



GCSE
COMBINED SCIENCE: SYNERGY
8465/2F

Foundation Tier Paper 2 Life and environmental sciences

Mark scheme

June 2019

Version: 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 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 his or her judgement
- the Assessment Objectives, level of demand 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 / ; e.g. 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 not 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, i.e. 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.

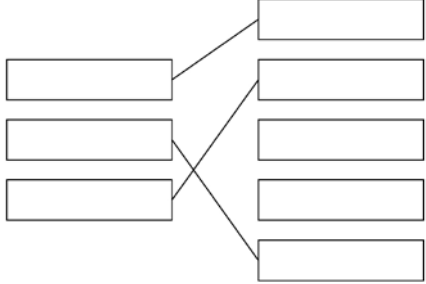
You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

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	B		1	4.1.4.2 AO2
01.2	C		1	4.1.4.2 AO2
01.3	2 / two		1	4.1.4.2 AO2
01.4		additional line from a box on the left negates the mark for that box	1 1 1	4.1.4.2 AO1
01.5	wave speed = frequency x wavelength		1	4.1.4.2 AO1
01.6	sound		1	4.1.4.1 AO1
01.7	0.34 (s)	answer line takes precedence if no answer on answer line allow answer written in box X in table	1	4.1.4.2 AO2
01.8	294 (m/s)	allow correct rounding of 294.11764705882 (m/s) allow ecf from question 01.7 correctly rounded	1	4.1.4.2 AO2
01.9	times are very short	allow sound travels quickly allow idea of reaction time affecting the measurement ignore human error	1	4.1.4.1 AO3
Total			11	

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	guard cell		1	4.2.2.3 AO1
02.2	8.3 μm		1	4.2.2.3 AO2
02.3	$\frac{4}{9} \times 100$ 44.4 (%)	an answer that rounds to 44 scores 2 marks allow $\frac{4}{9}$ or $4 \div 9$ or 0.444	1 1	4.2.2.3 AO2
02.4	to control water loss from the leaf		1	4.2.2.3 AO1
02.5	water / dye moves up / through the plant / stem / celery in the xylem to the leaf	do not accept phloem allow to the stomata	1 1 1	4.2.2.3 AO2 AO2 AO2
02.6	repeat (with different celery stalks) with different number of leaves measure the volume of the water that is taken up (in a given time)	allow use one stalk of celery and remove (some) leaves with each repeat ignore repeat with no leaves allow idea of time how long it takes for the water to reach the leaves or how long it takes the leaves to become dark red (if using separate stalks)	1 1	4.2.2.3 AO3 AO3

02.7	allow any two from: <ul style="list-style-type: none"> • increase the temperature of the room • use a fan (blowing over the leaves) • increase light (intensity) 	allow turn on a heater do not accept heat the water allow ways of increasing light (intensity)	2	4.2.2.3 AO2
Total			12	

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.	
03.1	it does not contain starch	ignore high / low amount	1	4.2.1.5 AO3	
	it contains sugar		1		
	it contains protein		1		
03.2	carbohydrase		1	4.2.1.5 AO1	
03.3	mitochondria		1	4.1.3.2 AO1	
03.4	B	no marks if incorrect or no food given if no food written on answer line check Table 2	1	4.3.1.5 4.2.1.5 AO3	
	does not contain sugar		1		AO2
	does not contain starch (that can be converted to sugar)		1		AO2
		ignore references to protein			
Total			8		

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	nucleus	in any order allow phonetic spelling	1	4.1.3.2 AO3
	chloroplast	ignore chlorophyll	1	AO2
	(permanent) vacuole	ignore cell sap	1	
		allow starch grains / granules		AO2
04.2	any one from: <ul style="list-style-type: none"> • (for) strength / support • (to) maintain the structure / shape of cell 	allow to stop the cell bursting allow (for) protection against mechanical damage	1	4.1.3.2 AO1
04.3	allows some substances through		1	4.1.3.3 AO1
04.4	by osmosis		1	4.1.3.3 AO1
04.5	by active transport		1	4.1.3.3 AO3
04.6	(substance C is) too big		1	4.1.3.3 AO3
	to pass through the membrane / holes / gaps	ignore it cannot pass / get through unqualified allow 2 marks for: the gaps are too small for substance C to pass through	1	

04.7	any three from: <ul style="list-style-type: none"> • (cubes cut from) same potato • (starting) volume / size (of potato) • temperature (of sugar solution) • volume of (sugar) solution • use potato with no skin on • time (in solution) 	allow (same) variety / type of potato allow (starting) length allow amount of (sugar) solution allow idea of potato being fully submerged in the (sugar) solution allow 1 hour (in solution) / how long you leave it for (in solution) ignore dry the potato	3	4.1.3.3 AO3
04.8	vernier callipers		1	4.1.3.3 AO1
04.9	the potato cube will stay the same size		1	4.1.3.3 AO2
Total			14	

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	oxygen	word takes precedence allow O ₂ ignore O ² / O2 / O	1	4.2.2.5 AO1
05.2	chlorophyll	allow phonetic spelling ignore chloroplast(s)	1	4.2.2.5 AO1
05.3	air / atmosphere	this order only	1	4.2.2.2 4.2.2.5 AO1
	soil / ground	ignore rain	1	
	sun	allow sunlight / light	1	
05.4	fungus		1	4.2.2.8 AO1
05.5	move the diseased rose bush to a different area		1	4.2.2.8 AO2
	remove the spotty leaves and burn them		1	
05.6	7 / 7.0 / seven (times)	answer line takes precedence	1	4.1.3.2 AO2
05.7	less chlorophyll	allow absolutes throughout, e.g. no chlorophyll	1	4.2.2.5 AO2
	less photosynthesis	allow less chloroplasts allow less green pigment	1	AO2
	(so) less glucose / sugar	allow cannot absorb as much light	1	AO2
	(so) less proteins / lipids / cellulose (needed for growth)	allow less respiration so less energy released (for growth)	1	AO2

05.8	TMV or Tobacco Mosaic Virus	ignore tmv allow Tomato Mosaic Virus / ToMV or Cucumber Mosaic Virus / CMV	1	4.2.2.8 AO3
Total			14	

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	A		1	4.1.3.4 AO3
06.2	C		1	4.1.3.5 AO3
06.3	D there is an extra chromosome or there are three copies of one of the chromosomes or there are 7 chromosomes	no marks if incorrect cell given	1 1	4.1.3.4 AO3 AO3
06.4	mitosis		1	4.1.3.4 AO2
06.5	have XX or have two X chromosomes	allow there is no Y chromosome	1	4.4.3.2 AO3
06.6	bb	do not accept uppercase letters	1	4.4.3.3 AO2

06.7	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th colspan="2" rowspan="2"></th> <th colspan="2" style="text-align: center;">Woman</th> </tr> <tr> <th style="text-align: center;">B</th> <th style="text-align: center;">b</th> </tr> </thead> <tbody> <tr> <th rowspan="2" style="text-align: center;">Man</th> <th style="text-align: center;">B</th> <td style="text-align: center;">BB Eye colour: brown</td> <td style="text-align: center;">Bb Eye colour: brown</td> </tr> <tr> <th style="text-align: center;">b</th> <td style="text-align: center;">Bb Eye colour: brown</td> <td style="text-align: center;">bb Eye colour: blue</td> </tr> </tbody> </table> <p>(Probability of child having brown eyes =) $0.75 / 3:1 / 3 \text{ in } 4 / \frac{3}{4}$</p>			Woman		B	b	Man	B	BB Eye colour: brown	Bb Eye colour: brown	b	Bb Eye colour: brown	bb Eye colour: blue	<p>3 correct genotypes = 2 marks 2 correct genotypes = 1 mark</p> <p>eye colour correct for all their genotypes</p> <p>allow 75 % do not accept 1:4</p> <p>probability must match their description of eye colour</p> <p>if no eye colour given allow correct probability from genotypes</p>	<p>2</p> <p>1</p> <p>1</p>	<p>4.4.3.3 AO2</p> <p>AO2</p> <p>AO3</p>
				Woman													
		B	b														
Man	B	BB Eye colour: brown	Bb Eye colour: brown														
	b	Bb Eye colour: brown	bb Eye colour: blue														
06.8	<p>any two from:</p> <ul style="list-style-type: none"> • lean / slim body • strong / muscular / long legs • muscular body • aerodynamic / streamlined shape • thin / short fur (to prevent overheating) 	<p>ignore long body unqualified</p>	<p>2</p>	<p>4.4.4.5 AO3</p>													
Total			13														

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	C		1	4.2.1.6 AO2

Question	Answer	Mark	AO/ Spec. Ref
07.2	Level 3: The design / plan would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	5–6	AO1
	Level 2: The design / plan would not necessarily lead to a valid outcome. Most steps are identified, but the plan is not fully logically sequenced.	3–4	AO1
	Level 1: The design / plan would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2	AO1
	No relevant content	0	
	Indicative content <ul style="list-style-type: none"> • consume / eat / drink controlled amounts of caffeine, e.g. volume of cola or fraction of a tablet • include eating / drinking sample with no caffeine (as a control) • control variables considered, e.g. age, no caffeine before the test, time intervals between caffeine, fitness levels • hold metre rule above hand of person to be tested • (so) the 0 mark is level with the top of the hand or from same height / position • drop the rule and the other person catches it and record the distance where the rule is caught • convert the distance into time using a standard scale chart or calculation • (instead of ruler drop test) use a computer program to determine reaction time or allow description of computer program • repeat the test • calculate a mean • safety issues discussed, e.g. ensuring not too much caffeine is consumed <p>For Level 3 how to change the independent variable and a valid method are both described</p>		4.2.1.6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.3	receptors		1	4.2.1.6 AO1
07.4	any two from: <ul style="list-style-type: none"> • age • medication / drugs / alcohol • level of tiredness • sports specialism (of athletes) • level of training • amount of practise (before test) • distance from the light box • quality of vision 	ignore caffeine ignore level of fitness allow height (of person) allow (quality of) background illumination ignore brightness of light box ignore use same light box ignore diet ignore weight / mass / BMI	2	4.2.1.6 AO3
07.5	Test 4		1	4.2.1.6 AO2
07.6	152.62 152.6 (ms)	an answer of 152.6 scores 2 marks allow correct rounding of an incorrect calculated value	1 1	4.2.1.6 AO2
07.7	0.138(2) (s)	allow 0.14 (s)	1	4.2.1.6 AO2
07.8	anomalies can be identified		1	4.2.1.6 AO3
07.9	only tested on one male / female athlete	allow sample size too small	1	4.2.1.6 AO3
Total			16	

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	any two from: <ul style="list-style-type: none"> • increased use of electronic devices (for reading / working) • increased recycling of paper • paper production processes are more efficient / modern (and produce less carbon dioxide) 	allow less paper used ignore less paper produced ignore references to re-planting trees ignore carbon offset	2	4.4.1.4 AO3
08.2	any two from: <ul style="list-style-type: none"> • decreased use of fossil fuels • increased use of renewable sources for electricity production • increased electricity production from nuclear power stations • increased use of carbon capture / carbon storage • less electricity produced / used (in the UK) • to comply with government regulations 	allow named example allow named example allow idea of greater use of energy efficient appliances / devices	2	4.4.1.4 4.4.1.5 AO3
08.3	$\frac{126\,300\,000}{631\,400\,000} \times 100$ <p>20 (%)</p>	an answer of 20 scores 2 marks allow $\frac{1263}{6314} \times 100$	1 1	4.4.1.4 4.4.1.5 AO2

Question	Answer	Mark	AO/ Spec. Ref
08.4	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	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	
	<p>Indicative content</p> <p>mechanism:</p> <ul style="list-style-type: none"> • rise in greenhouse gases • carbon dioxide / greenhouse gases absorb (long-wavelength) radiation • (causing) an increase in temperature • (causing) global warming • (causes) climate change <p>consequences of global warming:</p> <ul style="list-style-type: none"> • melting of ice caps • (causing) sea levels to rise • (causes) flooding (of low-lying land masses) • (causes) habitat destruction • leading to extinction • (causing) reduction in biodiversity • increase in extreme weather • changes in rainfall • (causes) drought / water shortage • (causes) changes to yield of crops in some areas • (may lead to) food shortages • changes to migratory patterns of animals • changes in species distributions • (causes) changes in food webs • increased (geographical) range of tropical diseases • increased absorption of carbon dioxide into the seas and oceans • (causes) acidification of oceans • (which) could lead to changes in species abundance <p>For Level 3 mechanism and linked consequences needed</p>		4.4.1.3 4.4.1.4 4.4.1.5 4.4.2.3 4.4.2.5
Total		12	