

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

BL03

Unit 3 Populations and Genes

Mark scheme

January 2026

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.

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Mark scheme instructions to examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the typical answer or answers which are expected
- extra information to help the examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit.

The extra information in the 'Comments' column is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme. At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right-hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

- 2.1** In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following bullet points is a potential mark.
- 2.2** A bold **and** is used to indicate that both parts of the answer are required to award the mark.
- 2.3** Alternative answers acceptable for the same mark are indicated by the use of **OR**. Different terms in the mark scheme are shown by a/; eg allow smooth/free movement.

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error/contradiction negates each correct response. So, if the number of errors/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (often prefaced by 'Ignore' in the 'Comments' column of the mark scheme) are not penalised.

3.2 Marking procedure for calculations

Full marks can be given for a correct numerical answer, without any working shown.

However, if the answer is incorrect, mark(s) can usually be gained by correct substitution/working and this is shown in the 'Comments' column or by each stage of a longer calculation.

3.3 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.4 Errors carried forward, consequential marking and arithmetic errors

Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation ECF or consequential in the mark scheme.

An arithmetic error should be penalised for one mark only unless otherwise amplified in the mark scheme. Arithmetic errors may arise from a slip in a calculation or from an incorrect transfer of a numerical value from data given in a question.

3.5 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.6 Brackets

(.....) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.7 Ignore/Insufficient/Do not allow

Ignore or insufficient is used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

Do **not** allow means that this is a wrong answer which, even if the correct answer is given, will still mean that the mark is not awarded.

Question	Marking guidance	Mark	Comments
01.1	(N-containing) Amino acids/proteins/nucleic acids/DNA/RNA/ ATP/NAD(H)/NADP(H)/FAD(H ₂); (No N) Carbohydrate/glucose/fructose/maltose/sucrose/starch/cellulose/ triglyceride;	2	Allow other correct named substances

Question	Marking guidance	Mark	Comments
01.2	Nitrate;	1	Ignore NO ₃ ⁻

Question	Marking guidance	Mark	Comments
01.3	P – Nitrogen fixation; Q – Nitrification;	2	Q – Allow oxidation

Question	Marking guidance	Mark	Comments
01.4	Decomposers/saprophytic (bacteria);	1	Allow saprobionts / saprobiotic (bacteria) / saprotrophs / saprophytes / ammonifying (bacteria) / putrefying (bacteria)

Question	Marking guidance	Mark	Comments
01.5	73/72.7(27) (%);	1	Allow correct answer to any number of decimal places

Question	Marking guidance	Mark	Comments
01.6	1. Ploughing ensures air/oxygen in soil; 2. Denitrifying bacteria/denitrification require(s) anaerobic conditions;	2	

Question	Marking guidance	Mark	Comments
02.1	Both alleles expressed (in phenotype);	1	

Question	Marking guidance	Mark	Comments
02.2	Individual 1 – I ^A I ^O ; Individual 3 – I ^B I ^O ;	2	

Question	Marking guidance	Mark	Comments
02.3	1. Genetic diagram showing individual 5 I ^A I ^O and individual 6 I ^O I ^O ; 2. Correct probability 0.5 or 50%;	2	

Question	Marking guidance	Mark	Comments
02.4	0.63;	1	

Question	Marking guidance	Mark	Comments
02.5	Statistical test: Chi-squared Reason for choice: (as) comparing observed with expected (frequencies);	1	

Question	Marking guidance	Mark	Comments
02.6	3;	1	

Question	Marking guidance	Mark	Comments
02.7	<p>1. People with some blood group(s) at more risk of cancer and may not survive to reproduce</p> <p>OR</p> <p>People with some blood group(s) are selected against;</p> <p>2. (So) some alleles may not be passed on</p> <p>OR</p> <p>(So) allele frequency of some alleles may change;</p>	2	

Question	Marking guidance	Mark	Comments
03.1	20 : 1; 0.04 times;	2	Allow 25 times Allow one mark for correct number times greater from incorrect ratio Allow one mark for correct population sizes from graph (600 moose and 30 wolf) if no other marks awarded

Question	Marking guidance	Mark	Comments
03.2	(Wolf population decreases because) more competition for food OR (Wolf population decreases) due to hunting OR (Wolf population decreases) due to disease;	1	

Question	Marking guidance	Mark	Comments
03.3	<p>Must have at least one yes for full marks</p> <p>Yes:</p> <ol style="list-style-type: none"> 1. Moose population decreasing when wolf number increasing; 2. Idea that cyclical pattern shows relationship between two populations; <p>No:</p> <ol style="list-style-type: none"> 3. Population may decrease due to disease; 4. Population may decrease due to competition for a named factor; 5. Population may decrease due to hunting/other predators; 6. Much steeper decrease in moose population size eg compared to 2002–2006; 7. Wolf population same or higher in other years without having same effect on moose population; 	4 max	

Question	Marking guidance	Mark	Comments
03.4	<ol style="list-style-type: none"> 1. Moose that survived may have selective advantage; 2. (More likely to) produce more offspring; 3. Favourable <u>alleles</u> passed on to next generation; 4. Increases frequency of favourable <u>alleles</u> (in gene pool); 	3 max	1. Allow valid selective advantage

Question	Marking guidance	Mark	Comments
04.1	Any two from: <ul style="list-style-type: none"> • Age of seeds • Timing of watering of seeds not controlled • Volume of water not controlled • Only 3 seed densities • Soil/sand mixture may not be ideal for seedlings; 	2	Do not allow reference to seeds from different plants (as intraspecific competition)

Question	Marking guidance	Mark	Comments
04.2	1. Heat (in an oven at suitable temperature); 2. (Weigh) until no further change of mass;	2	1. Suitable temperature eg 95–105 °C

Question	Marking guidance	Mark	Comments
04.3	1. No significant difference (between day of shoot appearance at different densities); 2. As P value greater than 0.05/5%;	2	1. Allow accept the null hypothesis OR difference is due to chance 1. Do not allow results due to chance OR results are not significant

Question	Marking guidance	Mark	Comments
04.4	1. As seed plant density increases mean dry biomass increases; 2. No significant difference in dry mass in seedlings at low and medium density; 3. Seedlings in high density significantly greater dry mass;	2 max	2. Allow difference in dry mass in seedlings at low and medium density due to chance

Question	Marking guidance	Mark	Comments
04.5	1. Shoots in high density have longer growing time; 2. (So) more time to photosynthesise (and produce more biomass);	2	

Question	Marking guidance	Mark	Comments																																								
05.1	<p>1. Without weedkiller and with weedkiller in column 1;</p> <p>2. Column headings and units (in column headings only) eg ‘Time for indicator to change colour / s’ and ‘Mean time / s’, no mixed units;</p> <p>3. Correct times and correct means calculated and given to consistent number of decimal places;</p>	3	<p>1. Allow in row 1 rather than column 1</p> <p>For example:</p> <table><tr><td></td><td colspan="4">Time for indicator to change colour / s</td></tr><tr><td></td><td>1</td><td>2</td><td>3</td><td>Mean</td></tr><tr><td>Without weedkiller</td><td>80</td><td>120</td><td>90</td><td>96.7</td></tr><tr><td>With weedkiller</td><td>186</td><td>225</td><td>220</td><td>210.3</td></tr></table> <table><tr><td></td><td colspan="4">Time for indicator to change colour / minutes</td></tr><tr><td></td><td>1</td><td>2</td><td>3</td><td>Mean</td></tr><tr><td>Without weedkiller</td><td>1.33</td><td>2.00</td><td>1.50</td><td>1.61</td></tr><tr><td>With weedkiller</td><td>3.10</td><td>3.75</td><td>3.67</td><td>3.51</td></tr></table> <p>Allow vertical orientation</p>		Time for indicator to change colour / s					1	2	3	Mean	Without weedkiller	80	120	90	96.7	With weedkiller	186	225	220	210.3		Time for indicator to change colour / minutes					1	2	3	Mean	Without weedkiller	1.33	2.00	1.50	1.61	With weedkiller	3.10	3.75	3.67	3.51
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Question	Marking guidance	Mark	Comments
05.2	Any two from: <ul style="list-style-type: none"> • Non-linear x-axis scale • Incorrect unit for rate • Extrapolation to 0; 	2	Allow converse e.g. line should start at 20 Allow should be curve or line of best fit

Question	Marking guidance	Mark	Comments
05.3	0.017/0.0168;	2	Allow one mark for correct readings from the graph Allow one mark for correct rate from incorrect readings from the graph

Question	Marking guidance	Mark	Comments
05.4	Curve above existing with steeper increase and higher/same plateau;	1	

Question	Marking guidance	Mark	Comments
05.5	1. More CO ₂ reacts with RuBP forming GP; 2. More GP <u>reduced</u> to triose phosphate; 3. More triose phosphate converted to named organic substances eg glucose, starch, cellulose, amino acids, proteins, RuBP;	3	More needed once for full marks

Question	Marking guidance	Mark	Comments
05.6	(Some) glucose used in respiration;	1	

Question	Marking guidance	Mark	Comments
06.1	Pie chart with each segment calculated as % (of 360) OR bar chart with method of seed distribution on x-axis and % on y-axis;	1	

Question	Marking guidance	Mark	Comments
06.2	1. Faeces contain N-containing substance for amino acid/protein synthesis; 2. Faeces contain phosphates for nucleic acid/ATP synthesis; 3. Faeces contain magnesium for chlorophyll; 4. Faeces contain water for seed germination; 5. Seeds passing through digestive system may germinate better;	2 max	1. Allow named N-containing substance eg ammonia/ammonium ions/uric acid/allow nitrate Allow function of other named substance eg potassium/calcium If no other mark awarded allow faeces contain named inorganic substance used for growth

Question	Marking guidance	Mark	Comments
06.3	1. Random sampling OR method described; 2. Large sample size OR suitable large sample suggested;	2	

Question	Marking guidance	Mark	Comments
06.4	<p>1. Colonisation by <i>Elymus arenarius</i></p> <p>OR</p> <p><i>Elymus arenarius</i> is pioneer species;</p> <p>2. (<i>Elymus arenarius</i>) makes environment/abiotic conditions less hostile/more suitable for <i>Cochlearia officinalis</i> and/or <i>Cerastium fontanum</i>;</p> <p>3. Named earlier species outcompeted;</p> <p>4. Overall increase in species diversity/biodiversity;</p>	3 max	If no other mark awarded, allow 1 mark for principle of pioneer species changing abiotic conditions OR previous species outcompeted by new species

Question	Marking guidance	Mark	Comments
06.5	<p>Any one from:</p> <ul style="list-style-type: none"> • Succession takes a long time • Environmental conditions still changing • Natural event prevents succession • Human activity eg grazing, farming; 	1	

Question	Marking guidance	Mark	Comments
07.1	<ol style="list-style-type: none"> 1. Carry hydrogen atoms/protons and electrons (from one molecule to another); 2. Reduced NADP used to reduce glycerate-3-phosphate/GP to triose phosphate; 3. Reduced NAD donates/transfers electrons to electron transfer chain; 4. Protons from reduced NAD pumped across inner mitochondrial membrane/to intermembrane space; 5. Protons diffuse through ATP synthase (embedded in membranes); 6. (Energy from movement of protons through ATP synthase) used to join ADP with phosphate; 7. Description of role of coenzyme A in transferring acetyl (from link reaction to Krebs cycle); 	6 max	3. and 4. Allow reference to FAD/reduced FAD

Question	Marking guidance	Mark	Comments
07.2	<p>1. Photosynthesis does not produce enough ATP to meet all plant requirements;</p> <p>2. No photosynthesis at night/when dark;</p> <p>3. Not all parts of plants photosynthesise;</p> <p>4. ATP cannot be stored</p> <p>OR</p> <p>ATP has to be produced continuously</p> <p>OR</p> <p>ATP cannot move from cell to cell;</p>	4	

Question	Marking guidance	Mark	Comments
07.3	<p>1. Light may be reflected</p> <p>OR</p> <p>light may miss chlorophyll molecule/chloroplasts;</p> <p>2. Not all wavelengths of light used for photosynthesis;</p> <p>3. Not all parts of organism are eaten;</p> <p>4. Some parts of organism not digested</p> <p>OR</p> <p>Some parts of organism are lost in faeces;</p> <p>5. Energy is lost in urine/urea/excretion;</p> <p>6. Energy lost as heat from respiration;</p>	5 max	