GCSE
COMBINED SCIENCE: SYNERGY
8465/1H

Higher Tier Paper 1 Life and Environmental Sciences

Mark scheme

June 2020

Version: 1.0 Final 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 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	prokaryotic cells		1	AO2 4.1.3.2
01.2	$\frac{13\,500 - 9\,000}{9\,000} \times 100$	allow $\frac{4500}{9\,000} \times 100$ for **1** mark	1	AO2 4.3.3.6
	50 (%)		1	
		if no other mark awarded allow $\frac{13\,500 - 9\,000}{9\,000} = 0.5$ for **1** mark		
01.3	any **two** from: • number of (antibiotic) resistant infections is increasing	allow (current) antibiotics don't always work allow (more) bacteria have become antibiotic resistant	2	AO2 4.3.3.6
	• existing tests to find which antibiotic to use are slow	allow existing tests to find which antibiotic to use take over 30 minutes		
	• to find new antibiotic(s)	allow new antibiotics are needed		
	• (too many) antibiotics are being given for viral infections	allow idea of reducing inappropriate use ignore reducing number of people taking antibiotics unqualified		
	• doctors can start effective treatment sooner			
	• (antibiotic) resistant infections cause deaths **or** burden on doctors / NHS			

01.4	antibiotic resistant bacteria are less likely to evolve fewer bacteria will be exposed to antibiotics		1 1	AO2 4.3.3.6 4.4.4.3
01.5	dead / inactive *E. coli*	allow parts of *E. coli* allow *E. coli* antigens ignore dead / inactive bacteria / pathogen(s) unqualified ignore italics ignore capitalisation	1	AO2 4.3.3.5
Total			**8**	

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	any **two** from: (in a solid) • regular arrangement / pattern (of particles / spaces) • particles are packed close(r) together • particles in a fixed position	allow converse allow each particle touches nearest neighbour allow particles are moving less in a solid	2	AO1 4.1.1.1
02.2	a mixture is formed (which) has a lower melting point **alternative approach:** (mixture) has a lower melting point (1) (so) temperature of surroundings / air / road is not cold enough to keep mixture / ice frozen (1)	allow a solution is formed allow (which) has a lower freezing point allow (mixture) has a lower freezing point	1 1	AO2 4.1.1.5
02.3 view with Figure 1 and mark with 02.4	line of best fit	ignore extrapolation	1	AO2 4.1.1.5
02.4 view with Figure 1 and mark with 02.3	answer consistent with their line	allow ecf from **02.3** if no line drawn allow value between 1.0 and 1.5 (kg)	1	AO3 4.1.1.5

02.5	any **two** from: • more ice is melted (by 1 kg of grit) at higher temperatures • increasingly more ice is melted at higher temperatures **or** gradient increases at higher temperatures • use of pairs of values that show more ice is melted at higher temperatures	allow converse allow the relationship is not linear / proportional allow a tolerance of +/- ½ a small square	2	AO2 4.1.1.5

02.6	any **one** from: • road temperature not air temperature • actual temperature (rather than prediction) • specific to a small area • avoids wasting grit • fewer accidents	allow weather forecasts are (often) inaccurate allow reference to cost of grit allow reference to safety	1	AO3 4.1.1.5

Total			**9**

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	(fat) mix sample with ethanol and add (distilled) water milky / white / cloudy (if fat is present) **or** rub food on paper (and allow to dry) (1) greasy mark (if fat is present) (1) (protein) mix sample with Biuret (reagent) mauve / purple / lilac / pink-purple (if protein is present)	result must correspond with test allow apply Sudan Red / III / Black stain to food (1) red / black (if lipid is present) (1) allow mix sample with Biuret A **and** Biuret B allow mix sample with potassium / sodium hydroxide solution **and** copper sulphate solution	1 1 1 1	AO1 4.2.1.5 RPA7
03.2	fatty acid(s) glycerol	in either order	1 1	AO1 4.2.1.5

03.3	E = 40 × 1250 (= 50 000 (MJ/hour)) E = 50 000 × 8760 E = 438 000 000 (MJ) **or** 4.38×10^8 (MJ)		1 1 1	AO2 4.4.1.5 4.2.1.5

Question	Answers	Mark	AO/ Spec. Ref
03.4	**Level 3:** A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.	5–6	AO3
	Level 2: Some logically linked reasons are given. There may also be a simple judgement.	3–4	AO2
	Level 1: Relevant points are made. They are not logically linked.	1–2	AO2
	No relevant content.	0	4.2.1.5 4.4.1.5 4.4.2.7 4.4.1.2 4.4.1.6 4.4.1.4
	Indicative content • fats and coal are stores of energy • fatbergs are (partially) renewable • coal is a non-renewable energy source • burning / using fatbergs is using a waste product • prevents sewers from being blocked • costs involved with removing blockages • more useful than sending fatbergs to landfill • if less fats are passed into drains then this will cause a supply issue to the (fatberg) power station • both fuels release carbon dioxide when burnt • fatberg power station might be carbon neutral • (if carbon neutral) global warming may be less • named consequence of global warming • coal releases other pollutants when burnt • such as sulfur dioxide • which can cause respiratory problems and acid rain • other items in fatbergs could cause pollution issues if burnt, or would need to be separated • which would be a cost issue • both fuels may release particulates when burnt • which can damage lungs		

Total			15

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	nucleus		1	AO1 4.1.3.2
04.2	(where aerobic) respiration (occurs)		1	AO1 4.1.3.2 4.2.1.1
	(which) releases energy	do **not** accept makes / produces / creates energy	1	
	(energy released) from glucose (using oxygen) **or** (energy released) for cell reactions / movement / muscle contraction	(energy released) for metabolic reactions	1	
04.3	amino acids		1	AO1 4.2.1.5
	(many) joined / linked / bonded together	allow giant (covalent) structure, macromolecule, long chain, polymer, polypeptide	1	
04.4	glycogen	allow phonetic spelling do **not** accept glucagon / glucose / glycerol	1	AO1 4.3.1.5
04.5	the shortest distance between two points that can be seen as separate points		1	AO1 4.1.3.1 RPA3
04.6	$650\,000 = \frac{27}{\text{size of real object}}$		1	AO2 4.1.3.1 RPA3
	$\text{real length} = \frac{27}{650\,000}$		1	
	0.000041538 (mm)	allow more or fewer significant figures	1	
	0.000042 (mm)	allow 4.2×10^{-5} (mm)	1	
Total			**12**	

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	radio (waves)		1	AO1 4.1.4.3
05.2	2.5 km = 2500 m		1	AO2 4.1.4.2
	300 000 000 = f × 2500	this mark may score if λ is not/incorrectly converted	1	
	$f = \frac{300\ 000\ 000}{2500}$	this mark may score if λ is not/incorrectly converted	1	
	f = 120 000 (Hz) **or** f = 1.2×10^5 (Hz)	allow an answer consistent with their value of λ	1	

Question	Answers	Mark	AO/ Spec. Ref
05.3	**Level 2:** The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.	3–4	AO1 4.1.4.3 RPA6
	Level 1: The method would not necessarily lead to a valid outcome. Most steps are identified, but the plan is not fully logically sequenced.	1–2	
	No relevant content.	0	
	Indicative content **Measurements** • take reading of temperature using infrared detector (and record) • repeat with each cube **Control variables** • cubes same volume • cubes made of same metal • add same volume of (hot) water • add water at same temperature • distance of detector from surface • air temperature • thickness / type of paint • leave for same amount of time **or** record every minute Methods with only measurements or only control variables are limited to Level 1		

05.4	black		1	AO1 4.1.4.3 RPA6
05.5	(people with measles / infections) have raised temperature (so) emit infrared (radiation) at a greater rate	allow people with measles / infections have fever ignore emit more infrared (radiation) unqualified	1 1	AO1 4.3.3.2 AO2 4.1.4.3
Total			**12**	

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	magnesium (ion)	allow Mg^{2+} allow Mg (ion)	1	AO1 4.2.2.2
06.2	active transport		1	AO1 4.2.2.3 4.1.3.3
06.3	(mineral ions) are dissolved in water	allow carried in water	1	AO1 4.2.2.2 4.2.2.3
	(so minerals) move up the plant in xylem (tissue / tubes / vessels)	allow through / in xylem (tissue / tubes / vessels)	1	
	(in / by) transpiration <u>stream</u>		1	
	(which is) caused / driven by the evaporation of water from the stomata / leaves	allow (which is) caused / driven by transpiration from the stomata / leaves	1	
06.4	a decrease in the concentration of water vapour in the air		1	AO2 4.2.2.3
	an increase in light intensity causing guard cells to curve more		1	
Total			**8**	

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	heterozygous		1	AO2 4.4.3.3
07.2 **view with Figure 5**	(parents genotype shown) **Rr** and **Rr**	may be on **Figure 5**	1	AO2
	(possible genotypes shown) **RR Rr Rr rr**	allow correct derivation of offspring genotypes from incorrect gametes allow 3 correct offspring genotypes for **1** mark	2	AO2
	correct identification of **rr** as having cystic fibrosis		1	AO2
	0.25	allow 25 % **or** 1 in 4 **or** 1:3 **or** ¼ do **not** accept 1 in 3 **or** 1:4 allow correct probability **or** percentage **or** ratio from incorrectly derived offspring	1	AO3 4.4.3.3
07.3	pathogens / bacteria / viruses breathed in	allow pathogen / bacteria / virus travels through the air allow pathogen / bacteria / virus enters the trachea / bronchi / bronchus	1	AO1
	(and pathogens / bacteria / viruses) stick to mucus in breathing system	allow stick to mucus in trachea / bronchi / bronchus	1	AO1
	(but) cilia cannot easily move thick(er) mucus (upwards / away)	allow cilia cannot move the mucus	1	AO2
	(so) pathogens / bacteria / viruses pass down into lungs (and cause infection)	allow (so pathogens / bacteria / viruses) will remain in the lungs longer	1	AO2 4.3.3.3

07.4	(human allele) inserted into vector / plasmid attached to (hamster) DNA with enzyme(s) **or** cut (vector / plasmid / DNA) with enzyme(s)	ignore vector / plasmid unqualified ignore enzyme unqualified	1 1	AO1 4.4.4.6

07.5	 (medical product) insulin (disorder) diabetes	disorder must match product do **not** accept Type 2 diabetes allow other examples such as (medical product) clotting factors (disorder) haemophilia **or** (medical product) human growth hormone (disorder) achondroplasia **or** (medical product) interferon (disorder) cancer	 1 1	AO1 4.3.3.8 4.3.1.5

Total			**14**

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1		for max marks comparisons must be made		AO2 4.1.2.4
	both have the same number of electrons **and** protons	allow both have 10 electrons **and** 10 protons	1	
	neon-21 has 1 more neutron **or** neon-20 has 1 less neutron	allow neon-20 has 10 neutrons **and** neon-21 has 11 neutrons	1	
		if no other mark awarded allow **1** mark for describing the number of particles in each of the isotopes		
08.2	(calculation of percentage of neon atoms in air) $(\frac{18 \times 100}{1\,000\,000}) = 0.0018$		1	AO2 4.1.2.4
	(calculation of isotope percentage) $(0.0018 \times \frac{0.27}{100}) = 0.0000049$ (%)	allow 0.00000486 (%) **or** 4.86×10^{-6} (%) **or** 4.9×10^{-6} (%)	1	
		allow correct calculation using incorrect calculation for percentage of neon in air		

08.3	(when the supply is switched on) electron(s) (in neon) gain energy (which) moves (electrons) to higher energy level (then) electrons drop back to lower levels releasing energy (that energy is) in the visible region of the spectrum		1 1 1 1	AO1 4.3.2.1

Total			**8**

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	phagocytosis	allow engulfing / ingestion of pathogens do **not** accept eats pathogens	1	AO1 4.3.3.4 4.2.1.4
	producing antibodies		1	
	(which) attach to pathogen **or** (which) make pathogens clump together	allow attaches to antigens on pathogen allow (antibodies) cause agglutination ignore kills pathogen unqualified	1	
	producing antitoxins		1	
	(which) destroy toxins released by pathogen		1	
	(some WBC are) memory cells which respond quickly on reinfection **or** (some WBC) recognise pathogens / antigen and respond quickly on reinfection		1	
09.2	antiretroviral	allow correctly named example of antiretroviral used to treat HIV for example, tenofovir / emtricitabine / lamivudine / efavirenz ignore prep ignore antiviral do **not** accept antibiotics	1	AO1 4.3.3.2
09.3	HIV is an infection by a virus, whereas AIDS is the consequences in the body from HIV infection	allow HIV is an infection by a virus whereas in AIDS the immune system can no longer deal with **other** infections / cancer	1	AO1 4.3.3.2
Total			**8**	

Question 10

Question	Answers	Mark	AO/ Spec. Ref
10	**Level 3:** A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.	5–6	AO3
	Level 2: Some logically linked reasons are given. There may also be a simple judgement.	3–4	AO3
	Level 1: Relevant points are made. They are not logically linked.	1–2	AO2
	No relevant content.	0	4.3.3.2 4.3.3.6
	Indicative content **advantages** • doctors know about problems with the wound sooner • information to patient / doctor faster • can get information about wound without uncovering it • can apply antibiotics without uncovering wound • wound will heal sooner because not removing as often to check for infection • less chance of infection because not removing as often to check for infection **disadvantages** • more expensive • needs a power source / battery / wireless signal • not readily available **or** cannot be bought in a chemist shop • not as easy to remove and clean • antibiotic from smart dressing may not be appropriate for that infection • could increase rate of evolution of antibiotic resistance • patient may panic unnecessarily • patient may have technical problems using phone, or no access to phone or signal • patient may have technical problems with sensor / electronics • doctor may receive more information than has time to deal with **both** • keep pathogens out • reduce blood loss • allow helps platelets to clot blood Answers with **only** advantages or **only** disadvantages limited to Level 1		

Total		6