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Paper 1 Biology Extension

Mark scheme

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2 2 B Y 9 2 0 4 / B E / 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 [oxfordaqaexams.org.uk](https://www.oxfordaqaexams.org.uk)

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Level of response marking instructions

Level of response mark schemes are broken down into levels, each of which has a descriptor. The descriptor for the level shows the average performance for the level. There are marks in each level.

Before you apply the mark scheme to a student's answer read through the answer and annotate it (as instructed) to show the qualities that are being looked for. You can then apply the mark scheme.

Step 1 Determine a level

Start at the lowest level of the mark scheme and use it as a ladder to see whether the answer meets the descriptor for that level. The descriptor for the level indicates the different qualities that might be seen in the student's answer for that level. If it meets the lowest level then go to the next one and decide if it meets this level, and so on, until you have a match between the level descriptor and the answer. With practice and familiarity you will find that for better answers you will be able to quickly skip through the lower levels of the mark scheme.

When assigning a level you should look at the overall quality of the answer and not look to pick holes in small and specific parts of the answer where the student has not performed quite as well as the rest. If the answer covers different aspects of different levels of the mark scheme you should use a best fit approach for defining the level and then use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 3 with a small amount of level 4 material it would be placed in level 3 but be awarded a mark near the top of the level because of the level 4 content.

Step 2 Determine a mark

Once you have assigned a level you need to decide on the mark. The descriptors on how to allocate marks can help with this. The exemplar materials used during standardisation will help. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the student's answer with the example to determine if it is the same standard, better or worse than the example. You can then use this to allocate a mark for the answer based on the Lead Examiner's mark on the example.

You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

Indicative content in the mark scheme is provided as a guide for examiners. It is not intended to be exhaustive and you must credit other valid points. Students do not have to cover all of the points mentioned in the Indicative content to reach the highest level of the mark scheme.

An answer which contains nothing of relevance to the question must be awarded no marks.

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement
- the Assessment Objectives, level of demand and specification content that each question is intended to cover.

The extra information 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 and underlining

- 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 a mark are indicated by the use of **or**. Different terms in the mark scheme are shown by a / ; eg allow smooth/free movement.
- 2.4** Any wording that is underlined is essential for the marking point to be awarded.

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 (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution?

[1 mark]

Student	Response	Marks awarded
1	green, 5	0
2	red*, 5	1
3	red*, 8	0

Example 2: Name two planets in the solar system.

[2 marks]

Student	Response	Marks awarded
1	Neptune, Mars, Moon	1
2	Neptune, Sun, Mars, Moon	0

3.2 Use of chemical symbols/formulae

If a student writes a chemical symbol/formula instead of a required chemical name, full credit can be given if the symbol/formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Marks should be awarded for each stage of the calculation completed correctly, as students are instructed to show their working. Full marks can, however, be given for a correct numerical answer, without any working shown.

3.4 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.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward is kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation ecf in the marking scheme.

3.6 Phonetic spelling

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

3.7 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.

3.8 Allow

In the mark scheme additional information, 'allow' is used to indicate creditworthy alternative answers.

3.9 Ignore

Ignore 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.

3.10 Do not accept

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

Question	Answers	Mark	AO/Spec. Ref.
01.1	Level 3: Relevant points are identified, given in detail and logically linked to form a clear account.	5–6	AO3 3.3.2.d/f
	Level 2: Relevant points are identified, given in detail and there are attempts at logical linking. The resulting account is not fully clear.	3–4	AO2 3.3.2.d/f
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	AO2 3.3.2.d/f
	No relevant content.	0	
	Indicative content • backward pointing spikes on tongue for catching / holding onto fish • sharp beak to kill prey • flipper-like wings for swimming to hunt for food • because penguins need lots of energy / food in a cold environment • layer of fat under the skin for insulation in a cold environment • layer of fat under the skin for thermoregulation • because warm body temperature aids enzyme action • smooth, waterproof feathers for swimming • streamlined body shape to swim fast to catch food • streamlined body shape to swim fast to escape predators		

Question	Answers	Extra information	Mark	AO/Spec. Ref.
01.2	increased chance of survival of offspring		1	AO1 3.4.5.b
	increased chance of parental alleles being passed on by the offspring	allow genes for alleles	1	

Question	Answers	Extra information	Mark	AO/Spec. Ref.
01.3	huddling	allow innate	1	AO1 3.3.2.f

Question	Answers	Extra information	Mark	AO/Spec. Ref.
01.4	measure temperature at start or put same temperature of water in all tubes	allow keep environmental temperature the same throughout the investigation	1	AO4 3.3.2.f
	measure temperature at the same time intervals or measure temperature after same period of time		1	
	calculate temperature differences		1	
	repeat (the experiment) and calculate a mean		1	

Question	Answers	Extra information	Mark	AO/Spec. Ref.
01.5	reduces heat loss (from penguins to the environment)	allow (penguins in a group) retain body heat for longer	1	AO3 3.3.2.f

Question	Answers	Extra information	Mark	AO/Spec. Ref.
01.6	heat released by penguins (through respiration / movement)	allow homeostasis	1	AO3 3.3.2.f

Question	Answers	Extra information	Mark	AO/Spec. Ref.
01.7	any one from: - less chance of harm to organisms - experiments can be repeated more easily - easier to collect results - easier to control conditions		1	AO3 3.3.2.f

Total			16	
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Question	Answers	Extra information	Mark	AO/Spec. Ref.
02.1	any two from: • disinfect the bench • wash hands • sterilise forceps • hold lid over agar when adding discs • secure lid on agar plate after adding discs	allow method described eg pass forceps through Bunsen flame	2	AO1 3.4.6.f

Question	Answers	Extra information	Mark	AO/Spec. Ref.
02.2	to show that the clear zone is caused by antibiotics	accept as a control (with no antibiotic) do not allow control variable	1	AO4 3.4.6.f

Question	Answers	Extra information	Mark	AO/Spec. Ref.																				
02.3	<table><tr><td></td><td>Dependent variable</td><td>Independent variable</td><td>Control variable</td></tr><tr><td>Diameter of clear zone around antibiotic disc</td><td>✓</td><td></td><td></td></tr><tr><td>Incubation temperature</td><td></td><td></td><td>✓</td></tr><tr><td>Species of bacteria used</td><td></td><td></td><td>✓</td></tr><tr><td>Type of antibiotic used</td><td></td><td>✓</td><td></td></tr></table>		Dependent variable	Independent variable	Control variable	Diameter of clear zone around antibiotic disc	✓			Incubation temperature			✓	Species of bacteria used			✓	Type of antibiotic used		✓		allow 1 mark for each correct column	3	AO1 3.4.6.f
	Dependent variable	Independent variable	Control variable																					
Diameter of clear zone around antibiotic disc	✓																							
Incubation temperature			✓																					
Species of bacteria used			✓																					
Type of antibiotic used		✓																						

Question	Answers	Extra information	Mark	AO/Spec. Ref.
02.4	mean area label and units on y-axis appropriate scale on y-axis all bars plotted accurately	allow 1 mark for 2 correctly drawn bars	1 1 2	AO2 3.4.6.f 6.3.9

Question	Answers	Extra information	Mark	AO/Spec. Ref.
02.5	(antibiotics) A has the largest clear zone	no mark for A allow largest area where bacteria killed	1	AO3 3.4.6.f

Question	Answers	Extra information	Mark	AO/Spec. Ref.
02.6	(area) 3.14×6.0^2	allow 3.14×36	1	AO2 3.4.6.f 6.3.10 6.3.14
	113.04	allow 113.09...	1	
	113 (mm ²)		1	

Question	Answers	Extra information	Mark	AO/Spec. Ref.
02.7	because (clear zones) all different sizes	allow C clearly has the largest clear zone	1	AO4 3.4.6.f

Total			15	
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Question	Answers	Extra information	Mark	AO/Spec. Ref.
03.1	(duodenum) E		1	AO1 3.2.3.a
	(gall bladder) F		1	
	(pancreas) C		1	

Question	Answers	Mark	AO/Spec. Ref.
03.2	Level 2: Scientifically relevant facts or processes are identified and given in detail to form an accurate account.	4–6	AO1 3.2.3.c
	Level 1: Facts or processes are identified and simply shared but their relevance is not clear.	1–3	
	No relevant content.	0	
	Indicative content • digestion breaks down large insoluble molecules to small soluble molecules • allows absorption of digested products (into bloodstream) • enzymes speed up the breakdown of molecules • amylase breaks down starch to glucose / sugars • protease breaks down protein to amino acids • lipase breaks down lipids to fatty acids and glycerol • bile emulsifies fat or bile causes fat to form smaller droplets • bile increases surface area of fats • bile neutralises stomach acid • bile provides neutral conditions for enzymes in small intestine to work • hydrochloric acid provides conditions for enzymes in the stomach to work • hydrochloric acid kills pathogens in the food		

Question	Answers	Extra information	Mark	AO/Spec. Ref.
03.3	enzymes work most efficiently / best at their optimum temperature	allow enzymes work best at 37(°C)	1	AO2 3.2.3.b
	and at high temperature the enzymes are denatured		1	
	which changes the shape of the active site		1	

Question	Answers	Extra information	Mark	AO/Spec. Ref.
03.4	pancreas / receptors detect low concentration of blood glucose	pancreas only needs to be mentioned once to allow mp1 and mp2 to be awarded	1	AO2 3.4.4.a/c
	so the pancreas releases glucagon		1	
	causing glycogen to be converted to glucose		1	
	therefore increasing the concentration of blood glucose or and glucose is released into the blood		1	

Total			16
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Question	Answers	Extra information	Mark	AO/Spec. Ref.
04.1	genetic information from two parents		1	AO2 3.5.1
	(genetic information) is mixed when gametes join (to produce seeds / plants / offspring)	‘(genetic information) is mixed at fertilisation (to produce seeds / plants / offspring)	1	

Question	Answers	Extra information	Mark	AO/Spec. Ref.
04.2	all the plants / flowers will be the same / clones	allow same desirable characteristics	1	AO3 3.5.5.a
	or shorter time to production of flowers	allow large numbers of plants produced quickly		

Question	Answers	Extra information	Mark	AO/Spec. Ref.
04.3	nitrate	allow other correct ions eg sulphate / phosphate	1	AO1 3.2.1.e

Question	Answers	Extra information	Mark	AO/Spec. Ref.
04.4	takes too long to measure them all	in this order	1	AO4 3.2.1.e
	cover a range of measurements / plants		1	
	or calculate a mean or more representative prevent bias	allow description eg not all taken from the edge / same position / selected for size	1	

Question	Answers	Mark	AO/Spec. Ref.
04.5	Level 2: A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.	3–4	AO3 3.2.1.c
	Level 1: Some logically linked reasons are given. There may also be a simple judgement.	1–2	
	No relevant content.	0	
	Indicative content Supports conclusion: • (18°C) shortest / quickest time for flowers to form (after planting) • (18°C) has highest score for flower quality • (18°C) more flowers can be harvested (than at lower temperatures) • (18°C) mean number of flowers on plant similar to higher temp • fewer flowers on a stem at lower temperatures Does not support conclusion: • stem length is shorter (18°C) than at 21°C • more flowers on a stem at 21°C • highest temperature seems to damage plant • more expensive to maintain higher temperature • lower temperature takes longer to develop Must include a statement supporting and a statement that does not support the conclusion to access level 2.		

Question	Answers	Extra information	Mark	AO/Spec. Ref.
04.6	10th percentile is 8 plants at 84 days		1	AO2 3.2.1.c 6.3.19
	90th percentile is 72 plants at 87 days		1	
	(84 to 87 =) 3 (days)		1	

Question	Answers	Extra information	Mark	AO/Spec. Ref.
04.7	any two from: • light intensity • volume / mass of fertiliser • fertiliser composition • watering regime • carbon dioxide concentration • each group has same age of plants (from tissue culture)	if no other mark awarded allow 1 mark for keep environmental conditions the same for all plants	2	AO4 3.2.1.c

Total			16	
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Question	Answers	Extra information	Mark	AO/Spec. Ref.
05.1	presence of an extra chromosome		1	AO2 3.4.6.a/e 3.5.4.b
	pathogen / virus		1	

Question	Answers	Extra information	Mark	AO/Spec. Ref.
05.2	heterozygous		1	AO1 3.5.3.g

Question	Answers	Extra information	Mark	AO/Spec. Ref.
05.3	Nn	in this order	1	AO3 3.5.3.e 3.5.4.a
	nn		1	

Question	Answers	Extra information	Mark	AO/Spec. Ref.
05.4	(person B) may be NN or Nn or (person B) may be homozygous or heterozygous		1	AO2 3.5.3.f/g
	the phenotype would be the same for both (NN and Nn) or both (NN and Nn) result in no cystic fibrosis		1	

Question	Answers	Extra information	Mark	AO/Spec. Ref.
05.5	any one from: - less air / oxygen can move into / out of the lungs - more infections / pathogens in lungs - less oxygen diffuses into blood (in alveoli) - cilia cannot move the mucus (easily)	allow less efficient gas exchange ignore breathing difficulties	1	AO2 3.2.4.a/c

Question	Answers	Extra information	Mark	AO/Spec. Ref.
05.6	N allele isolated using an enzyme (gene) inserted into vector / plasmid / virus (vector used to) insert gene into epithelial / lung cells	allow normal (CFTR) gene / allele isolated allow correct use of a correctly named enzyme in the process	1 1 1 1	(2) AO1 (2) AO2 3.5.5.b

Question	Answers	Extra information	Mark	AO/Spec. Ref.
05.7	any one from: - to see if it works - to identify side effects - to minimise effects of testing on humans	allow to check if it is safe	1	AO3 3.5.4.a

Total			13	
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Question	Answers	Extra information	Mark	AO/Spec. Ref.
06.1	cell membrane		1	AO2 3.2.2.n

Question	Answers	Extra information	Mark	AO/Spec. Ref.
06.2	DNA has a specific order of bases		1	(3) AO1 (1) AO2 3.5.3.i/j/k
	a gene is a section of DNA that codes for a protein		1	
	each amino acid is coded for by three bases		1	
	each antibody has a specific order of amino acids		1	

Question	Answers	Extra information	Mark	AO/Spec. Ref.
06.3	causes an impulse in a relay / motor neurone	allow to pass an impulse from one neurone to another neurone allow causes an impulse in the second / next neurone	1	AO1 3.4.1.d

Question	Answers	Extra information	Mark	AO/Spec. Ref.
06.4	any two from: - a series of enzyme-controlled reactions (in the blood) - fibrinogen changed into fibrin (by enzymes) - to form a network of fibres which traps blood cells		2	AO1 3.2.2.m

Total			8	
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Question	Answers	Extra information	Mark	AO/Spec. Ref.
07.1	act as catalyst or speed up the chemical reaction(s)	allow lowers activation energy or provides a different pathway for the reaction	1	AO2 3.2.3.b 3.2.5.b

Question	Answers	Extra information	Mark	AO/Spec. Ref.
07.2	$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$	allow CO_2 and H_2O in either order allow 1 mark for correct reactant and products unbalanced ignore names of chemicals	2	AO1 3.2.5.c

Question	Answers	Extra information	Mark	AO/Spec. Ref.
07.3	no mitochondria		1	AO3 3.2.2.j 3.2.5.b

Question	Answers	Extra information	Mark	AO/Spec. Ref.
07.4	any one from: - oxygen is not used up (by the cell) - more space for haemoglobin	allow more oxygen reaches the tissues ignore more oxygen is transported	1	AO3 3.2.2.j 3.2.5.b

Question	Answers	Extra information	Mark	AO/Spec. Ref.
07.5	any one from: • handle isopods carefully (when moving into boiling tubes) • provide food • use water from natural environment • make sure water is aerated (at the start) • return isopods to natural habitat • return isopods to sea water		1	AO3 3.3.2.a

Question	Answers	Extra information	Mark	AO/Spec. Ref.
07.6	rate of respiration increases as temperature increases	allow rate of oxygen uptake increases as temperature increases do not accept temperature increases as rate of oxygen uptake increases	1	AO3 3.2.5.b
	species A have higher rates of respiration than species B	allow species A have a higher rate of oxygen uptake than species B	1	

Question	Answers	Extra information	Mark	AO/Spec. Ref.
07.7	$\frac{0.8}{0.5} = 1.6$		1	AO2 3.2.5.c 6.3.10/12
	$\frac{10}{(10 - 5)} = 2$		1	
	$1.6^2 = 2.56$		1	

Question	Answers	Extra information	Mark	AO/Spec. Ref.
07.8	easy to compare different organisms / processes / experiments / temperatures	ignore to compare unqualified	1	AO3 3.2.5.c

Question	Answers	Extra information	Mark	AO/Spec. Ref.
07.9	two populations (of the species) became separated by depth		1	(3) AO1 (1) AO2 3.6.2.c
	each population had genetic variation		1	
	different alleles selected to help the organisms survive (in their different habitats) or individuals in each population reproduce and pass on advantageous alleles		1	
	eventually the populations could not interbreed to produce fertile offspring	allow eventually the populations could not interbreed successfully	1	

Total			16	
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