AQA

GCSE
Combined Science: Synergy

8465/2H – Paper 2 – Life and Environmental Sciences – Higher Tier

Mark scheme

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	any **three** from: • same surface area of bag (exposed to sun) • same volume / mass of water • use same starting temperature of water • place all bags out at the same time • place all bags out in same area / conditions • same thickness of material / bag • same type of material (for each bag) • use IR lamp in a lab	allow same sized bag allow same amount of water allow measure temperature at the start	3	AO3 4.1.4.3
01.2	0.1 (˚C)		1	AO2 4.1.4.3
01.3	any **one** from: • more cloudy • less sunny • less sunlight • cooler day	ignore less Sun	1	AO3 4.1.4.3
01.4	24.3 (˚C)		1	AO2 4.1.4.3
01.5	black (it has the) greatest (temperature) rise	reason only scores if black is given allow it is the best absorber of IR (radiation) ignore best emitter of IR (radiation)	1 1	AO3 4.1.4.3
Total			**8**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	ionising radiation	allow UV / X-rays / gamma (radiation) allow environmental factors qualified eg carcinogenic chemicals	1	AO1 4.4.4.1
02.2	enzymes vectors		1 1	AO1 4.4.4.6

Question	Answers	Mark	AO / Spec. Ref
02.3	**Level 2:** Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.	4–6	AO2 AO1
	Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.	1–3	AO1
	No relevant content	0	
	Indicative content • pre-clinical trials of the new drug on cells / tissues / live animals • to test for toxicity / dosage / efficacy • clinical trials / tests on healthy volunteers • clinical trials / tests on children with Dravet syndrome at very low doses • so you can monitor for safety / side effects • and only after these stages trial to find optimum dosage / test for efficacy • trial could be double blind / use a placebo • which does not contain the new drug • children with Dravet syndrome would be randomly allocated to the test groups • so no one knows who has the drug / placebo • comparison to existing drugs • peer review of data • to help prevent false claims • approval by NICE to access **level 2** the key ideas of testing on healthy volunteers followed by testing on patients must be given		4.3.3.7
Total		**9**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	trachea		1	AO1 4.2.1.3
03.2	any **one** from: • can see more detail in lungs • you can see the bronchus / bronchioles / soft tissues	ignore gives clearer image ignore bones allow it doesn't use ionising radiation allow X-rays can cause cancer / mutations	1	AO3 4.2.1.3
03.3	you can see the ribs / bones	allow cheaper allow takes less time	1	AO3 4.2.1.3
03.4	any **three** from: (aerobic) • uses / needs / requires oxygen (and anaerobic does not) • transfers more energy (than anaerobic) • produces carbon dioxide / water (anaerobic does not) • does not produce lactic acid (anaerobic does) • does not cause an oxygen debt (anaerobic does)	allow converse in terms of anaerobic allow releases more energy (than anaerobic) do **not** accept energy is created / produced / made allow aerobic takes place in mitochondria **and** anaerobic takes place in cytoplasm	3	AO1 4.2.1.1

Question	Answers	Mark	AO / Spec. Ref
03.5	**Level 3:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	5–6	AO2 4.2.1.2 4.2.1.3 4.3.1.2
	Level 2: Relevant points (reasons / causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.	3–4	
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	
	No relevant content	0	
	Indicative content (stopping smoking will improve health because): • smoking is a risk factor for cardiovascular disease • raises blood pressure • increases cholesterol and / or lowers HDL • increases artherosclerosis **or** thickened artery walls • increases the risk of blood clots forming • increases risk of stroke • smoking is a risk factor for lung cancer • as it can cause mutations • caused by carcinogenic chemicals in smoke (tar) • leading to uncontrolled growth of cells • smoking damages alveoli • causing the surface area of the alveoli to decrease • causes emphysema / COPD • causes shortness of breath **or** reduces gas exchange • chemicals / tar / nicotine in the smoke irritate / inflame the bronchi / lung / bronchioles • which damage the cilia • causes goblet cells to secrete more mucus • causes shortness of breath **or** reduces gas exchange • causing chronic bronchitis **or** increases risk of infections		

Question	Answers	Mark	AO / Spec. Ref
03.5 cont.	• carbon monoxide is produced • which is toxic / poisonous • binds / attaches to haemoglobin / Hb • so oxygen carrying capacity of blood is decreased		
Total		**12**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	availability of food		1	AO1 4.4.2.3
	new diseases		1	
04.2	(sampling has been used) so not all mice / voles / owls are counted **or** some mice / voles / owls won't have been caught **or** were hidden	allow idea of animals (constantly) moving around	1	AO3 4.4.2.4
	(sampling has been used) so some counted more than once	if no other marks awarded allow we don't know the sampling method used	1	
04.3	line rises and falls		1	AO3 4.4.2.1
	rise and fall pattern is below the line for mice and voles (throughout graph)		1	
	rise and fall pattern is after the corresponding rise and fall for mice and voles (from first trough onwards)		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4		no mark for decrease / increase mark as pairs with correct increase / decrease given		
	(voles decrease / drop)			
	(because) less mice for the owls to eat		1	AO3 4.4.2.2
	(therefore) owls eat more voles	allow for **2** marks (decrease) because they are the only / main source of food for owls	1	AO2 4.4.2.2
	or			
	(voles increase / rise)			
	(because) more food is available (1)			
	(because) mice are not eating it (1)			
Total			**9**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	<u>antigen</u> (in vaccine) stimulates white blood cells	allow leucocytes / lymphocytes do **not** accept phagocytes	1	AO1 4.3.3.5
	to produce specific antibodies		1	AO1 4.3.3.5
	(so) if the person ingests salmonella	allow idea of secondary exposure	1	AO1 4.3.3.5
	(so on secondary exposure to antigen / bacteria white blood cells) produce the (correct) antibodies faster **or** in larger quantities	allow idea of memory cells produced	1	AO1 4.3.3.5
	(so) toxins (produced by the bacteria) don't reach high enough concentrations / levels (to make the person have symptoms)		1	AO2 4.3.3.2
05.2	(random) mutations (in the population of bacteria)	do **not** accept bacteria deliberately mutate	1	AO1 4.4.4.1 4.4.4.3
	(so that) resistant salmonella / bacteria are not killed by the antibiotic / nalidixic acid	allow those bacteria without the mutation are killed by antibiotic / nalidixic acid do **not** accept immune bacteria	1	AO1 4.4.4.3
	(so) these bacteria reproduce to pass on the gene for resistance (to their offspring)		1	AO1 4.4.4.3
Total			**8**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	(715.1 − 238.8 = 476.3) $\frac{476.3}{715.1}$ (× 100) 66.6 (%)	an answer of 66.6 (%) scores **2** marks allow correct rounding of 66.60606908	1 1	AO2 4.2.1.6
06.2	hold metre rule above hand of person to be tested so the bottom of the ruler is level with the top of the hand drop the rule and the other person catches it record / measure the distance where the rule is caught convert the distance into time using a standard (scale) chart **or** calculation	ignore electronic methods allow description of any reasonable method that would give results	1 1 1 1	AO1 4.2.1.6
06.3	any **one** from: - higher resolution - times are too small (for humans) to measure - random - no calculation errors	allow measured in milliseconds ignore human error unqualified allow not biased allow it is quicker ignore more precise	1	AO3 4.2.1.6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	any **two** from: • used a different person in each test **or** different people need different amounts of sleep **or** no baseline established (for comparison) • only one person was tested for each sleep time **or** sample size is too small • only did the test on one night • as reaction times in ms they need to do (more than three / five) repeats **or** there is wide variation in the results **or** result for Student C **or** 4 hours' sleep shows a decrease in reaction time • don't know if other factors were controlled • table only shows some of the data	allow correct named example, such as caffeine consumed, sleep before investigation, age	2	AO3 4.2.1.6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.5	**reasons in support:** • performance / accuracy decreases with increasing alcohol concentration **and** performance / accuracy decreases as lack of sleep increases • reduction in performance at the legal alcohol limit / 0.08% (for driving) is the same as (more than) 24 hours without sleep **reasons against:** • idea that the statement is sensationalised and does not use (quantifiable) data • the (performance) scales are different, so difficult to make comparison **or** the (performance) scales are different so the data is misleading • being tired is subjective / different for everyone • there is wide variation in the data • (the graph shows that) some people have 16 / 18 hours without sleep and don't have a drop in performance • at alcohol levels of 0.09% some people have a 14% drop in performance (which is much higher than lack of sleep) • (data contradicts the statement because) for some a small amount of alcohol improves performance	**max 3** marks if only reasons in support or reasons against given ignore study design allow idea that lack of sleep does not necessarily correlate with tiredness allow other correct points of comparison	4	AO3 4.2.1.6
Total			**13**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1		an answer of 2.7 (%) scores **4** marks		AO2 4.3.3.2
	(number of deaths =) 91 **and** (number of cases =) 3.4 × 10^3	allow readings in range 90 to 92 allow readings in range 3.3 × 10^3 to 3.5 × 10^3	1	
	$\dfrac{91}{3.4 \times 10^3}$ (× 100)	allow correct substitution of incorrect readings from 2004	1	
	(=) 2.68	allow correct calculation using incorrect readings from 2004	1	
	2.7 (%)		1	
07.2		ignore numbers		AO3 4.3.3.2
	the number of deaths peaked (to 120 in 2008)	the percentage deaths peaked (to 3.2%)	1	
	(but) the number of reported cases fell / did not rise		1	
07.3	we don't know what the data was before 2002		1	AO3 4.3.3.2
07.4	any **two** from: • poor sanitation **or** idea of poor toilet hygiene • drinking contaminated water • eating contaminated food **or** using contaminated water to grow crops	ignore overcrowding	2	AO2 4.3.3.1 4.3.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.5	air / water under the sheet is warmed by the Sun		1	AO2 4.4.1.7
	(so) water evaporates (from the ground / contaminated water)		1	AO2 4.4.1.7
	(then water) condenses on (the underside of) the plastic sheet		1	AO2 4.4.1.7
	the weight causes a drip point in the centre of the plastic sheet		1	AO2 4.4.1.7
	(so clean) water drips into the can (continuously ready for drinking through the plastic tubing)		1	AO2 4.4.1.8
07.6	UV (light)	ignore ionising radiation	1	AO2 4.4.1.8
	causes mutations in the DNA	causes breakage(s) in the DNA	1	AO2 4.4.4.1 4.3.2.6
	(so) bacteria cannot replicate (and so die out)	(so) cellular processes stop	1	AO2 4.1.3.4
Total			**17**	

Question	Answers	Mark	AO / Spec. Ref
08.1	**Level 3:** The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	5–6	AO2
	Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced.	3–4	AO1
	Level 1: The method 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 • lay a transect line from the edge of the sea up to the stony beach • place a quadrat at regular intervals • on the same side of the transect line each time • use quadrats that don't float • count number of each species present (in the quadrat) **or** estimate percentage cover of plant / seaweed / algae • use a key to identify the individual species • repeat another transect line parallel to the original / 5m further along the shore • conduct at least three transect lines • calculate the means for each distance up the shore to access **level 3** the key ideas of using quadrats with transect lines and counting the number of each species need to be given to produce a valid outcome		4.4.2.4

Question	Answers			Mark	AO / Spec. Ref
08.2	toothed wrack			1	AO3 4.4.2.4
	kite / bar is longest **and** deepest / widest / thickest		do **not** accept if incorrect organism named allow kite / bar has the greatest area	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.3	any **three** from: • more stable • more habitats • greater range of food sources • greater interdependence • sand / stony beach is (very) dry so plants can't grow there • fewer temperature fluctuations	ignore more food unqualified	3	AO3 4.4.2.3 4.4.2.5

| **Total** | | | **11** | |

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	atoms / electrons gain energy		1	AO1 4.3.2.1
	(some) electrons move to a higher energy level	allow (sub) shell for energy level	1	
	(so) as the electrons fall to a lower / original energy level	allow (sub) shell for energy level	1	
	(EM) radiation with a frequency / wavelength within the visible region of the spectrum is emitted		1	
09.2	there should be two electrons on the inner shell (not three)		1	AO3 4.1.2.4 4.1.2.5
	there should only be four electrons in the outer shell **or** there should only be six electrons in total		1	AO3 4.1.2.4 4.1.2.5
	there should be one more proton	allow should be six protons	1	AO3 4.1.2.3
	there should be one fewer neutron	allow should be seven neutrons allow **2** marks for one of the neutrons should be a proton	1	AO3 4.1.2.3
09.3	$_{-1}^{0}e$		1	AO1 4.3.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.4	a neutron splits into a proton **and** an electron	allow beta particle for electron	1	AO2 4.3.2.2
	so there is an extra proton (in the nucleus)		1	AO3 4.3.2.2
09.5		an answer of 17 190 (years old) scores **2** marks		AO2 4.3.2.3
	12.5% is 3 half lives **or** 5730 × 3		1	
	17 190 (years old)		1	
Total			**13**	