GCSE
COMBINED SCIENCE: SYNERGY
8465/2F

Foundation Tier Paper 2 Life and Environmental Sciences

Mark scheme

June 2021

Version: 1.0 Final Mark Scheme

2 1 6 G 8 4 6 5 / 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.

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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, 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 / ; 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 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 1

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
01.1	sun		1	AO1 4.2.2.5 4.4.2.1

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
01.2	primary consumer		1	AO2 4.4.2.1

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
01.3	wheat plants		1	AO2 4.4.2.1

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
01.4	mice added with line to wheat plants and sparrowhawks both arrows in correct direction (from wheat plants to mice to sparrowhawks)		1 1	AO2 4.4.2.1

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
01.5	any **one** from: • mates • territory	ignore food / mice / blue tits allow nesting sites allow habitat	1	AO1 4.4.2.2 4.4.2.3

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
01.6	(the caterpillars) will decrease		1	AO3
	(because the caterpillars) will not have enough food		1	AO2
		allow (because the caterpillars) will not have enough habitat / shelter		4.4.2.1 4.4.2.2

Total Question 1		**8**

Question 2

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
02.1	1 °C		1	AO3 4.1.1.4 RPA2

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
02.2	$\frac{42 + 45 + 45}{3}$ = 44 (°C)	allow $\frac{132}{3}$	1 1	AO2 4.1.1.4 RPA2

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
02.3	ring drawn around 64 test 3 at 15 minutes	additional ring drawn round other value in table means no mark for that box	1	AO3/ 4.1.1.4 RPA2

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
02.4	any **one** from: • not use it • not include in the mean	ignore reference to 'ignore anomalous result' unqualified allow repeat the test	1	AO3 4.1.1.4 RPA2

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
02.5	insulate the beaker add a lid	allow description, eg cover beaker with felt	1 1	AO3 4.1.1.4 RPA2

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
02.6	E = 0.20 × 4200 × 33 E = 27 720 J		1 1 1	AO2 AO2 AO1 4.1.1.4 RPA2

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
02.7	mass of water decreased (because) some evaporated		1 1	AO3 AO2 4.1.1.1 4.1.1.4

Total Question 2		**12**

Question 3

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
03.1	any **one** from: • root • stem		1	AO1 4.2.2.2

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
03.2	any **two** from: • volume of water • temperature • type / variety / species of tomato • height of the plant / seedlings (at start) • number of leaves • height of lamp / light • light intensity • the distance from other lights • type of soil	allow amount of water allow size of plant / seedling (at start) ignore light unqualified allow brightness / power of light / bulb allow other light in the room ignore nutrients	2	AO3 4.2.2.5 4.2.2.6 RPA10

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
03.3	any **two** from: • seedlings grow tallest under blue light • seedlings are the shortest under white light • there was very little difference in height of seedlings grown under white and red light	 allow seedlings grow better / taller under blue light (than under red / white light) allow seedlings grow the worst / least under white light allow seedlings are shorter under white light (than under blue / red light) allow seedlings grow taller under red light than white light	2	AO3 4.2.2.6 RPA10

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
03.4	use a lamp / light (and) move closer and / or further away (from pondweed)	allow reference to light source allow place lamp / light different distances (from pondweed) allow use different power ratings of bulb / lamp	1 1	AO1 4.2.2.6 RPA10

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
03.5	use water at a higher temperature		1	AO3 4.2.2.6 RPA10

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
03.6	rate of photosynthesis = $\frac{\text{number of bubbles}}{\text{time}}$		1	AO2 4.2.2.6 RPA10

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
03.7	any **two** from: • the rate of photosynthesis increases up to 35 / 300 (arbitrary units) • after 35 / 300 (arbitrary units) the rate of photosynthesis then stays the same / constant • the rate increases at a decreasing rate (between 100 and 300 arbitrary units)	do **not** allow photosynthesis stops allow the rate increases at a decreasing rate between 100 and 300 arbitrary units for 2 marks if no other mark awarded allow photosynthesis increases then levels out for **1** mark	2	AO2 4.2.2.6 RPA10

Total Question 3		**11**

Question 4

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
04.1	any **two** from: • sex • age • fitness levels • weight • medical condition / illness • smoking	Ignore reference to healthier unqualified allow gender allow level of exercise allow BMI ignore height / size allow relevant named medical condition / illness eg asthma allow use of caffeine / drugs	2	AO3 4.2.1.1

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
04.2	difficult to count breaths while exercising	ignore human error unqualified allow lose count of breaths (over minute) allow breaths too fast to count allow description of overlap in counting breaths each minute	1	AO3 4.2.1.1 4.2.1.3

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
04.3	4 / 4.0 / four (minutes)		1	AO3 4.2.1.1

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
04.4	any **two** from: (student **X**) • has a higher (resting) breathing rate • breathing rate increased more • breathing rate decreased later after exercise stopped • breathing rate returned to resting rate later • breathing rate stayed higher after exercise stopped	allow converse if clearly referring to student **Y**	2	AO3 4.2.1.1

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
04.5	to increase the uptake of oxygen from the air		1	AO2 4.2.1.1 4.2.1.3

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
04.6	to break down lactic acid		1	AO2 4.2.1.1

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
04.7	any **one** from: • increase in heart rate • increase in depth of breathing	 allow increase in pulse rate allow heavier breathing allow panting allow increase in temperature allow sweating allow blushing allow reddening of skin allow increase in metabolic rate	1	AO2 4.2.1.1 4.2.1.3

Total Question 4		**9**

Question 5

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
05.1	protease		1	AO1 4.2.1.5

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
05.2	liver		1	AO1 4.2.1.5

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
05.3	urea		1	AO1 4.2.1.5

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
05.4	any **three** from: mycoprotein sausages • contain less protein • contain more carbohydrate • contain less fat • contain less salt	allow converse for meat sausages allow contain carbohydrate but meat sausages contain none allow contain less energy (than meat sausages)	3	AO3 4.2.1.5

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
05.5	Biuret reagent		1	AO1 4.2.1.5 RPA7

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
05.6	lilac		1	AO1 4.2.1.5 RPA7

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
05.7	**Level 3:** The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.		5–6	AO1 4.2.1.5 RPA7
	Level 3: The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced.		3–4	
	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 • grind up the sausage • add the sausage to the test tube • add water to the sausage and shake • add the same mass of sausage • add Benedict's solution to the test tube • using a pipette • add the same volume of Benedict's solution • place the test tubes in a water bath • heat the water bath (to ≥ 65 °C / to boiling) • monitor the temperature of the water bath • leave the test tubes in the water bath for the same time • repeat the test for each sample • record the colour change of the Benedict's solution • Benedict's will go green / yellow / orange / brown / red if sugar present • Benedict's solution will stay blue if no sugar present **Level 3** must refer to comparison of test colour for meat sausage and mycoprotein sausage.			

Total Question 5		**14**

Question 6

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
06.1	Felis		1	AO2 4.4.4.4

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
06.2	by natural selection		1	AO1 4.4.4.2

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
06.3	any **one** from: • fossils • DNA • similarities in structure		1	AO1 4.4.4.3 4.4.4.4

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
06.4	by sexual reproduction		1	AO2 4.4.3.1

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
06.5	DNA		1	AO1 4.4.3.1 4.1.3.4

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
06.6	any **one** from: • shape of tail • banding / stripes on tail • markings on chest • markings on face • size of ears		1	AO3 4.4.3.4

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
06.7	any **one** from: • white (front) paw **or** markings on paw • line down body • pattern on body	allow markings on front leg	1	AO3 4.4.3.4

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
06.8	any **one** from: • they all look similar • difficult to see different marking	allow because it is dark allow because they are camouflaged	1	AO3 4.4.2.4

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
06.9	any **three** from: between 1987 and 2008 • the number of wild cats decreased • the number of hybrid cats increased • the overall number of cats decreased • the number of cats in the centre of Scotland decreased • hybrid cats moved further south	allow most cats live in the east of Scotland (in 2008) allow description of reduced density	3	AO3 4.4.2.4

Total Question 6		**11**

Question 7

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
07.1	lack of exercise	allow exercise	1	AO2 4.3.1.2 4.3.1.3

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
07.2	24(%)		1	AO2 4.3.1.2

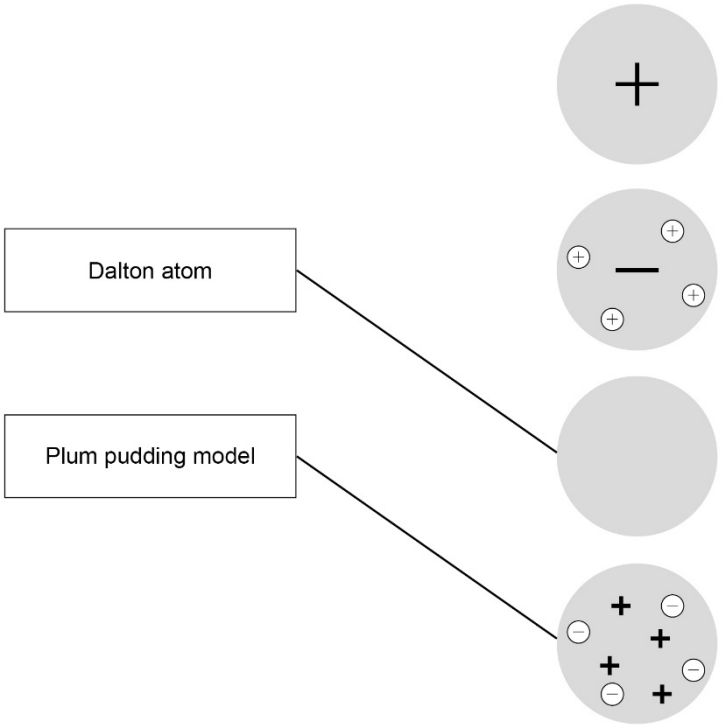
Question	Answers	Extra information	Mark	AO/ Spec. Ref.
07.3	any **one** from: • (lung) cancer • lung disease	allow correct named cancer allow correct named disease eg asthma	1	AO1 4.3.1.2

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
07.4	any **two** from: • reduce fat in diet • reduce cholesterol in diet • eat less sugary foods • take regular exercise • reduce alcohol intake	ignore healthy / balanced diet unqualified allow eat less fatty foods allow eat foods without / low in fat allow eat foods without / low in cholesterol allow eat foods without / low in sugars allow eat a high fibre diet allow reduce salt allow keep a healthy weight allow take statins allow reduce stress	2	AO2 4.3.1.3 4.3.1.2 4.3.1.1

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
07.5		ignore reference to blood pressure		
	reduced / restricted blood flow	allow blood flow stopped	1	AO1
	(so) less oxygen getting to heart (muscle / cells)		1	AO2
	(so) less (aerobic) respiration **or** (so) less energy released	do **not** accept less anaerobic respiration do **not** accept less energy produced / made	1	AO2 4.3.1.3 4.2.1.1

Total Question 7		**8**

Question 8

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
08.1	**Atomic model** **Representation of model**  do **not** accept more than one line form a box on the left		1 1	AO1 AO2 4.1.2.1

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
08.2	a helium nucleus		1	AO1 4.3.2.2

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
08.3	$\frac{8\ 288\ 000}{700}$ **or** 8 288 000 : 700 11 840 (:1)		1 1	AO2 4.1.2.1

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
08.4	most of the (alpha) particles pass straight through	allow most of the (alpha) particles are **not** deflected / repelled / bounced back	1	AO3 4.1.2.1

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
08.5	some of the (alpha) particles bounce back **or** some of the (alpha) particles are deflected		1	AO1
	(because the charged) alpha particles were repelled (by the charged nucleus)		1	AO2 4.1.2.1 4.3.2.2

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
08.6	79 protons **and** 79 electrons		1	AO2
	118 neutrons		1	AO2
	protons in the nucleus		1	AO1
	neutrons in the nucleus		1	AO1
	electrons are arranged in energy levels (around the nucleus)	allow electrons are arranged in shells (around the nucleus)	1	AO1 4.1.2.3 4.1.2.4 4.1.2.5

Total Question 8		**13**

Question 9

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
09.1	microorganisms that cause disease	allow microbes / bacteria / virus / fungi that cause disease	1	AO1 4.3.1.1

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
09.2	**A**		1	AO3 4.3.3.6

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
09.3	**D** (very) small percentage of resistant bacteria	no marks if **D** not chosen allow little / least increase in bacterial resistance do **not** accept small percentage of antibiotic are resistant	1 1	AO3 4.3.3.6

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
09.4	$\frac{297}{55\,000\,000}$ **or** 0.0000054 **or** 5.4×10^{-6} $\left(\frac{297}{55\,000\,000}\right) \times 100\,000$ **or** $0.0000054 \times 100\,000$ **or** $5.4 \times 10^{-6} \times 100\,000$ = 0.54	alternative method $\frac{55\,000\,000}{100\,000}$ (1) $\frac{297}{550}$ (1) = 0.54 (1)	1 1 1	AO2 4.3.3.6

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
09.5	any **one** from: • use of different / new antibiotics • reduction in use of methicillin • increase in staff disinfecting / washing hands between every patient • making visitors wash / disinfect hands • isolating patients with MRSA • testing patients for MRSA before entering hospital • increased use of protective clothing / gloves	ignore reference to hygiene unqualified allow use of PPE	1	AO3 4.3.3.6 4.3.3.1

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
09.6	**Level 3:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form clear account.		5–6	AO2
	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	
	Indicative content **how a vaccine works:** • vaccine would contain a weak / dead form of bacteria / microorganism / microbe / MRSA • reference to immune system / white blood cells • vaccine stimulates white blood cells • reference to antibodies • white blood cells produce antibodies • (antibodies) specific to MRSA / microorganism / microbe / bacteria **when MRSA bacteria enter the body (immunity):** • reference to more rapid response if pathogen re-enters • reference to memory cells • reference to production of specific antibodies • (white blood cells produce) antibodies quicker / immediately • (white blood cells produce) more antibodies • (so) will kill bacteria immediately • person will not develop disease / MRSA For **level 3** there must be reference to MRSA and immunity			4.3.3.5

Total Question 9		**14**