GCSE
COMBINED SCIENCE: TRILOGY
8464/B/2F

Biology Paper 2F

Mark scheme

June 2023

Version: 1.0 Final

2 3 6 G 8 4 6 4 / B / 2 F / 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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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 their judgement
- the Assessment Objectives 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 (for example, a scientifically correct answer that could not reasonably be expected from a student's knowledge of the specification).

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**.
Alternative words in the mark scheme are shown by a solidus 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** magnetic materials.

[2 marks]

Student	Response	Marks awarded
1	iron, steel, tin	1
2	cobalt, nickel, nail*	2

3.2 Use of symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, or uses symbols to denote quantities in a physics equation, 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. At any point in a calculation students may omit steps from their working. If a subsequent step is given correctly, the relevant marks may be awarded.

Full marks are **not** awarded for a correct final answer from incorrect working.

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

An error can be carried forward from one question part to the next and is shown by the abbreviation 'ecf'.

Within an individual question part, an incorrect value in one step of a calculation does not prevent all of the subsequent marks being awarded.

3.6 ic spelling

Marks should be awarded if spelling is not correct but the intention is clear, **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 <u>not</u> 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.

3.11 Numbered answer lines

Numbered lines on the question paper are intended to support the student to give the correct number of responses. The answer should still be marked as a whole.

4. Level of response marking instructions

Extended response questions are marked on level of response mark schemes.

- 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 two marks in each level.

Before you apply the mark scheme to a student's answer, read through the answer and, if necessary, 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. Do **not** look to penalise 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.

Use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 2 with a small amount of level 3 material it would be placed in level 2 but be awarded a mark near the top of the level because of the level 3 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.

You should ignore any irrelevant points made. However, full marks can be awarded only if there are no incorrect statements that contradict a correct response.

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

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	to produce garden compost		1	AO1 4.7.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	microorganism(s) / bacteria / fungi	allow decomposer(s) / microbe(s) allow mould / mushrooms ignore worm(s) / germ(s)	1	AO1 4.7.2.2 4.7.3.3 4.6.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	oxygen carbon dioxide	must be in this order only	1 1	AO1 4.7.2.2 4.7.3.3 4.6.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	$3\,700\,000 \times \frac{46}{100}$		1	AO2 4.7.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	any **one** from: • climate change • global warming	allow it is getting warmer	1	AO2 4.7.3.3 4.7.3.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.6	building factories quarrying rocks		1 1	AO1 4.7.3.3

Total Question 1	**8**

Question 2

Question	Answers	Mark	AO / Spec. Ref.
02.1	<table><tr><th>Variable</th><th>Independent variable</th><th>Dependent variable</th><th>Control variable</th></tr><tr><td>Distractions from background sounds</td><td></td><td></td><td>✓</td></tr><tr><td>Reaction time</td><td></td><td>✓</td><td></td></tr><tr><td>Type of stimulus</td><td>✓</td><td></td><td></td></tr></table> do **not** accept more than one tick in any row	1 1 1	AO1 4.5.2 RPA6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	repeat both methods 10 times		1	AO3 4.5.2 4.5.1 RPA6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	any **one** from: • practice • fewer distractions • familiarity (with test)	ignore repeating allow reference to effect of caffeine allow answers referring to competitiveness eg the student wanted to beat a previous time	1	AO3 4.5.2 4.5.1 RPA6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	2 bars correctly plotted **and** 2 bars correctly labelled as seeing (the stimulus) and hearing (the stimulus) (y axis label) (mean reaction) time in milliseconds / ms	allow a tolerance of ± ½ a small square allow any width bars touching or not allow bars in either order	1 1	AO2 4.5.2 4.5.1 RPA6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	(when seeing stimulus reaction time is) longer / greater / higher	allow converse for hearing stimulus if clearly stated allow bigger / larger allow slower (reaction time) allow slower (reactions) allow 130 milliseconds more ignore 130 milliseconds unqualified	1	AO3 4.5.2 4.5.1 RPA6

Total Question 2	**8**

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	line approximately perpendicular to river	allow on either side of river ignore length of line do **not** accept a line parallel to the river	1	AO2 4.7.2.1 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	quadrat		1	AO1 4.7.2.1 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	6 / six	ignore calculation / range given if mean is clear	1	AO2 4.7.2.1 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	increases		1	AO3 4.7.2.1 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	to know the uncertainty of the mean		1	AO3 4.7.2.1 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.6	light intensity moisture levels		1 1	AO1 4.7.1.2 4.7.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.7	more / increased carbon dioxide (in air) **or** less carbon dioxide absorbed / used (by plants) (due to) less photosynthesis	 allow (due to) more decay / burning (of plants) allow **2** marks for less carbon dioxide used for photosynthesis if no other mark awarded allow **1** mark for carbon dioxide is used in photosynthesis	1 1	AO2 4.7.2.1 4.7.2.2 4.7.3.5

Total Question 3	**9**

Question 4

Question	Answers	Mark	AO / Spec. Ref.
04.1	<table><tr><th>Group</th><th>Classification for salmon</th></tr><tr><td>Kingdom</td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td>Genus</td><td></td></tr><tr><td>Species</td><td></td></tr></table> ignore upper case and italics	1 1 1	AO2 4.6.4

Question	Answers	Mark	AO / Spec. Ref.
04.2	soya plants → salmon → sea lice	1	AO2 4.7.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	the transfer of energy in the food chain		1	AO1 4.7.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	breed together the offspring that are most resistant to sea lice		1	AO2 4.6.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	when all offspring are resistant to sea lice		1	AO2 4.6.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.6	any **one** from: • salmon grow larger • salmon grow faster • salmon need less food • salmon lose less energy • do not have to remove sea lice • no / less need for pesticides • not off-putting (to consumers / buyers) • (salmon) more likely to be sold / bought • salmon less likely to be damaged / infected • no / less need for antibiotics / medication	allow converse for salmon that have sea lice if clearly stated allow no / less need for insecticides do **not** accept the idea of antibiotics / medication killing sea lice ignore sea lice are not feeding on salmon unqualified	1	AO3 4.6.2.3

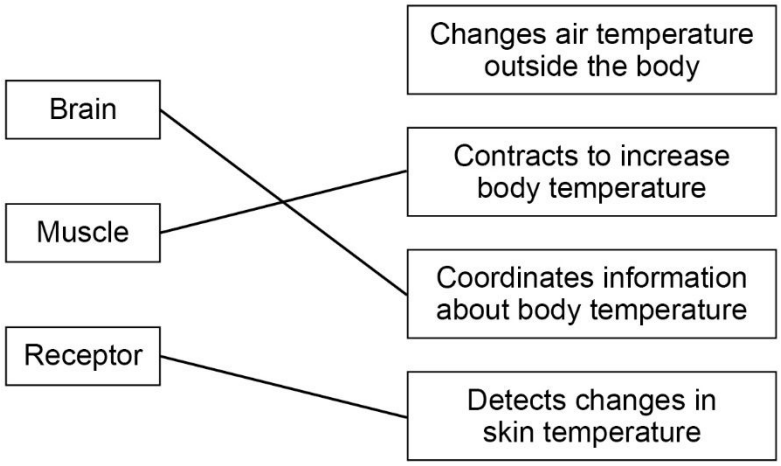
Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.7	all the salmon may suffer from the same diseases		1	AO3 4.6.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.8	any **two** from: (GM salmon) • more profit(able) / cost-effective • cost less to feed • grow faster • do not need to be farmed / kept as long • feeds more people	answers must be comparative allow converse for non-GM salmon if clearly stated allow sell for more money / revenue ignore less food unqualified allow can be sold sooner allow sell twice as many (in 3 years) allow grow bigger (in 3 years) allow cheaper to buy salmon ignore reference to sea lice	2	AO3 4.6.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.9	to reduce the risk of GM salmon breeding with wild salmon		1	AO3 4.6.2.4

Total Question 4	**12**

Question 5

Question	Answers	Mark	AO / Spec. Ref.
05.1	 do **not** accept more than one line from a box on the left	1 1 1	AO1 4.5.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	to allow cells to function properly to maintain the optimum conditions for enzymes		1 1	AO1 4.5.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	(body) temperature decreases (with increasing time)	ignore decreases unqualified	1	AO2 4.5.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	37 – 35.5 1.5 (°C)	 ignore minus sign ignore decrease	1 1	AO2 4.5.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	suitable extrapolation line on **Figure 6** answer consistent with student's line	 if no extrapolation allow value in range 4.3 to 4.8 allow answer in minutes **or** hours and minutes if units are given	1 1	AO2 AO3 4.5.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.6	pancreas		1	AO1 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.7	endocrine (system)		1	AO1 4.5.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.8	decrease		1	AO1 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.9	obesity / overweight	allow any **one** from: • lack of exercise • inactivity • family history (of diabetes) • age • high blood pressure • high cholesterol • race • smoking • high BMI • diet high in carbohydrate / sugar / fat / salt	1	AO1 4.5.3.2

Total Question 5	**14**

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	meiosis	allow phonetic spelling	1	AO1 4.6.1.1 4.6.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	gametes / eggs / sperm are not (genetically) identical	allow gametes / eggs / sperm are (genetically) different allow cells produced by meiosis are not (genetically) identical	1	AO1 4.6.1.1 4.6.1.2
	(there is) mixing of genetic information / genes / DNA **or** genetic information / genes / DNA from two / both parents	allow genetic information / genes / DNA from each parent ignore gametes fuse unqualified ignore two parents unqualified if no other mark awarded allow **1** mark for mutations	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	heterozygous	ignore dominant / recessive	1	AO2 4.6.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	(parents gamete genotypes shown) **D d** and **d d**	allow in either position in Punnett square	1	AO2
	(possible offspring genotypes correctly derived) **Dd Dd dd dd**	allow correct derivation of offspring genotypes from incorrect gametes allow 3 correct offspring genotypes for **1** mark	2	AO2
	correct identification of **Dd** offspring as having polydactyly	if derivation not correct and shows **DD** and **Dd**, both must be identified as having polydactyly	1	AO2
	probability must match derived offspring genotypes	if no derivation shown allow 0.5 **or** 50% **or** 1 in 2 **or** 1:1 **or** ½ do **not** accept 1:2 allow correct probability from incorrectly derived offspring	1	AO3 4.6.1.4 4.6.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.5	any **two** from: • can find out if the embryo has an (inherited) disorder • can prepare for baby (with the disorder) • can decide whether to continue with the pregnancy • fewer people with (inherited) disorders over time	 allow can find out if the embryo has inherited disease ignore can find out if the embryo has disease(s) allow description of preparation for the baby eg access to early treatment allow choice of (in vitro) embryos (to be implanted)	2	AO3 4.6.1.5

Total Question 6	**11**

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	humans have not found evidence of every species		1	AO3 4.6.3.2 4.6.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2	fossils	allow fossil record allow remains of organisms allow DNA do **not** accept fossil fuels	1	AO1 4.6.3.1 4.6.3.2 4.6.3.3

Question	Answers	Mark	AO / Spec. Ref.
07.3	**Level 3:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	5–6	AO2
	Level 2: Relevant points (reasons / causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.	3–4	AO2
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	AO1
	No relevant content	0	

	Indicative content
	Methods of reducing rate of evolution and linked explanation
	• doctors should not prescribe antibiotics inappropriately
	  ○ so fewer *C. difficile* are exposed to antibiotic(s)
	• do not use antibiotics to treat mild (bacterial) infection
	  ○ because the immune system can respond (to mild bacterial infection)
	• do not use antibiotics to treat (any) viral infections
	  ○ because antibiotics do not kill viruses
	• patients should complete their course of antibiotics
	  ○ so (more likely that) all *C. difficile* are killed
	  ○ so none survive to mutate (and form resistant strains)
	• the agricultural use of antibiotics should be restricted
	  ○ so fewer *C. difficile* are exposed to antibiotic(s)
	• hand washing after going to toilet
	  ○ will reduce spread of *C. difficile*
	• people with diarrhoea / *C. difficile* should stay away from school / work
	  ○ to reduce spread of *C. difficile*
	• develop new antibiotic against *C. difficile*
	  ○ so all *C. difficile* are killed
	  ○ so none survive to mutate and form (another) resistant strain
	• develop vaccine against *C. difficile*
	  ○ would decrease the use of antibiotics
	For **Level 3**, answers must refer to method(s) and linked explanation(s).
			4.6.3.4
			4.6.3.1
			4.6.2.2

Total Question 7	**8**