GCSE
COMBINED SCIENCE: SYNERGY
8465/1H

Higher Tier Paper 1 Life and Environmental Sciences

Mark scheme

June 2021

Version: 1.0 Final Mark Scheme

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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 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 1

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
01.1	**W**		1	AO1 4.2.1.7

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
01.2	liver		1	AO1 4.3.1.5 4.3.1.4

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
01.3	hormones travel more slowly than impulses		1	AO1 4.2.1.6 4.2.1.7 4.3.1.4

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
01.4	(the hormones) act on other glands to (stimulate / cause) release of other hormone(s)	 allow causes other glands to release hormones for **2** marks	1 1	AO1 4.2.1.7 4.3.1.4

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
01.5	(**A**) white blood cell (**B**) red blood cell	this order only ignore WBC allow named white blood cell ignore RBC	1 1	AO1 4.2.1.4

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
01.6	$500 = \frac{3.5}{\text{diameter of real cell}}$ $\text{diameter of real cell} = \frac{3.5}{500}$ diameter of real cell = 0.007 (diameter of real cell = 0.007 × 1000 =) 7 (micrometres)	allow conversion of unit at any point in the calculation	1 1 1 1	AO2 4.1.3.1 RPA3

Total Question 1		**11**

Question 2

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
02.1	(**A**) evaporation (**B**) condensation	this order only	1 1	AO1 4.4.1.7

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
02.2	$0.3 \times \frac{83}{100}$ 0.249 (%)	allow $\frac{0.3}{100} \times 83$ allow 0.25 / 0.2 (%)	1 1	AO2 4.4.1.7

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
02.3	any **two** from: • sewage • toxins / chemicals • fertilisers		2	AO1 4.4.2.6

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
02.4	deep(er) / middle layer is warmer (than surface) **or** deep(er) / middle layer does not freeze **or** (organisms) move to deep(er) / middle layer	 allow deep(er) layer is insulated by ice allow only the surface freezes	1	AO3 4.1.1.2

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
02.5	3.8 °C (at 15 m) $\left(\frac{\text{change in temperature}}{\text{change in depth}} =\right)$ $\frac{3.8 - 0}{15 - 7}$ = 0.475 (°C/m)	 allow $\frac{3.8}{8}$	1 1 1	AO2 4.1.1.2

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
02.6	density = $\frac{\text{mass}}{\text{volume}}$ **or** $\rho = \frac{m}{V}$	allow any correct rearrangement	1	AO1 4.1.1.2

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
02.7	$920 = \frac{2.3}{V}$ $V = \frac{2.3}{920}$ V = 0.0025 (m^3)		1 1 1	AO2 4.1.1.2

Question	Answers	Mark	AO/ Spec. Ref.
02.8	**Level 2:** The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.	3–4	AO1 4.1.1.2 RPA1
	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 • measure mass of empty measuring cylinder • with an electronic balance • pour liquid into vessel • measure mass of liquid and measuring cylinder • subtract mass of measuring cylinder (allow use of taring measuring cylinder) • measure volume with a measuring cylinder • measuring to lowest point on meniscus • view with eye level with liquid surface allow use of other appropriate apparatus for measuring volume but **not** beaker		

Total Question 2	**18**

Question 3

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
03.1	any **two** from: • oral contraceptive • injection • implant • skin patch • (some) IUDs	allow the pill allow IUSs allow named methods	2	AO1 4.3.1.7

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
03.2	luteinising hormone		1	AO2 4.3.1.6

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
03.3	maintains the uterus lining		1	AO2 4.3.1.6

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
03.4	formed from two / different eggs fertilised by different sperm so have different genes	 allow so have different alleles / DNA / chromosomes allow so have different genetic information	1 1 1	AO2 4.1.3.5 4.4.3.4

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
03.5	(more women are having) IVF		1	AO2 4.3.1.8
	(in which) FSH given / injected		1	4.3.1.6
	(which) causes more eggs to mature (and be harvested)	allow multiple eggs harvested	1	
	(and) multiple embryos are implanted	allow two (or more) embryos are implanted	1	
	or			
	more women are seeking fertility treatment (1)			
	(in which) FSH / LH is given / injected (1)			
	(which) causes more eggs to be matured / released (1)	effect must match correct hormone		
	(and be) fertilised at the same time (1)			

Total Question 3		**11**

Question 4

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
04.1	time (taken) for count rate from a sample to decrease to half the initial rate **or** for the number of nuclei in a sample of the isotope to halve **or** for the activity of a sample to halve		1 1	AO1 4.3.2.3

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
04.2	2136 – 1986 = 150 years 150 years is 5 half-lives 28 ÷ 2 ÷ 2 ÷ 2 ÷ 2 ÷ 2 (= 0.875 kg) 875 (g)	 allow $\frac{150}{30}$ = 5 allow 0.875 (kg) **or** 0.88 (kg) allow 28 divided by 2 the number of times that is consistent with an incorrect number of half-lives allow 880 (g)	1 1 1 1	AO2 4.3.2.3

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
04.3	as (ionising) radiation (dose) increases number of dragonflies decreases	allow negative correlation	1	AO2 4.3.2.6 RPA12
	as the (ionising) radiation (dose) increases the rate of change in number of dragonflies decreases **or** at a decreasing rate	allow as the (ionising) radiation (dose) increases the change in number of dragonflies decreases	1	

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
04.4	any **one** from: • time of year • time of day • time after accident • water • temperature • weather • wind direction / strength • all sampled at same time • habitat	allow season allow rain / snow / cloudy	1	AO1 4.4.2.3 4.4.2.4 RPA12

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
04.5	mutation decreases / stops protein production causing death **or** inability to reproduce **or** tumour growth **or** cancer **or** (at time of accident) ionising radiation killed large number (of dragonflies) (1) population took years to recover (1) close to the site a greater proportion of the population were killed so population near site is still fewer (1)	allow change in DNA / gene allow different protein made	1 1 1	AO1 4.3.2.6 4.4.4.1

Total Question 4		**12**

Question 5

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
05.1	may contain dissolved substances	allow may contain (dissolved) ions / salts allow may contain other substances / components (which are not harmful to drink)	1	AO1 4.4.1.8 4.1.1.5

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
05.2	heat / boil (sea) water		1	AO1 4.4.1.8
	(so) water evaporates as water vapour		1	RPA11
	cool the water vapour		1	
	(so) water vapour condenses to form potable / liquid / pure / distilled water		1	

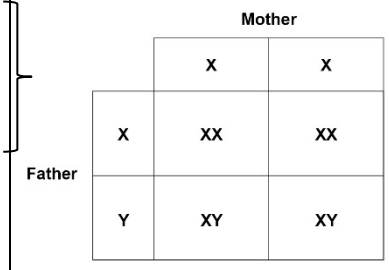
Question	Answers	Extra information	Mark	AO/ Spec. Ref.
05.3	(membrane) allows movement of water	ignore concentration gradients	1	AO2 4.4.1.8 4.1.3.3
	(membrane) does not allow movement of dissolved substances	(membrane) does not allow movement of salt / bacteria / minerals / effluent	1	

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
05.4	requires / needs energy	allow maintenance costs ignore cost of replacement parts ignore electricity unqualified	1	AO2 4.4.1.8

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
05.5	3942 = 1538 + time (270 + 230)		1	AO2 4.4.1.8
	(time =) $\frac{3942 - 1538}{270 + 230}$	allow (time =) $\frac{2404}{500}$ allow evidence of consecutively adding 500 to 1538 until it reaches >3942 for **2** marks	1	
	= 4.808 (years)	allow 4.8 / 4.81 / 5 (years)	1	

Total Question 5		**11**

Question 6

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
06.1	mother XX **and** father XY (possible offspring) XX XX XY XY	 for **2** marks allow correct derivations from incorrect parental gametes using X and Y	1 1	AO1 AO2 4.4.3.3 4.4.3.2

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
06.2	(parents genotype) **Rr and Rr**		1	AO2
	(possible offspring genotypes) **RR Rr Rr rr**	allow correctly derived offspring genotypes from incorrect parental genotypes	1	AO2
	offspring genotype (rr) with cystic fibrosis (CF) identified		1	AO2
	(probability of CF) 0.25 **or** 1/4 **or** 25%	allow correct probability from incorrect parental genotypes	1	AO3
	(probability 0.5 x 0.25 =) 0.125 **or** 1/8 **or** 12.5%	allow student's probability of child with CF divided by 2 allow 0.125 with no probability of CF given for **2** marks	1	AO3 4.4.3.2 4.4.3.3

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
06.3	(for) helps develop drugs / treatments for humans with cystic fibrosis	ignore to help people unqualified	1	AO3 4.4.4.6 4.3.3.8

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
06.4	sheep may be harmed	allow sheep will suffer ignore it is cruel unqualified ignore references to religion / cost	1	AO3 4.4.4.6 4.3.3.8

Question	Answers	Mark	AO/ Spec. Ref.
06.5	**Level 2:** Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.	3–4	AO2
	Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.	1–2	AO1
	No relevant content	0	4.3.3.8 4.4.4.6 4.4.3.1
	Indicative content Isolation • cystic fibrosis gene cut out from human DNA / chromosome • with enzyme Insertion • gene inserted into sheep embryo / egg • using a vector • such as bacterial plasmid or virus • gene inserted into the nucleus of a / some cells • two alleles required • because cystic fibrosis is recessive • or one allele required if sheep do not have a dominant allele for this Development • sheep gives birth to sheep with (symptoms of) cystic fibrosis • cystic fibrosis gene codes for a faulty protein **or** cystic fibrosis gene codes for protein with incorrect shape • this protein causes cystic fibrosis symptoms Responses referring to only one stage are **Level 1**.		

Total Question 6	**13**

Question 7

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
07.1	any **one** from: • through air / coughs / sneezes • touch of (same) surfaces / skin		1	AO1 4.3.3.1 4.3.1.1

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
07.2		need reference to both gel and mucus for maximum marks		
	gel / mucus (both) trap pathogens	allow spray / mucus (both) trap pathogens	1	AO2
	gel / mucus will be moved by cilia		1	AO1
	gel / mucus will be swallowed so pathogens will be killed in stomach acid		1	AO1
				4.3.3.3

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
07.3	any **one** from: • do not know how long cold would last without the spray • there are different strains / types of cold • difficult controlling conditions	allow immune response of different people varies allow named condition that is difficult to control, for example do not know exactly when symptoms started ignore placebo effect	1	AO3 4.3.3.7

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
07.4	any **two** from: • different ingredients have different roles (some ingredients): • improve smell / taste • make other ingredients work • are disinfectants • are solvents • are lubricants		2	AO1 4.3.3.6

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
07.5	any **one** from: • viruses living in cells can be the trigger for cancers • immune reactions (initially caused by a pathogen) can trigger allergies / rashes / asthma • severe physical ill health can lead to depression **or** other mental illness	allow examples such as HPV virus and cervical cancer allow examples such as people with dementia becoming aggressive **or** depressed allow mental illness can lead to physical ill health allow other examples, eg diabetes leading to heart disease	1	AO1 4.3.3.10

Total Question 7		**8**

Question 8

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
08.1	(2018) 1854 (ppb) **and** (2019) 1865 (ppb)		1	AO2 4.4.1.4
	$\frac{1865 - 1854}{1854} \times 100$	allow $\frac{11}{1854} \times 100$ allow correct use of incorrectly determined concentration values	1	
	0.593 (%)	allow any answer that rounds to 0.593 (%)	1	

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
08.2	any **one** from: • variation month to month (within a year) • variations in changes between years • variation about the trend line	ignore variation unqualified allow increasing awareness of climate change may cause reduced (increase in) methane emissions allow cannot predict if more livestock will be farmed allow may eat / produce less meat allow may eat / plant less rice allow methane (production) from landfill is unpredictable	1	AO3 4.4.1.4

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
08.3	less carbon dioxide released	ignore peat bogs release methane do **not** accept methane released when burnt	1	AO2 4.4.2.6 4.4.1.2 4.4.1.3
	(because) less decomposition of peat (as compost) **or** (because) less burning of peat	allow peat absorbs carbon dioxide when photosynthesising (1) so more carbon dioxide would be removed from the atmosphere (1)	1	

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
08.4	short(er) wavelength radiation which enters the atmosphere (from the Sun)	allow UV / ultraviolet / gamma radiation which enters the atmosphere (from the Sun)	1	AO1 4.4.1.3
	(short(er) wavelength radiation) is absorbed by matter / materials / Earth **and** re-emitted		1	
	as a longer wavelength radiation	allow as IR / infrared radiation	1	
	(the longer wavelength radiation) is absorbed by a greenhouse gas which reduces radiation escaping (to space) **or** (the longer wavelength radiation) is absorbed by a greenhouse gas so temperature increases	allow a named greenhouse gas **or** atmosphere for greenhouse gas(es)	1	

Question	Answers	Mark	AO/ Spec. Ref.
08.5	**Level 2:** Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.	4–6	AO1 4.4.1.1
	Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.	1–3	
	No relevant content	0	
	Indicative content Evidence from volcanoes • (current) volcanic emissions • release of carbon dioxide • water vapour (from volcanoes) condensed (forming oceans) therefore decreased in atmosphere • nitrogen (from volcanoes) (mostly) remained due to low reactivity of nitrogen • methane / ammonia (from volcanoes) entered atmosphere Evidence from plants / algae / photosynthesis • (eventually) photosynthesis by algae / plants decreased carbon dioxide • photosynthesis by algae / plants increased oxygen Evidence from oceans / rocks • carbon dioxide decreased in the atmosphere as it dissolved in the oceans • carbon dioxide also decreased in formation of sedimentary rocks Evidence from other planets • the current atmospheres of Mars and Venus are mainly carbon dioxide which adds evidence for this theory For **Level 2** responses must refer to detail of volcanoes and one other source of evidence (photosynthesis / oceans / rocks / planets)		

Total Question 8	**16**