GCSE
COMBINED SCIENCE: TRILOGY

8464/B/2H - BIOLOGY PAPER 2 HIGHER TIER

Mark scheme

8464

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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 Assessment Writer.

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 his or her 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.

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 error / 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 <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.

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 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.

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.

<table>
<tr><th>Question</th><th>Answers</th><th>Extra information</th><th>Mark</th><th>AO / Spec. Ref.</th></tr>
<tr><td>01.1</td><td><table><tr><th>Factor</th><th>Biotic</th><th>Abiotic</th></tr><tr><td>Diseases</td><td>✓</td><td></td></tr><tr><td>Herbivores</td><td>✓</td><td></td></tr><tr><td>Temp</td><td></td><td>✓</td></tr><tr><td>Water</td><td></td><td>✓</td></tr></table></td><td>allow 1 mark for 2 or 3 correct</td><td>2</td><td>AO1
4.7.1.3
4.7.1.2</td></tr>
<tr><td>01.2</td><td>(leaves block light near tree so) more light (as you move outwards)

for photosynthesis

(which) produces (more) glucose / proteins (for growth)</td><td>allow low light intensity under tree
ignore Sun

allow less photosynthesis under the tree

ignore growth
ignore food

allow molecules, cell components or other correct substances instead of proteins

if no other mark awarded allow less water / ions / minerals / nutrients under the tree</td><td>1

1

1</td><td>AO2
4.7.2.1

AO1
4.7.2.1
4.4.1.1
4.4.1.3

AO1
4.7.2.1
4.4.1.1
4.4.1.3</td></tr>
<tr><td>01.3</td><td>
quadrat

light meter</td><td>in this order

correct spelling only

allow lux meter
allow light intensity meter
allow light data logger</td><td>
1

1</td><td>AO1
4.7.2.1</td></tr>
<tr><td>01.4</td><td>1.5(0) (m^2)</td><td>allow 15 000 cm^2</td><td>1</td><td>AO2
4.7.2.1</td></tr>
</table>

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	to keep light (intensity) as similar as possible	allow the light (intensity) might change ignore references to temperature ignore weather ignore Sun	1	AO3 4.7.2.1
01.6	any **one** from: • repeat (investigation) around the tree • repeat (investigation) for other trees / areas • sample every one metre • count the number of each species present (rather than percentage cover)	allow repeat in different directions ignore repeats unqualified ignore repeat at different times / days / seasons ignore different size quadrat ignore random sampling	1	AO3 4.7.2.1
01.7	daisy		1	AO3 4.7.2.1
01.8	as light (intensity) increased so did the percentage / cover of plants up to 100% / maximum at 175 (arbitrary units)	ignore directly proportional ignore positive correlation unqualified ignore distance	1 1	AO3 4.7.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.9	any pair from: • (lack of) water / rain (1) because the leaves are stopping the rain **or** because the roots of the tree are absorbing it (1) • (lack of) minerals / ions (1) because the tree (roots) have absorbed them (1) • temperature (1) because less thermal energy from the sun is reaching under the tree canopy (1)	ignore carbon dioxide do **not** accept oxygen allow soil moisture allow magnesium / nitrate / nutrients allow too cold / cooler allow ‘heat’ for thermal energy allow pH / acidity (1) because (some) fallen leaves are acidic (1)	2	AO2 4.7.2.1
Total			**15**	

Question	Answers	Mark	AO / Spec. Ref.
02	**Level 3:** Relevant points (advice / reasons) are identified, given in detail and logically linked to form a clear account.	5–6	AO2
	Level 2: Relevant points (advice / reasons) are identified, and there are attempts at logical linking. The resulting account is not fully clear.	3–4	AO2 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 **precautions with reasons** • do not prescribe fluroquinolone / antibiotics for mild infections • because they will get better due to the body's normal immune system • do not prescribe fluroquinolone / antibiotics for viral infections / colds / flu • because antibiotics do not kill viruses • if you do prescribe fluroquinolone / antibiotics make sure the patient finishes the course • because any bacteria left may develop resistance, survive and reproduce rapidly (due to lack of competition) • only prescribe fluroquinolone if the patient has the new strain • because routine use would lead to an increase in resistant bacteria **other relevant content** • doctors and nurses in the practice / hospital should be using antibacterial / alcohol hand wash between each patient **and / or** disinfectant to clean wards • to kill (resistant) bacteria • doctors should isolate patients with this strain of bacteria • to prevent other patients getting the resistant infection		4.6.3.4 4.3.1.8
Total		**6**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	they survive in high temperatures they survive where it is acidic		1 1	AO2 4.7.1.4
03.2	C		1	AO3 4.7.1.4
03.3	because it has (high / optimum) activity at high temperature or 65 °C **and / or** low pH or pH 3 or high acidity	mark dependent on C correct for question **03.2** allow it is the only enzyme that is active between 55 °C and 75 °C **and / or** below pH4	 1	AO2 4.7.1.4
03.4	any **three** from: • based on DNA / chemical evidence (the three domains are) • (Archaea) –primitive / simple bacteria • Prokaryota / Bacteria – true / modern bacteria • Eukaryota – includes (protists, fungi,) plants and animals	 allow Eukaryota - includes organisms with cells having a nucleus if no other mark awarded allow for **1** mark mention of Archaea, Prokaryota / Bacteria and Eukaryota **or** three correct descriptions	3	AO1 4.6.4
03.5	(these microorganisms) live in extreme conditions	allow (most Archaea) are extremophiles	1	AO2 4.6.4
Total			**8**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	(P) synapse	allow phonetic spelling	1	AO1 4.5.2
	(Q) relay neuron(e)	allow intermediate neuron(e)	1	
04.2	(in neurone) as electrical impulse	allow electrical potential ignore signal / message	1	AO1 4.5.2
	(across synapse / gap P) as diffusion / movement of chemical / neurotransmitter		1	
		if no mark awarded allow **1** mark for mention of electrical and chemical in that order		
04.3	the impulse has to travel to the brain (and back)	allow it needs time to be processed by the brain allow the pathway is (a lot) longer allow more synapses	1	AO3 4.5.2
04.4		an answer of 13(.33…) (ms) scores **3** marks an answer 0.013(33…) **or** 1/75 scores **2** marks		AO2 4.5.2
	$120 = \frac{1.6}{\text{time}}$ **or** evidence of: $\text{speed} = \frac{\text{distance}}{\text{time}}$		1	
	0.013(33…) (s) **or** $\frac{1}{75}$		1	
	13(.33…) (ms)	an incorrect answer correctly converted to ms scores **1** mark	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	as age (in years) increases the time for the muscle to contract increases	do **not** accept directly proportional	1	AO2 4.5.2
	at an increasing rate	allow correct description of 'at an increasing rate'	1	
Total			**10**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	(the scientists)			
	chose / used (traditional varieties of) rice plants with short stems and rice plants with large grains **or** chose rice plants with short stems and large grains.		1	AO2 4.6.2.3
	(cross) bred the rice plants	allow cross pollinated the rice plants	1	AO1 4.6.2.3
	(from the offspring) chose the plants with best / desired characteristics **or** chose plants with short(est) stems and big(gest) grains		1	AO1 4.6.2.3
	bred repeatedly until all plants had desired characteristics **or** bred repeatedly until they bred true **or** bred repeatedly until they produced IR8		1	AO1 4.6.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	agree (**max 3** marks) • resistance to disease / pests / pathogens so higher yield • resistant to herbicides so less competition for (sun)light / water / minerals / ions (from weeds) • larger / more grains per plant or higher yield so more food for people or more income for farmers • better nutritional content (vitamins / protein / low GI index) so will improve health disagree (**max 3** marks) • may affect wild plants (if genes transfer) so making them herbicide resistant • use of herbicides may reduce biodiversity because other plants are killed • traditional varieties no longer grown so reduction in biodiversity • may affect health of people who eat the rice because not enough research done yet	each reason must be explained to gain credit allow improved survival in harsh conditions so can be grown in wider area allow (GM) seeds are expensive for farmers because they have to buy new seeds every year **or** because farmers have to buy specific herbicide if no explanations allow **1** mark for one agree reason **and** one disagree reason	4	AO3 4.6.2.4
Total			**8**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1		an answer of 0.46 **or** 0.47 scores **2** marks		AO2 4.5.3.3
	$\frac{33}{72}$ **or** 0.45833…	allow $\frac{34}{72}$ **or** 0.47222…	1	
	0.46 (arbitrary units per hour)	allow 0.47 (arbitrary units per hour) allow an answer given to 2 significant figures from an incorrect calculation in step 1 for **1** mark	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	any **five** from: • (during the first days of the cycle) FSH from the pituitary stimulates an egg / follicle to mature • FSH stimulates oestrogen from the ovaries • oestrogen causes thickening of the uterus lining (in the first half of the cycle) • oestrogen inhibits FSH but stimulates LH from the pituitary • the high levels of LH stimulate release of the egg / ovulation (on day 14) • progesterone is secreted by the (empty) follicle / corpus luteum (after day 14 / ovulation) • progesterone maintains the lining of the uterus (during the second half of the cycle) **or** progesterone inhibits both FSH and LH • progesterone falls (if no pregnancy happens) and uterus lining comes away as the menstrual blood flow	points must be in correct order to gain full credit if no other marks awarded allow **1** mark for oestrogen and progesterone are produced by the ovaries and FSH and LH are produced by the pituitary	5	AO1 4.5.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	any **one** from: • (lower dose so) fewer side effects • (patch lasts longer so) don't have to remember to take pill every day • hormone (from patch) goes directly into bloodstream so (contraception) unaffected by vomiting		1	AO3 4.5.3.4
Total			**8**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	one X and one Y chromosome and 9 pairs of other chromosomes		1	AO2 4.6.1.6
07.2	any **three** from: • (called) meiosis • DNA / chromosomes replicate **or** DNA makes a copy • two divisions to form 4 cells • so only 1 set of chromosomes per cell • (daughter cells / gametes) are all genetically different	correct spelling only allow cells are haploid ignore half the DNA if no other mark awarded allow **1** mark for forms gametes / cells which are all different **or** only happens in testes and (embryonic) ovaries	3	AO1 4.6.1.2
07.3	(meiosis will not work because) number of chromosomes cannot halve	allow chromosomes cannot form pairs allow chromosomes cannot split up evenly	1	AO2 4.6.1.2
07.4	do not use energy in reproduction so more (energy) available to synthesise proteins	allow converse if clearly describing diploid oysters allow other correct molecules or cell components	1 1	AO2 4.6.1.3 4.4.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.5	any **two** from: • global warming may be raising temperature of water and killing oysters • pollutants in the water may be toxic and kill the oysters **or** increased acidity of the oceans is killing oysters • new competitors / triploid oysters are using up the normal food source • new pathogens may be causing diseases • new predators eating oysters	allow correctly named pollutant with reason ignore over harvesting	2	AO2 4.7.3.5 4.7.3.2 4.7.1.2 4.7.1.3

Question	Answers	Mark	AO / Spec. Ref.
07.6	**Level 3:** A judgement strongly linked and logically supported by a sufficient range of correct reasons is given.	5–6	AO3
	Level 2: Some logically linked reasons are given. There also may be a simple judgement.	3–4	AO3 AO2
	Level 1: Relevant points are made. They are not logically linked.	1–2	AO2
	No relevant content	0	
	Indicative content **for:** • oysters are available to eat all year **so** eating oysters has become very popular • cheaper to produce **so** more food for expanding population • oysters grow faster **so** more oysters for supermarkets / restaurants or more profit for farmers • stocks are replenished each year **so** more sustainable fishing • they can harvest / sell all year **so** more stable and profitable for oyster farmers **against:** • carcinogen put into environment / oysters **so** may enter the food chain or cause cancer in humans • bigger triploid oysters may outcompete the smaller native diploid oysters **so** upset balance of the ecosystem / cause extinction • people may not buy / eat them because they have used a carcinogenic chemical **so** reduced profit for farmers / suppliers / supermarkets / restaurants • farmers have to buy new seed oysters every time **so** more expensive **other content:** • shouldn't be eating the oysters until they are thoroughly tested • should be looking for alternative ways to get triploid oysters • should stop using triploid oysters until the effect on the (marine) environment is known • would replace lost oyster beds **but** could change the ecosystem • oysters available to eat all year **but** probably do not taste the same or have the same flavour		4.7.3.2 4.7.3.6 4.7.2.1 4.7.1.3 4.7.1.1
Total		**15**	