GCSE
COMBINED SCIENCE: TRILOGY
8464/B/2H

Biology Paper 2H

Mark scheme

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2 3 6 G 8 4 6 4 / B / 2 H / 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 Phonetic 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	meiosis	allow phonetic spelling	1	AO1 4.6.1.1 4.6.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	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.
01.3	heterozygous	ignore dominant / recessive	1	AO2 4.6.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	(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.
01.5	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 1	**11**

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	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.
02.2	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.
02.3	**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 2	**8**

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	measure / string / transect / line at right angles to river (edge)	allow measure / string perpendicular to river (edge) allow shown on **Figure 1** allow measure / string / transect / line straight from the river into the field ignore measure / string / transect / line from the river into the field unqualified	1	AO1
	place quadrat at intervals (along transect)	allow place quadrat at named intervals (of between 1 m and 10 m) allow place quadrats along transect do **not** accept place quadrat at random intervals	1	AO1
	count the (different plant) species (in each quadrat) at each distance	ignore references to counting numbers of plants **or** percentage cover	1	AO1
	repeat for 2 more transects	allow 2 or more repeats (of transect) allow repeat at 2 or more locations (along the river) allow 3 or more correct transect lines shown on **Figure 1**	1	AO1 4.7.2.1 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	the mean value students can be most certain about is 5 metres from the river		1	AO3 4.7.2.1 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	moisture levels in the soil		1	AO1 4.7.1.2 4.7.1.1

Question	Answers	Mark	AO / Spec. Ref.
03.4	**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	AO1
	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 **consequences of increasing number of cows** • fewer plants • due to more trampling • due to more plants being eaten (by cows) • (fewer plants so) less photosynthesis • so more carbon dioxide in the atmosphere • (more) cows will release carbon dioxide • from respiration • (more) cows release methane • deforestation to provide farmland • more (cow) faeces entering river / streams / watercourses **environmental implications** o carbon dioxide is a greenhouse gas o methane is a greenhouse gas o global warming may be greater o description of consequence(s) of global warming o description of consequence(s) of (cow) faeces entering river / streams / watercourses o less land available to grow crops o effects of deforestation (eg reduced biodiversity) For **Level 3**, explanations include consequence(s) and linked environmental implication(s).		4.7.1.3 4.7.2.1 4.7.2.2 4.7.3.4 4.7.3.5 4.7.3.2

Total Question 3	**12**

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	Oncorhynchus	ignore capitals ignore italics do **not** accept *Oncorhynchus keta*	1	AO2 4.6.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	eukaryota	allow eukaryote	1	AO1 4.6.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	select fish that have / get least / less / no (attachment of) sea lice **and** breed (selected fish) together	ignore with desired genes	1	AO2
	select offspring that have least sea lice **and** breed (selected offspring) together	allow select offspring with desired characteristic **and** breed together	1	AO1
	repeat over many generations until all offspring have no sea lice (attached)	do **not** accept idea of repeating with the same parents	1	AO2 4.6.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	sea lice will not be feeding on salmon (skin / blood)	allow skin less likely to be damaged / infected	1	AO3 4.6.2.3
	(so) salmon grow larger / faster	allow (so) salmon lose less energy allow no / less need for pesticides / insecticides allow (so) not off-putting (to consumers / buyers) allow (so) more (likely to be) sold allow salmon with sea lice cannot be sold	1	
	(so) salmon can be sold for more money	allow more profit allow no need to remove lice	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	all fish genetically similar	allow all fish have many / mostly same genes ignore inbreeding unqualified do **not** accept fish are clones do **not** accept fish are genetically identical	1	AO1 4.6.2.3
	(therefore) all may have (same) inherited disorder / defect **or** (therefore) prone / susceptible to same disease **or** (therefore) lack of variation to survive future environmental change		1	

Total Question 4	**10**

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	FSH and LH		1	AO1 4.5.3.5 4.5.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	ovary / ovaries		1	AO1 4.5.3.5 4.5.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	any **one** from: • to be able to select / check egg(s) • to select / check sperm sample for live sperm • to see injection / guiding sperm to egg(s) • to see if the egg has been fertilised • to select / check (developing) embryo(s)	allow to count the eggs (collected) allow to grade the embryos ignore egg(s) / embryo(s) / sperm are too small to be seen without a microscope unqualified	1	AO3 4.5.3.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	(hormones / FSH / LH used in IVF) cause an increase in progesterone **and** oestrogen		1	AO1
	progesterone / oestrogen maintain uterus <u>lining</u>	allow oestrogen / progesterone causes thickening of uterus <u>lining</u>	1	AO1
	(uterus) <u>lining</u> is prepared / ready for embryo to be inserted / implanted	allow the (uterus) <u>lining</u> is prepared / ready for implantation	1	AO2 4.5.3.5 4.5.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	$\left(\frac{135}{450}\right) = 0.3$ 3 : 7 alternative method 1: $\frac{135}{45} : \frac{315}{45}$ **or** $\frac{135}{45} : \frac{450 - 135}{45}$ (1) 3 : 7 (1) alternative method 2: evidence of dividing both sides of 135 : 315 by 5 **and** by 9 (1) 3 : 7 (1)	allow $\left(\frac{450 - 135}{450}\right) = 0.7$ if **no** other mark awarded allow **1** mark for 27 : 63 **or** 9 : 21 **or** 15 : 35 **or** 3 : 10	1 1	AO2 4.5.3.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.6	any **one** from: • age • obesity / fitness / BMI / diet • (the original) reason for infertility • allow the number of eggs collected • the number of embryos implanted	 allow menopause allow body mass **/** weight allow a named reason for infertility / miscarriage eg endometriosis ignore infertility unqualified	1	AO3 4.5.3.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.7	any **two** from: • (physical / emotional) stress of operations • success rate is low • multiple births are a risk to mother **/** baby • (ethical concern regarding) embryos are created but not used	 allow physical / emotional stress of named part of IVF process eg infection from surgery ignore side effects unqualified allow (may) take many months / years (to be successful) allow may need several / many attempts allow multiple births more likely ignore unethical unqualified	2	AO3 4.5.3.5

Total Question 5	**11**

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	any **one** from: • blood glucose / sugar (concentration) • water (content of the body)	allow pH allow ions / salt allow carbon dioxide allow oxygen allow blood pressure	1	AO1 4.5.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	to maintain (temperature close to) optimum / optimal conditions / temperature		1	AO1 4.5.1
	for enzyme action	allow for cells to function allow for reactions in cells allow for **2** marks enzymes have an optimum temperature	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	$\frac{37.0 - 35.5}{4}$	allow $\frac{1.5}{4}$	1	AO2 4.5.1
	0.375 (°C per hour)	allow 0.4 **or** 0.38 (°C per hour) ignore minus sign	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	$37 \times \frac{5.5}{100}$	allow 37×0.055	1	AO2 4.5.1
	2.035 (°C)		1	
	$(37 - 2.035 =)$ 34.965	allow 34.97	1	
	35 (°C)	allow an incorrectly calculated temperature given correctly to 2 significant figures do **not** accept 35.0 (°C)	1	
	alternative method: $1 - \frac{5.5}{100}$ (1)			
	0.945 (1)			
	$(37 \times 0.945 =)$ 34.965 (1)	allow 34.97		
	35 (°C) (1)	allow an incorrectly calculated temperature given correctly to 2 significant figures do **not** accept 35.0 (°C)		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.5	pituitary (gland)		1	AO1 4.5.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.6	(adrenal glands) release / produce adrenaline		1	AO1
	(to) increase heart rate		1	AO1
	(so) more / faster delivery of oxygen **and** glucose to brain / muscles		1	AO2
	(because) more oxygen / glucose needed for respiration		1	AO2
	to move muscles to increase body temperature **or** to release energy / heat to increase body temperature	allow for shivering to increase body temperature do **not** accept energy is made / produced / created ignore flight or fight	1	AO3 4.5.3.6 4.5.3.1 4.5.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.7	(decreasing body temperature causes thyroid gland to) release / produce thyroxine		1	AO2 4.5.3.6
	(which) increases / stimulates (basal) metabolic rate	allow (which) increases metabolism allow (which) increases respiration allow (which) increases reactions in cells	1	
	(so) increasing body temperature which decreases the release / production of thyroxine		1	

Total Question 6	**18**