or** oxygen uptake balanced by carbon dioxide production **or** oxygen cannot collect in air spaces; 3. (Idea of) discs do not float;	3	

Question	Marking guidance	Mark	Comments
03.1	(NPP is) the (chemical) energy stored/ taken in by plants minus respiratory loss; NPP = GPP – R;	2	Accept idea of energy available to consumer

Question	Marking guidance	Mark	Comments
03.2	301 (kJ m^{-2} $year^{-1}$);;	2	Award 1 mark for correct answer not given to 3 significant figures eg 300.92013 Award 1 mark for correct working and incorrect answer: 11.3/100 ×12.6/100 × 21 135

Question	Marking guidance	Mark	Comments
03.3	Any **two** from the following: • breed of cows • age of cows • amount of food/water • time since giving birth • temperature (of surroundings) • movement;;	2	Accept species or type of cow for breed Ignore mass of cow

Question	Marking guidance	Mark	Comments
03.4	(Yes) 1. FCR (4 times) lower with diet containing different crops; 2. Significant difference in FCR as error bars do not overlap; (No) 3. Only 18 cows (per group) **or** small sample size **or** only one trial 4. Breed of cow not specified **or** other suitable control variable; 5. Only 7 weeks; 6. No information about cost of food/profit; 7. No information about quality of milk or health of cows;	4 max	Must have at least one 'Yes' for full marks. 1. Must use data from Figure 5 2. Reject 'results are not significant' 5. Accept (Yes) 7 weeks is a suitable length of time

Question	Marking guidance	Mark	Comments
04.1	1. A condition that occurs mainly in one sex / in males; 2. (Due to) gene/allele being on the X-chromosome **or** gene/allele on one of the sex chromosomes;	2	2. Reject if stated on **both** X and Y chromosome.

Question	Marking guidance	Mark	Comments
04.2	Two unaffected parents have affected offspring / offspring with OA **or** 7 and 8 produce 11 **or** 12 and 13 produce 14;	1	Accept 1 (with OA) produces 6 or 7 (without OA)

Question	Marking guidance	Mark	Comments
04.3	1. Parental genotypes correct: X^AX^a and X^AY; 2. Gametes correct: X^A, X^a and X^A, Y; 3. Offspring genotypes correct: X^AX^A, X^AX^a, X^AY, X^aY; 4. Offspring phenotypes and ratio correct: 2 females with pigment : 1 male with pigment: 1 male with OA;	4	2. Accept correct gametes from incorrect parental genotypes 3. Accept correct offspring genotypes from incorrect gametes 4. Only accept this ratio of phenotypes

Question	Marking guidance	Mark	Comments
04.4	1. No significant difference between expected and observed ratios **or** accept null hypothesis **or** we expect this variation by chance (in 10% of cases); 2. (because) P > 0.05 **or** (because) P > 5%;	2	1. Reject 'results due to chance' or 'results are not significant'

Question	Marking guidance	Mark	Comments
05.1	56.44%;;;	3	Award 3 marks for 56% or 56.4% Award 2 marks for 0.56 / 0.564 / 0.5644 Award 2 marks for 82.6% (incorrect assumption that p^2 = 0.34) Award 1 mark for p = 0.34 correctly read from graph. Accept q = 0.34 for 1 mark Award 1 mark for percentage with LCS = $p^2 + 2pq$ **OR** $1 – q^2$

Question	Marking guidance	Mark	Comments
05.2	(Between 4000 and 3000 years ago) 1. Allele frequency decreases/is low because allele is disadvantageous **or** because allele increases chance of predation **or** because allele decreases chance of survival; (Between 3000 and 2000 years ago) 2. Allele frequency increases because horses with LCS selected (by humans) for breeding; 3. (So) allele is passed on to offspring;	3	

Question	Marking guidance	Mark	Comments
05.3	1. Geographical isolation; 2. (Variation due to) <u>mutation</u>; 3. Different selection pressures; 4. Organisms with favourable phenotypes more likely to survive and reproduce; 5. Change in allele frequency **or** pass on favourable allele(s); 6. Cannot (inter)breed to produce fertile offspring;	5 max	3. Accept description of selection pressure 5. Ignore 'pass on favourable gene' 5. Allow 'pass on mutation' or 'pass on mutated gene'

Question	Marking guidance	Mark	Comments
06.1	1. (Idea of) measure the temperature of contents of test tubes; 2. (Idea of) check if temperature inside tube equals temperature of water bath **or** time how long needed to reach required temperature;	2	

Question	Marking guidance	Mark	Comments
06.2	1. Methylene blue would be oxidised; 2. (so) would stay blue **or** would not decolourise **or** would turn blue again;	2	1. Accept description of oxidised eg oxygen added, or hydrogen removed

Question	Marking guidance	Mark	Comments
06.3	1. Test tube containing glucose solution, yeast, and methylene blue; 2. Leave to fully decolourise; **OR** 3. Test tube containing glucose solution and yeast; 4. Add water instead of methylene blue;	2	Mark as pairs

Question	Marking guidance	Mark	Comments
06.4	1. Enzymes/proteins denatured; 2. No/less respiration **or** methylene blue will not decolourise **or** no/less reaction;	2	1. Accept yeast killed

Question	Marking guidance	Mark	Comments
06.5	To show that yeast respiration causes decolourisation **or** To show that enzymes cause decolourisation **or** To show that glucose does not cause decolourisation;	1	

Question	Marking guidance	Mark	Comments
06.6	1. Measure volume of carbon dioxide produced and count number of cells in known volume; 2. Divide (volume of) carbon dioxide by number of cells;	2	

Question	Marking guidance	Mark	Comments
06.7	4.6×10^{-11} (cm^3 per cell minute $^{-1}$);;	2	Allow 2 marks for answers in the range of 4×10^{-11} to 5×10^{-11} (cm^3 per cell minute $^{-1}$) Allow 1 mark for answer not x 10^{-9}

Question	Marking guidance	Mark	Comments
06.8	(At 35 minutes) 1. Running out of substrates; 2. Build-up of waste products;	2	1. Accept running out of glucose/oxygen 2. Accept build-up of ethanol/carbon dioxide 2. Accept change in pH

Question	Marking guidance	Mark	Comments
07.1	1. Glucose is phosphorylated **or** glucose is converted to glucose phosphate **or** phosphate is added to glucose; 2. Using ATP; 3. Triose phosphate is produced; 4. (Triose phosphate is) oxidised to pyruvate; 5. Net gain of ATP; 6. Reduced NAD formed;	6	Accept correct diagram for all marking points 3. Accept TP for triose phosphate 4. Accept TP converted to pyruvate 5. Accept description of net gain eg 2 ATP used and 4 ATP produced 6. Allow NADH or $NADH_2$ or $NADH + H^+$ 6. Reject NADPH

Question	Marking guidance	Mark	Comments
07.2	1. Insufficient oxygen (for aerobic respiration); 2. Formation of lactate requires reduced NAD; 3. NAD is regenerated; 4. (NAD) allows glycolysis to continue; 5. (Some) ATP still produced for muscle contraction;	5	

Question	Marking guidance	Mark	Comments
07.3	1. Carbon dioxide produced in Krebs cycle but used in Calvin cycle; 2. Reduced coenzymes produced in Krebs cycle but reduced coenzymes used/oxidised in Calvin cycle; 3. ATP produced in Krebs cycle but used in Calvin cycle; 4. (Idea of) four-carbon molecule in Krebs cycle, but 5C/ribulose bisphosphate/RuBP in Calvin cycle; 5. Acetyl coenzyme A enters Krebs cycle, but carbon dioxide enters Calvin cycle;	4 max	2. Accept correct named examples of coenzymes 2. Accept reduced coenzymes are NAD and FAD in Krebs cycle but NADP in Calvin cycle