GCSE
COMBINED SCIENCE: TRILOGY

8464/B/1H – BIOLOGY PAPER 1 HIGHER TIER

Mark scheme

8464

June 2018

Version/Stage: 1.0 Final

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.

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 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.

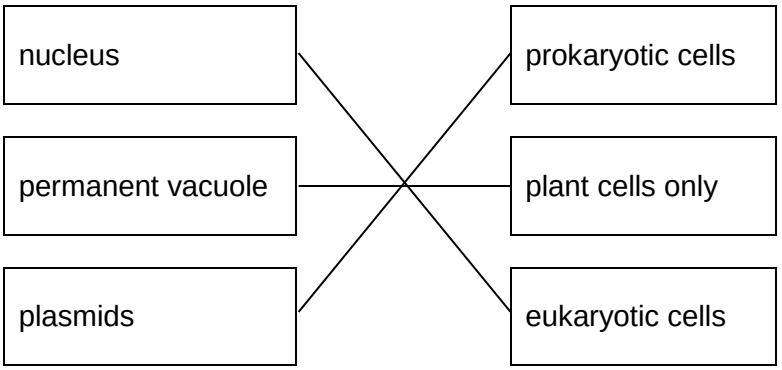
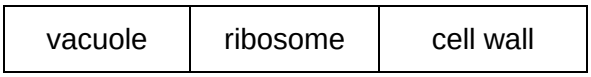
The exemplar materials used during standardisation will help. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the student's answer with the example to determine 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.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	 allow **1** mark for one or two correct links		2	AO1 4.1.1.1 4.1.1.2
01.2	 tick box takes precedence if no tick is given, look at both the figure and the circling of words in the table if writing is seen on the figure and in the table both must be correct		1	AO1 4.1.1.2
01.3	turn the (fine focusing) knob until the cells are in focus	allow focus it do **not** accept increase magnification ignore decrease magnification ignore clear ignore references to resolution / illumination ignore zoom in / out	1	AO2 4.1.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	(rotate the) nosepiece / objective lens	allow change the (objective / eyepiece) lens	1	AO2 4.1.1.2
	to a higher power (lens)	allow (to) increase the magnification a comparator is required ignore change / adjust the magnification allow stronger or more powerful lens ignore references to resolution / illumination unqualified ignore zoom in / out ignore references to an electron microscope	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5		an answer of 400 (×) scores **3** marks		AO2 4.1.1.2
	conversion of units: (112 mm →) 112 000 (µm) **or** (280 µm →) 0.28 (mm)		1	
	(magnification =) $\frac{112}{0.28}$ **or** (magnification =) $\frac{112\ 000}{280}$	allow **1** mark for no conversion of units 112 / 280 **or** incorrect value from step 1 correctly substituted	1	
	400 (×)	do **not** accept if units are given	1	
		if no other mark scored allow **1** mark for: magnification = $\frac{\text{size of image}}{\text{size of real object}}$ a triangle with words or letters in is insufficient, as the correct rearrangement is needed		
Total			**9**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	is not caused by a pathogen / infective organism	allow not caused by a microorganism / microbe ignore not caused by infection ignore named pathogen unless bacteria, virus and fungus all mentioned	1	AO1 4.2.2.4 4.2.2.5 4.3.1.1 4.3
	(so) is not passed / spread (from person to person)	allow cannot be spread / caught allow is not infectious / contagious	1	AO2 4.2.2.4 4.2.2.5 4.3.1.1 4.3
02.2		allow 'it' for heart		AO1 4.2.2.4
	reduced / restricted / stopped blood flow	it does not matter where blood flow is restricted to – heart / body	1	
	(so) less oxygen reaches heart (muscle / cells)	must reference heart / it allow no oxygen reaches the heart (muscle / cells)	1	
	(so heart muscle / cells) cannot respire (enough) **or** (so heart muscle / cells) do not release (enough) energy	do **not** accept do not make / produce / create energy ignore references to breathing / suffocation ignore blood clots / blockages	1	

Question	Answers	Mark	AO / Spec. Ref.
02.3	**Level 3:** Relevant points (factors / effects) are identified, given in detail and logically linked to form a clear account.	5–6	AO2
	Level 2: Relevant points (factors / effects) 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 **medical risk factors:** • high blood pressure • high cholesterol • diabetes • genetic factors • medications **lifestyle risk factors:** • smoking • obesity • lack of exercise • high fat / energy diet • eating insufficient fruit / vegetables • alcohol • high salt intake • exposure to air pollution • certain drugs / correct named drug **examples of links:** • smoking – high bp / cholesterol / fatty deposition • obesity – lack of exercise / high bp / cholesterol / fatty deposition / diabetes • exercise – obesity / bp /diabetes • diet – obesity / cholesterol / diabetes • alcohol – bp / cholesterol • high salt intake - high blood pressure • genetic factors – bp / cholesterol / diabetes / obesity • medication – can affect blood / blood vessels / metabolism the main discriminator is the quality of linking both lifestyle and medical factors are required for **level 3**		4.2.2.2 4.2.2.4 4.2.2.5 4.2.2.6
Total		**11**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	$6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$		1	AO2 4.4.1.1
03.2	endothermic		1	AO1 4.4.1.1
03.3	measure the volume of gas released increase length of time	allow use a measuring cylinder / capillary tube / (gas) syringe allow sensible length of time allow video the investigation so you could re-count the bubbles later allow repeat the measurement at each distance several times **and** calculate a mean ignore references to using other distances	1 1	AO3 4.4.1.2
03.4	temperature affects **rate** of photosynthesis **or** temperature affects **rate** of bubble production (because) reaction / photosynthesis is controlled by **enzymes**	allow correct description of effect of temperature on rate allow high temperatures denature enzymes enzymes being denatured must be linked to high temperature	1 1	AO3 4.4.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	evidence of squaring for **two** distances that double: 25 **and** 100 **or** 100 **and** 400		1	AO2 4.4.1.2
	calculate $1/d^2$ for **two** distances that double: 0.04 **and** 0.01 **or** 1/25 **and** 1/100 **or** 0.01 **and** 0.0025 **or** 1/100 **and** 1/400	allow **2** marks for these calculations without working ignore calculations for a third distance as long as two where the distance doubles are correct	1	AO2 4.4.1.2
	(therefore as distance doubles) light intensity is quartered		1	AO3 4.4.1.2
03.6	2 (bubbles would be produced)		1	AO3 4.4.1.2
	(as) very little light / energy for **photosynthesis** to occur	do **not** accept no light allow **2** marks for a quarter of the bubbles are produced as light distance doubles so 2 bubbles would be expected	1	AO2 4.4.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.7	(independent variable) use different concentrations of sodium hydrogencarbonate solution	allow three concentration values ignore different concentrations of carbon dioxide ignore different amounts of sodium hydrogen carbonate solution	1	AO3 4.4.1.2
	(control variables) any **two** from: • distance from light source • temperature of solution • same plant • time for plant to equilibrate	**max 2** marks for control variables allow light intensity ignore light unqualified ignore same lamp allow type / size of plant allow time for plant to adjust to different solution ignore time unqualified	2	
Total			**14**	

<table>
<tr><th>Question</th><th>Answers</th><th>Extra information</th><th>Mark</th><th>AO / Spec. Ref.</th></tr>
<tr><td>04.1</td><td>to control for the starting mass (of the pieces of carrot)</td><td>allow because the pieces of carrot were not all the same mass at the start

do not accept were not all the same size
do not accept as a control variable</td><td>1</td><td>AO3
4.1.3.2</td></tr>
<tr><td>04.2</td><td>suitable scale and label for y-axis

all points plotted correctly

line of best fit</td><td>allow 5 or 6 per 2 cm

do not accept 5 per 1 cm

allow ± ½ a square
allow 1 mark for 4 correct points

<table><tr><th>conc. …</th><th>percentage (%) change…</th></tr><tr><td>0.0</td><td>+ 24</td></tr><tr><td>0.2</td><td>+ 12</td></tr><tr><td>0.4</td><td>+ 1</td></tr><tr><td>0.6</td><td>- 8</td></tr><tr><td>0.8</td><td>- 15</td></tr></table></td><td>1

2

1</td><td>AO2
4.1.3.2</td></tr>
<tr><td>04.3</td><td>value from student’s line of best fit</td><td>allow ± ½ a square</td><td>1</td><td>AO3
4.1.3.2</td></tr>
</table>

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	mass decreased		1	AO2 4.1.3.2
	(due to) **loss of water** by **osmosis**	ignore diffusion	1	AO1 4.1.3.2
	through a partially / selectively / semi permeable membrane		1	AO1 4.1.3.2
		a clear reference to concentration of water or concentration of sugar is required for the fourth mark		
	(as) concentration of sugar solution is greater than concentration of sugar (solution) inside cells / carrot **or** (as) the concentration of water is less outside the cells / carrot than the concentration inside the cells / carrot	allow (as) concentration of sugar solution inside cells / carrot is lower than the concentration of sugar solution (in the tube or around the carrot) allow answers in terms of dilute and concentrated solutions	1	AO2 4.1.3.2
04.5	the (partially permeable / cell) membrane was damaged	allow idea that cell membrane is no longer intact **or** is **more** permeable / leaky allow the membrane is denatured ignore cells are dead	1	AO3 4.1.3.2
Total			**11**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	any **one** from: • not everyone would go to the doctor • sample will not always be sent for analysis • some cases not tested / diagnosed / confirmed	allow not all cases recorded allow only medically confirmed cases recorded ignore some cases are unknown allow idea that doctor may make a judgemental error or mis-diagnosis	1	AO2 4.3.1.2
05.2	$\frac{1939}{2030} \times 100$ 96 / 95.5	an answer of 96 / 95.5 scores **2** marks allow **1** mark only for 95 or other incorrect rounding allow for **1** mark: $\left(\frac{91}{2030} \times 100 = \right) 4.5\%$ allow **2** marks for correct rounding of 95.51724138 allow **1** mark for correct calculation using incorrect subtraction **only** if working shown	1 1	AO2 4.3.1.2
05.3	most people are **immune** so do **not become ill** (from infection) less chance of **non-immune** / **unvaccinated** individuals being exposed to pathogen / measles / virus	allow herd / community immunity so do not become ill (from infection) allow most people are immune so do not become infected ignore most people are immune so don't get / catch it reference to an organism is needed allow 'it' for the measles virus allow fewer people to pass it on to non-immune people	1 1	AO1 4.3.1.1 4.3.1.7

Question	Answers	Mark	AO / Spec. Ref.
05.4	**Level 3:** Relevant points (comparisons / reasons) are identified, given in detail and logically linked to form a clear account.	5–6	AO1
	Level 2: Relevant points (comparisons / reasons) 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	AO2
	No relevant content	0	
	Indicative content **differences (after exposure to measles virus):** • greater number / higher concentration of antibodies produced • quantitative statement, eg 9 times higher **or** 0.8 to 7.2 • antibodies produced sooner – idea of immediate response • antibodies produced quicker • antibodies stay (in higher concentration) for longer **explanation** • white blood cells / leucocytes / lymphocytes / B cells ignore phagocytes / macrophages • reference to previous exposure (of white blood cells) to pathogen / virus • (white blood cells) recognise pathogen / virus / antigen • memory cells • production of specific / correct antibodies		4.2.2.3 4.3.1.2 4.3.1.6 4.3.1.7
Total		**11**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	any **one** from: • meristem(s) • **tip** of shoot • **tip** of root	ignore stem and embryo	1	AO1 4.1.2.3 4.2.3.1
06.2	to produce large numbers of identical plants		1	AO1 4.1.2.3
06.3	6×10^{-12} (grams)		1	AO2 4.1.2.1 4.1.2.2
06.4	$\frac{28}{360} \times 15$ **or** 1.166666666(r) 1.17 (hours)	an answer of 1.17 (hours) scores **2** marks allow $\frac{7}{90} \times 15$ allow correct rounding allow 1.16 allow **1** mark for 1 hour 10 minutes **or** 1 and 1/6 hours **or** 70 minutes **only** if units given	 1 1	AO2 4.1.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.5		**max 4** if correct sequence but no reference to stage numbers **max 4** marks if no stage numbers given ignore names of phases marks can be awarded for labelled diagrams		AO1 4.1.2.1 4.1.2.2
	stage 1 cell growth **or** increase in number of organelles	allow increase in named organelle eg ribosomes / mitochondria	1	
	DNA replicates **or** two copies of each chromosome form	allow DNA duplicates / doubles ignore genetic information replicates if this statement given as part of stage 2 allow **max 4** marks	1	
	stage 2 / mitosis one set of chromosomes moves to each end of cell	allow chromosomes separate or are pulled apart	1	
	nucleus divides	allow nucleus splits into two	1	
	stage 3 cytoplasm / cell membrane divides to form two (genetically) identical cells	allow cytokinesis	1	

06.6	any **two** from: **advantages:** • may be used to cure / treat (current / future) diseases **or** cure medical conditions **or** produce replacement cells / tissues / organs • cells / tissues of any type could be produced • cells unlikely to be rejected by the patient • many cells produced • cells produced could be used for research • would reduce waiting time for organ transplants any **two** from: **disadvantages:** • potential life is killed / destroyed • shortage of donors / eggs • egg donation / collection has risks • do not yet know risks /side effects of the procedure on the patient • may transfer (viral) infection • poor success rate to produce viable eggs / embryo	ignore references to cost allow example eg diabetes / paralysis ignore used for medical treatments allow cells differentiate into many types ignore identical cells are produced unqualified ignore references to cost ignore unethical unqualified ignore references to religion / beliefs allow embryo is destroyed ignore cells destroyed or wasted allow may cause tumours / cancer	2 2	AO1 AO3 4.1.2.3 4.1.1.4 4.6.2.4
Total			**14**	