GCSE
COMBINED SCIENCE: TRILOGY
8464/B/2F

Biology Paper 2F

Mark scheme

June 2022

Version: 1.0 Final Mark Scheme

2 2 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.

Further copies of this mark scheme are available from aqa.org.uk

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	larger yields		1	AO1 4.6.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	GM crops will harm wildlife		1	AO1 4.6.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	gene(s)	allow allele(s)	1	AO1 4.6.1.3 4.6.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	protein		1	AO1 4.6.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	an allele that is only expressed if two copies are present		1	AO1 4.6.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.6	heterozygous		1	AO2 4.6.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.7 mark with 1.8	offspring genotypes correctly derived hh circled **Woman** / **H** / **h** **Man** / **H** / HH / Hh **h** / Hh / hh	allow **1** mark for 1 or 2 correct genotypes	2 1	AO2 4.6.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.8 mark with 01.7	25%	probability must match derivations (hh) in question **01.7**	1	AO3 4.6.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.9	any **one** from: • it might harm the embryo / baby / mother • it might cause a miscarriage • they do not want to make a choice about having an abortion • it is against their religious beliefs	ignore cost ignore harmful / dangerous unqualified allow against their religion	1	AO3 4.6.1.4 4.6.1.5

Total Question 1		**11**

Question 2

Question	Answers	Mark	AO / Spec. Ref.
02.1	**Level 2:** The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	3–4	AO1 4.7.2.1 RPA 7
	Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2	
	No relevant content	0	
	Indicative content • place quadrat randomly / systematically • description of how randomness is achieved **or** description of how systematic placement is achieved • count number of buttercups in quadrat • record number • repeat quadrat (in another location in the same wet soil area) • (repeat) at least 5 times • calculate a mean number of buttercups per quadrat • the area of the wet soil area is 100 m^2 • estimate the buttercup population using the area of the quadrat		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	an abiotic factor		1	AO2 4.7.1.2 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	any **two** from: • light (intensity) • temperature • competition • herbivores / grazing • pollinators • trampling / mowing • wind (direction / strength) • soil pH **or** soil type • ions / minerals / nutrients in the soil • pathogens • herbicides	ignore rain / water / weather allow shade ignore sun allow other plants growing there allow pests **or** named pest allow insects or named pollinator allow named mineral allow infection ignore disease unqualified allow pesticides	2	AO2 4.7.1.2 4.7.1.3 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	(the) dependent		1	AO2 4.7.1.2 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5 mark with 02.6	0.25 (m^2)		1	AO2 4.7.1.2 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6 mark with 02.5	8 ÷ 0.25 32 (buttercups per m^2)	allow ecf from question **02.5** allow 8 × 4	1 1	AO2 4.7.1.2 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.7	any **two** from: • repeat • same volume of water • same mass / volume of soil • more acidity / pH levels • same number of bean seeds • same spacing / depth of seeds • same species / variety / type of bean seeds • same size boxes • same light (intensity) • same temperature	allow same amount of water allow same amount of soil } if neither marking point awarded, allow put them in the same place eg greenhouse	2	AO3 4.7.1.2 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.8	$\frac{11+12+11+17+19}{5}$ **or** $\frac{70}{5}$ 14 (cm)		1 1	AO2 4.7.1.2 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.9	bean plants grow less well (in acid soil) **or** bean plants are shorter (in acid soil)	allow converse	1	AO3 4.7.1.2 RPA7

Total Question 2		**16**

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	knowledge of how DNA controls inheritance		1	AO1 4.6.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	there was no oxygen in the amber		1	AO2 4.6.3.1 4.6.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	silverfish	ignore A	1	AO3 4.6.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	C		1	AO2 4.6.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	dragonflies	ignore A / B	1	AO3 4.6.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.6	<table><tr><td></td><td>animalia</td></tr><tr><td></td><td></td></tr><tr><td></td><td>insecta</td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td>Musca</td></tr><tr><td></td><td>domestica</td></tr></table>	all correct for **3** marks allow **2** marks for 2 or 3 correct allow **1** mark for 1 correct allow animals allow insects ignore italics and upper / lower case letters	3	AO2 4.6.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.7	eukaryota		1	AO2 4.6.4

Total Question 3		**9**

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	D		1	AO1 4.5.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	B		1	AO1 4.5.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	(in / through / via) blood(stream)	allow (in / through / via) plasma allow (in / through / via) blood vessels allow (in / through / via) arteries / veins / capillaries	1	AO1 4.5.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	insulin		1	AO1 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	glucose is converted to glycogen glucose moves from the blood into the cells		1 1	AO1 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.6	8:30 (am)	allow 8:15 – 8:35 (am) allow time written in words	1	AO3 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.7	any value in the range ≥ 6.5 to ≤ 20 ($mmol/dm^3$)		1	AO3 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.8	any **two** from: • low carbohydrate diet • exercise (regime) • lose body mass	 allow low calorie / fat / sugar diet allow eat fewer (sugary) snacks allow description of exercise allow lose weight allow (metformin) tablets to reduce blood glucose	2	AO2 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.9	(less) respiration		1	AO1 4.5.3.2
	(so) less energy released / transferred **or** less muscle contraction	do **not** accept energy produced / made / created	1	AO2 4.4.2.1

Total Question 4		**12**

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	aerobic respiration		1	AO1 4.4.2.1 4.8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	1. evaporation	allow evaporate(s) / evaporating	1	AO1 4.7.2.2
	2. condensation	allow condense(s) / condensing	1	
	3. precipitation	allow rain(ing) / rainfall allow named precipitation ignore precipitates	1	
	4. draining / drainage	allow run-off / percolation / infiltration allow groundwater / underground flow	1	
	5. transpiration		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	$6\,000\,000\,000 \times \frac{4.5}{100}$	allow $6\,000\,000\,000 \times 0.045$	1	AO2 4.7.2.2
	$270\,000\,000$		1	
	2.7×10^8	allow an incorrectly calculated number of people given in correct standard form	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	climate change has increased the area of deserts		1	AO3 4.7.2.2
	more water is used to grow crops		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	decay / decomposition of leaves	allow leaves are broken down	1	AO2
	respiration (by microorganisms / decomposers)	ignore aerobic / anaerobic ignore respiration by worms / detritivores / insects / leaves	1	AO1
	respiration releases carbon dioxide **or** microorganisms release carbon dioxide		1	AO1
	carbon dioxide is used in photosynthesis (for new plant growth)	do **not** accept carbon dioxide absorbed in the roots	1	AO1 4.7.2.2 4.4.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.6	nitrates are released into the soil		1	AO2 4.7.2.2 4.4.1.3

Total Question 5		**16**

Question 6

Question	Answers	Mark	AO / Spec. Ref.
06	**Level 3:** Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account.	5–6	AO3
	Level 2: Relevant points (reasons/causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.	3–4	AO3 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	

06 cont.	**Indicative content**
	Increase in world population
	• sewage (released into rivers / lakes / seas)
	  ○ causes algae to grow
	  ○ algae block light
	  ○ causing plants to die and decompose
	  ○ leading to lack of oxygen in the water
	  ○ (sewage) could contain pathogens
	
	Need to produce more food for world's population
	• fertilisers (used on farms to increase crop yield, leach into rivers / lakes / seas)
	  ○ causes algae to grow
	  ○ leading to lack of oxygen in the water
	• herbicides / pesticides (used on farms to increase crop yield, run into rivers / lakes / seas)
	  ○ build-up in food chains
	
	Increasing demand for products / energy
	• toxic chemicals **or** named toxic chemicals (run into rivers / lakes / seas)
	  ○ from factories / industry **or** power stations
	  ○ build-up in food chains
	  ○ chemicals may cause mutations **or** chemicals may act as hormones
	  ○ radiation leaks from nuclear (power stations)
	  ○ (oil) spills from extraction / rigs / tankers in oceans
	  ○ acid rain formation
	  ○ acidification of lakes
	  ○ increased carbon dioxide emissions causes acidification of oceans
	
	Buildup of waste products
	• litter / plastics (thrown in rivers / lakes / seas)
	  ○ example of effect on living organisms, such as plastics consumed or plastics build up in stomach or plastics get stuck around beaks
	  ○ (most) plastics are not biodegradable
	  ○ build-up of microplastics in water animals
	
	Consequence of the above is that organisms living in rivers / lakes / seas are harmed / die
	
	For **Level 3** students need to consider different types of pollution
			4.7.3.2
			4.7.2.1

Total Question 6		**6**