

INTERNATIONAL A-LEVEL **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.

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	1. Protons for reduction of NADP OR Protons used to produce ATP; 2. Electrons to (replace those lost from) chlorophyll OR Electrons to electron transfer chain OR Electrons to produce ATP OR Electrons for reduction of NADP;	2	1. Allow other correct ways of expressing eg H ⁺ for protons Allow for one mark provides protons and electrons if neither marking point awarded

Question	Marking guidance	Mark	Comments
01.2	1. ATP/adenosine triphosphate; 2. Reduced NADP;	2	2. Allow other correct ways of expressing reduced NADP eg NADPH

Question	Marking guidance	Mark	Comments
01.3	Stroma;	1	

Question	Marking guidance	Mark	Comments
01.4	X - Carbon dioxide; Y – Glycerate(-3-)phosphate;	2	Allow CO ₂ Allow GP Allow (3-) phosphoglycerate or phosphoglyceric acid

Question	Marking guidance	Mark	Comments
01.5	Rubisco;	1	Allow correct alternatives eg ribulose biphosphate carboxylase/oxygenase

Question	Marking guidance	Mark	Comments
01.6	Regeneration of RuBP (so that more carbon dioxide can be fixed);	1	

Question	Marking guidance	Mark	Comments
01.7	Any two correct named organic substances;	1	eg glucose, starch, cellulose, amino acids, proteins

Question	Marking guidance	Mark	Comments
02.1	0.72;	1	

Question	Marking guidance	Mark	Comments
02.2	Days 1 – 5: fatty acids/lipids are respiratory substrates; Day 5 – 7: mixture of respiratory substrates/protein/amino acids; Days 7 – 9: carbohydrate/glucose is (the main) respiratory substrate;	3	

Question	Marking guidance	Mark	Comments
02.3	Anaerobic respiration OR mixture of aerobic and anaerobic respiration OR other respiratory substrates;	1	eg organic acids

Question	Marking guidance	Mark	Comments
03.1	<p>Mark as pairs: 1 and 2 OR 3 and 4</p> <p>1. Rate of photosynthesis is higher;</p> <p>2. Due to more vegetation OR due to higher temperature OR due to longer days/more light;</p> <p>3. Weather is warmer;</p> <p>4. (So) less (fossil) fuel used/burned;</p>	2	<p>3. Allow Weather is cooler;</p> <p>4. Allow (Weather is cooler so) less (fossil) fuel used to power air conditioning;</p>

Question	Marking guidance	Mark	Comments
03.2	<p>1. Carbon dioxide is a greenhouse gas;</p> <p>2. (More) greenhouse gases/CO₂ absorb (more) heat;</p> <p>3. More heat is (re-)radiated back to Earth;</p>	3	<p>2. and 3. Need reference to more heat at least once for full marks</p>

Question	Marking guidance	Mark	Comments
03.3	<p>1. Damage to plants eg from heavy rain/pests/pathogens;</p> <p>2. Waterlogged soil so less oxygen for nitrifying bacteria/nitrification</p> <p>OR</p> <p>Waterlogged soil so anaerobic conditions for denitrifying bacteria/denitrification;</p> <p>3. Waterlogged soil so less oxygen for aerobic respiration/ATP production in roots;</p> <p>4. (Less ATP) for active transport (of ions) into roots;</p> <p>5. Less named ions for producing named biological molecules;</p> <p>6. Leaching of ions from soil;</p>	4	

Question	Marking guidance	Mark	Comments
04.1	Reduction/conversion of nitrogen (gas)/N ₂ to ammonia/NH ₃ /ammonium compounds/NH ₄ ⁺ ;	1	Do not allow nitrites/nitrates

Question	Marking guidance	Mark	Comments
04.2	<p>1. Legume – gains source of nitrogen so more named N-containing biological molecules (for growth);</p> <p>2. Bacteria – gain source of carbohydrate from plant so source of energy (for growth);</p>	2	<p>1. Allow named source of nitrogen</p> <p>1. Named N-containing biological molecules eg amino acids/proteins</p> <p>2. Allow named carbohydrate</p>

Question	Marking guidance	Mark	Comments
04.3	Arrange values in numerical order and find middle value;	1	

Question	Marking guidance	Mark	Comments
04.4	<p>Mark as pairs: 1 and 2 OR 3 and 4 OR 5 and 6</p> <ol style="list-style-type: none"> 1. Phosphate needed for ATP synthesis OR more ATP available; 2. ATP provides energy for nitrogen-fixation/synthesis of named organic molecule (for growth of crop); 3. Phosphate is needed for synthesis of nucleic acids/phospholipids; 4. So more cell division (for growth of crop); 5. Phosphate needed for NADP synthesis; 6. So more photosynthesis (for growth of crop); 	2	

Question	Marking guidance	Mark	Comments
04.5	<p>Any three from:</p> <ul style="list-style-type: none"> • Cost of treatment/seeds • Dosage/amount/concentration of nitrogen-fixing bacteria/phosphate needed • Effectiveness on other crops • If the investigation was completed in laboratory/field • Environmental effects eg leaching, weed growth • Reference to composition of soil before treatment • If the scientists are biased or not • Germination of seeds compared to untreated;;; 	3	

Question	Marking guidance	Mark	Comments
05.1	<p>Any two from:</p> <ul style="list-style-type: none"> • Volume of water • Seed variety/age • Length of time seeds grow for • Measurement strategy;; 	2	<p>Do not allow:</p> <ul style="list-style-type: none"> • temperature • number of seeds • light • size of dish

Question	Marking guidance	Mark	Comments
05.2	<p>1. (Disinfectant) to kill/prevent contamination with bacteria/fungi;</p> <p>2. (So) bacteria/fungi don't compete with seeds/seedlings (for resources)</p> <p>OR</p> <p>(So) bacteria/fungi don't kill the seeds/seedlings</p> <p>OR</p> <p>(So) bacteria/fungi don't cause disease in seeds/seedlings;</p> <p>3. (20°C) to provide suitable temperature for enzymes;</p> <p>4. (So) named enzyme-controlled reaction can occur;</p>	4	<p>2. Allow prevent germination</p> <p>4. Named example eg hydrolysis, synthesis, respiration</p> <p>4. Allow other correct effect of optimum temperature</p>

Question	Marking guidance	Mark	Comments
05.3	Any two from: <ul style="list-style-type: none"> do repeats and calculate mean measure length of whole seedling measure (seedling) after specified time determine (dry) mass of seedlings use optimum temperature for seedlings;; 	2	Repeat at least twice more Ignore differences between seeds eg mass

Question	Marking guidance	Mark	Comments
05.4	Damaged seedling(s) (included in mean) OR Seedling(s) that didn't grow (included in mean);	1	Allow examples of damage eg disease Allow not enough water

Question	Marking guidance	Mark	Comments
05.5	1. Suitable type of graph and correct orientation and suitable scale and both axes fully labelled; 2. All 10 points plotted correctly;; 3. Line of best fit excluding anomaly OR ruled point to point excluding anomaly;	4	2. Allow one mark for 7, 8, or 9 points correct 2. Allow a tolerance of $\pm \frac{1}{2}$ small square

Question	Marking guidance	Mark	Comments
05.6	As number of seeds (per dish) increases, (shoot) length decreases;	1	Allow negative correlation

Question	Marking guidance	Mark	Comments
05.7	1. Spearman rank OR correlation coefficient; 2. No (significant) correlation/relationship between number of seeds (per dish) and seedling (shoot) length;	2	1. Allow other named correlation test eg Pearson

Question	Marking guidance	Mark	Comments
06.1	1. Eggs less likely to be damaged (by host parents); 2. Offspring (larger/more developed so) better competitors/get more food (than host offspring);	2	

Question	Marking guidance	Mark	Comments
06.2	1. Asian koel has <u>higher</u> survival rate; 2. Host 44.8/45 % survival rate and Asian koel 70.6/71 % survival rate;	2	1. Accept converse 2. Allow probabilities Asian koel 1.6 times more likely to survive = 2 marks

Question	Marking guidance	Mark	Comments
06.3	Correct answer of 1.3 in all three boxes in Table 3 = 2 marks ;; 1.3 in two boxes in Table 3 = 1 mark OR Correct answers in all three boxes not to 1 decimal place = 1 mark ;	2	Correct answers not to one decimal place: 1.30(43), 1.33(92), 1.33(33)

Question	Marking guidance	Mark	Comments
06.4	<p>Does not use mimicry because:</p> <ol style="list-style-type: none"> 1. Asian koel eggs have a different egg shape ratio to host eggs in crow and shrike; 2. No <u>significant</u> difference in length/width of Asian koel eggs in different host nests; 3. Asian koel eggs have a <u>significantly</u> smaller length/width than crow eggs; 4. Asian koel eggs have a <u>significantly</u> larger length/width than shrike eggs; <p>May use mimicry because:</p> <ol style="list-style-type: none"> 5. No information about colour/pattern (of eggs); 6. No information about volume OR idea that only one measurement of width; 7. Asian koel eggs have same egg shape ratio as myna eggs; 8. No <u>significant</u> difference in length/width of Asian koel eggs compared to myna eggs; 9. Asian koel eggs only compared to three host birds so may use mimicry with others; 10. No information about sample size so may not be representative; 	5	<p>For full marks must have 'significance' at least once Must have at least one for and one against for max marks</p> <p>3. and 4. If no reference to smaller/larger allow 1 mark for <u>significant</u> length/width difference between Asian koel eggs and crow and shrike eggs</p> <p>9. Allow so cannot be generalised</p>

Question	Marking guidance	Mark	Comments
07.1	<p>White</p> <p>1. If A present (AA or Aa) then white squash;</p> <p>2. Enzyme 1 inhibited/inactive;</p> <p>Green</p> <p>3. If aabb then green squash;</p> <p>4. Enzyme 1 active but no Enzyme 2 produced;</p> <p>Yellow</p> <p>5. If aaBB or aaBb then yellow squash;</p> <p>6. Enzyme 1 active <u>and</u> Enzyme 2 produced;</p>	6	

Question	Marking guidance	Mark	Comments
07.2	<ol style="list-style-type: none"> Frequency of genetic condition is q^2; Square root to find q; Use $p + q = 1.0$ to find frequency of dominant allele; Use $2pq$ to find frequency of heterozygotes; For one mark any two from: <ul style="list-style-type: none"> no mutations population is isolated population is large no selection diploid; 	5	5. Ignore random mating

Question	Marking guidance	Mark	Comments
07.3	<ol style="list-style-type: none"> Variation in population (of bacteria); Bacteria with the allele have a selective advantage; Bacteria with the allele more likely to survive and reproduce; Pass on the allele (increasing frequency in population); 	4	4. Allow horizontal gene transmission