OXFORD AQA
INTERNATIONAL QUALIFICATIONS

INTERNATIONAL A-LEVEL

BIOLOGY (9610)

BL03

Unit 3 Populations and Genes

Mark scheme

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2 5 1 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.

Further copies of this mark scheme are available from oxfordaqa.com

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 <u>not</u> 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	Biotic, abiotic, community, niche;;	2	Allow 1 mark for 2 or 3 correct terms

Question	Marking guidance	Mark	Comments
01.2	1. Suitable x-axis scale **and** labelled Energy / kJ m^{-3} $year^{-1}$; 2. All bars drawn to correct scale **and** labelled (Microscopic algae, Worms, Trout, Parasitic lice);	2	2. Bars should be pyramid shaped 2. Allow +/- half small square for width of bars

Question	Marking guidance	Mark	Comments
01.3	1. Energy loss (between trophic levels); 2. Due to respiration/heat **OR** due to uneaten/undigested parts of organisms;	2	

Question	Marking guidance	Mark	Comments
01.4	1.2×10^{12};;	2	Allow 1 mark for correct answer not in standard form Allow 1 mark for 1.2×10^{x}

Question	Marking guidance	Mark	Comments
01.5	1. One trout would have many lice; 2. Total energy content of lice is less than energy content trout;	2	

Question	Marking guidance	Mark	Comments
02.1	Directional;	1	

Question	Marking guidance	Mark	Comments
02.2	Curve drawn skewed to left of mean **OR** new normal distribution curve to left of mean;	1	

Question	Marking guidance	Mark	Comments
02.3	(**Yes**) 1. Geographical isolation due to Central Valley; 2. Reproductive separation of east and west populations; 3. Different environmental conditions **OR** different selection pressures **OR** different abiotic/biotic factors (at coast than inland); 4. Mutations lead to differences in colouration; (**No**) 5. All sub-species are same (genus and) species **so** no speciation has occurred; 6. Some sub-species (in west/south) not geographically isolated but do not interbreed/reproductively isolated **OR** some sub-species (in west/south) not geographically isolated **so** may be sympatric/not allopatric; 7. Some sub-species (in east or in west) still interbreed **so** speciation may not occur;	5 max	1. Allow idea that geographically separated 2. Allow no gene flow or cannot interbreed

Question	Marking guidance	Mark	Comments
03.1	Leaching; Eutrophication;	2	

Question	Marking guidance	Mark	Comments
03.2	1. (Build-up of nutrients) causes algal bloom blocking light; 2. Less photosynthesis **so** plants/algae die **OR** less photosynthesis **so** less oxygen produced; 3. Saprophytes/decomposers use oxygen (in respiration); 4. (Less oxygen so) less (aerobic) respiration **so** fish die/fish population decreases;	3 max	1. Allow rapid growth of algae for algal bloom

Question	Marking guidance	Mark	Comments
03.3	1. No further increase in yield with increasing fertiliser mass; 2. Smaller increases in protein content with increasing fertiliser mass; 3. Idea of greatest profit qualified; 4. Use of data e.g. protein content increases by 0.8% compared to 0.4% **or** 0.2% **OR** $10 profit per hectare compared to $4 with 50 kg **or** loss with 75 kg and 100 kg;	4	

Question	Marking guidance	Mark	Comments
04.1	1. Genetic bottleneck **OR** severe reduction in population size (due to hunting); 2. Reduction in gene pool **OR** many alleles lost; 3. (So) only limited variety of alleles passed on **OR** seals interbreed with others with similar alleles **OR** no new alleles coming into population as isolated **OR** new alleles due to mutation which happens rarely;	3	

Question	Marking guidance	Mark	Comments
04.2	9.47 / 9.5 (kg day^{-1});	1	Allow correct answer (9.47368) to any number of decimal places

Question	Marking guidance	Mark	Comments
04.3	1. No overlap in standard deviations; 2. Indicates that difference is (likely to be) significant **OR** difference is not due to chance;	2	2. Allow reference to ‘reject null hypothesis’ 2. Do not allow ‘results significant’ or ‘results due to chance’

Question	Marking guidance	Mark	Comments
04.4	(Recognise own pup) (idea of) high energy cost to mother **OR** to protect her own pup; (Feed other pups) as genetically related **OR** for survival of colony **OR** to increase population of colony;	2	

Question	Marking guidance	Mark	Comments
05.1	Any **two** from: • Temperature using a (thermostatically controlled) water bath • Concentration of sugar solution by adding same mass of sugar per unit volume • pH using a buffer solution;;	2 max	

Question	Marking guidance	Mark	Comments
05.2	12 (mm);	1	

Question	Marking guidance	Mark	Comments
05.3	33.0;;;	3	2 marks for correct answer ($3.14 \times 0.5^2 \times 14 \times 3$) not given to 1 decimal place e.g. 32.97 2 marks for 131.9 ($3.14 \times 1^2 \times 14 \times 3$) – diameter used instead of radius 2 marks for 65.9 ($3.14\times 0.5 \times 14 \times 3$) radius not squared 1 mark for $3.14 \times 0.5^2 \times 14$ **or** 10.99

Question	Marking guidance	Mark	Comments
05.4	Volume change with solution to absorb oxygen/carbon dioxide **and** Volume change without solution to absorb oxygen/carbon dioxide;	1	

Question	Marking guidance	Mark	Comments
05.5	1.36 (times more);;	2	Allow correct answer (1.359375) to any number of decimal places e.g. 1.4 Rounding must be correct 1 mark for both correct readings from graph (maltose = 87 **and** glucose = 64) 1 mark for correct number of times more from incorrect readings

Question	Marking guidance	Mark	Comments
05.6	(**Yes**) 1. Highest volume of carbon dioxide produced; (**No**) 2. Glucose starting to plateau **OR** maltose still increasing; 3. Only tested four sugars **OR** did not test other respiratory substrate(s);	3	2. Allow idea that maltose might reach same volume

Question	Marking guidance	Mark	Comments
05.7	1. Lactose starts increasing before fructose - lactose at 25 minutes **or** fructose at 57 minutes; 2. Both same volume of carbon dioxide at 3 cm^3 **or** 80-90 minutes; 3. Lactose plateaus (after 80 minutes), **and** fructose increases steadily/does not plateau; 4. Final volume of carbon dioxide 3 cm^3 with lactose **and** 9 cm^3 with fructose **OR** final volume of carbon dioxide 3x higher with fructose (than lactose);	3 max	1. and 2. Allow +/- 1 minute for times

Question	Marking guidance	Mark	Comments
05.8	Difficult for yeast to hydrolyse lactose (into its monomers);	1	Allow yeast needs enzyme/lactase

Question	Marking guidance	Mark	Comments
06.1	68 (megatonnes);	1	

Question	Marking guidance	Mark	Comments
06.2	13.2 / 13.16 (%);;;	3	2 marks for correct total percentage increase (53 / 52.6 / 52.63 %) 1 mark for correct values from graph (current 76, predicted 116) 1 mark for correct total percentage increase from incorrect values from graph in range current 76±1 and predicted 116±1

Question	Marking guidance	Mark	Comments
06.3	1. Increases metabolic rate **so** food intake increases; 2. Increases population growth rate **so** feed on more crops;	2	

Question	Marking guidance	Mark	Comments
06.4	(**Yes**) 1. True for maize (approx.19% per °C so > 15%); (**No**) 2. Use of data about wheat **OR** rice showing not over 15%; 3. Only information about 3 grain crops **so** may not be true for all; 4. Crop loss based on prediction/modelling; 5. No statistical test to show if increase is significant; 6. Reference to uncertainty with regards to temperature increase;	4 max	

Question	Marking guidance	Mark	Comments
07.1	1. (Chlorophyll) absorbs light (energy); 2. (Light energy) excites electrons **OR** electrons emitted; 3. (Energy from) excited electrons generates ATP (and reduced NADP); 4. Photolysis of water; 5. Produces electrons that replace those lost from chlorophyll;	5	1. Allow light (energy) 'hits' chlorophyll 1. Allow photon for light (energy) 2. Allow photoionisation 3. Allow photophosphorylation 4. Allow description of photolysis

Question	Marking guidance	Mark	Comments
07.2	1. (Series of) oxidation/dehydrogenation (and reduction) reactions; 2. Generates reduced coenzymes/NAD/FAD; 3. (Reduced coenzymes) transfer electrons to electron transfer chain; 4. (Idea of) substrate-level phosphorylation;	4	1. Allow description of oxidation e.g. H removed from substrates 2. Allow alternative names e.g. NADH 2. Do not allow reduced NADP or NADPH 3. Allow 'transfer electrons for oxidative phosphorylation'

Question	Marking guidance	Mark	Comments
07.3	1. Restricting movement **so** less energy is used (in muscle contraction); 2. Keeping environment warm **so** less heat loss (from the body); 3. Controlled feeding **so** animals receive (idea of) optimum nutrition; 4. Excluding predators/pests (of animals) **so** no loss to other organisms; 5. Selective breeding (of animals) **so** faster growth rate; 6. Using hormones **so** growth rate is increased; 7. Using antibiotics (in animals) **so** disease prevented; 8. Using herbicides **so** less competition between crop plants and weeds; 9. Using pesticides **so** less crop loss/damage (by pests); 10. Using fertilisers **so** growth rate increased;	6 max	9. Allow examples of pesticides e.g. fungicide, insecticide