GCSE
COMBINED SCIENCE: SYNERGY
8465/1F

Foundation Tier Paper 1 Life and Environmental Sciences

Mark scheme

June 2022

Version: 1.0 Final Mark Scheme

226G8465/1F/MS

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 their 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 (for example, a scientifically correct answer that could not reasonably be expected from a student's knowledge of the specification).

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**.
Alternative words in the mark scheme are shown by a solidus 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** magnetic materials.

[2 marks]

Student	Response	Marks awarded
1	iron, steel, tin	1
2	cobalt, nickel, nail*	2

3.2 Use of symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, or uses symbols to denote quantities in a physics equation, 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. At any point in a calculation students may omit steps from their working. If a subsequent step is given correctly, the relevant marks may be awarded.

Full marks are **not** awarded for a correct final answer from incorrect working.

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

An error can be carried forward from one question part to the next and is shown by the abbreviation 'ecf'.

Within an individual question part, an incorrect value in one step of a calculation does not prevent all of the subsequent marks being awarded.

3.6 Phonetic spelling

Marks should be awarded if spelling is not correct but the intention is clear, **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.

3.11 Numbered answer lines

Numbered lines on the question paper are intended to support the student to give the correct number of responses. The answer should still be marked as a whole.

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, if necessary, 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. With practice and familiarity you will find that for better answers you will be able to quickly skip through the lower levels of the mark scheme.

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.

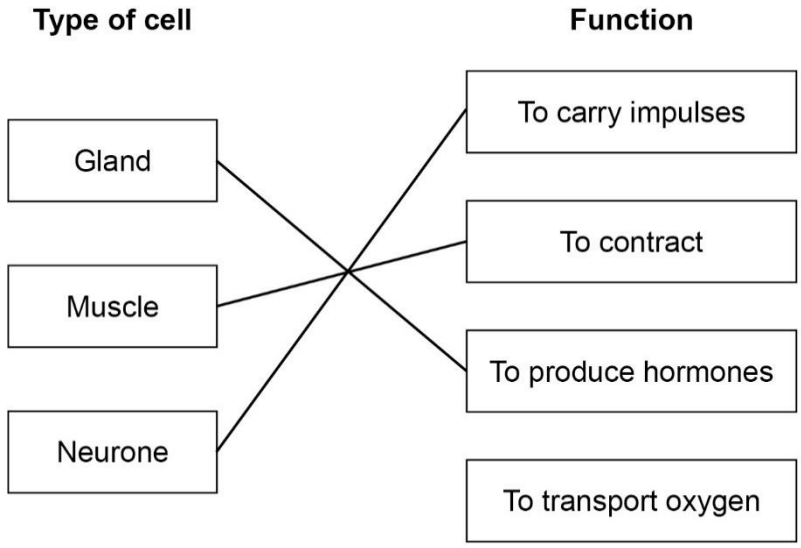
You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

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	 do **not** accept more than **one** line from a box on the left		1 1 1	AO1 4.1.3.6 4.2.1.6 4.2.1.7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	in the foot		1	AO2 4.2.1.6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	the central nervous system		1	AO2 4.2.1.6

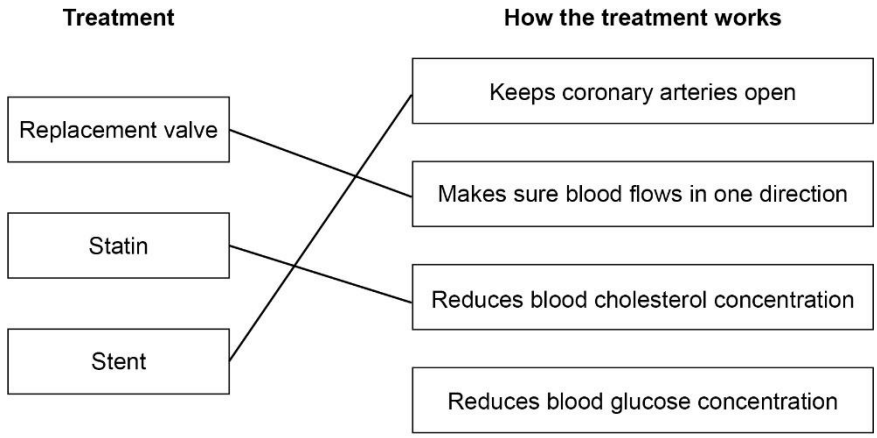
Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	the toes curling		1	AO2 4.2.1.6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	to release energy	allow for energy do **not** accept energy is made / produced / created	1	AO1 4.2.1.1 4.2.1.6
	for movement	allow for (muscle) contraction allow for active transport allow for keeping warm allow for muscle repair / growth	1	

Total Question 1		**8**

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	heart	ignore heart muscle ignore cardiac muscle	1	AO1 4.2.1.3 4.3.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	 do **not** accept more than **one** line from a box on the left		1 1 1	AO1 4.3.1.3 4.2.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	genes are transferred into the bacteria		1	AO1 4.3.3.8 4.4.4.6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	large quantities of the drug can be produced		1	AO3 4.3.3.8 4.4.4.6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	organs from GM animals are less likely to be rejected by the human immune system		1	AO1 4.3.3.8 4.4.4.6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	any **one** from: • animals are killed • against religious beliefs • cruel • the animals may spread disease	allow animals are hurt / harmed allow may not be safe for humans	1	AO3 4.3.3.8 4.4.4.6

Total Question 2		**8**

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	any **one** from: • metre rule • Vernier callipers	allow ruler allow micrometer allow tape measure	1	AO1 4.1.1.2 RPA1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	27.0 cm^3		1	AO2 4.1.1.2 RPA1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	density = $\frac{13}{8.0}$ density = 1.625 density = 1.6	 allow 1.63 allow a correctly calculated answer to 2 significant figures from an incorrect calculation which uses the values in the question	1 1 1	AO2 4.1.1.2 RPA1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	balance		1	AO1 4.1.1.2 RPA1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	add key and record / measure / note level of water		1	AO1 4.1.1.2 RPA1
	subtract original volume **or** subtract 70 cm^3	allow measure the increase / rise in water level allow fill measuring cylinder to top and add key (1) allow collect water that overflows and record volume (1)	1	

Total Question 3		**8**

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	appearance DNA	in this order only	1 1	AO1 4.4.4.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	*Brassica*		1	AO2 4.4.4.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	4 (million years ago)	allow four	1	AO2 4.4.4.4 4.4.4.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	lipid		1	AO1 4.2.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	selective breeding		1	AO1 4.4.4.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.6	all of the DNA in an organism		1	AO1 4.4.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.7	25 000		1	AO2 4.4.3.1
	$\frac{25\ 000}{30\ 000} \times 100$	allow from an incorrect reading from figure	1	4.4.4.4
	= 83.3 (%)	allow 83 (%) allow 83.3 (%) (recurring) allow an answer to more significant figures	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.8	most genes are the same in cabbage and in cauliflower		1	AO3 4.4.4.4

Total Question 4		**11**

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	gonorrhoea		1	AO1 4.3.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	bar correctly plotted at 60%	allow a tolerance of ± ½ a small square ignore width of bar	1	AO2 4.3.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	HPV **or** human papillomavirus		1	AO3 4.3.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	55(%) **and** 10(%) 55(%) – 10(%) = 45(%)		1 1	AO2 4.3.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	estimated risk is higher (than actual risk)	allow actual risk is lower (than estimated risk)	1	AO3 4.3.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.6	any **one** from: • barrier method (of contraception) • condom • abstinence	ignore contraception unqualified allow femidom	1	AO1 4.3.3.2 4.3.1.7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.7	(causes / increases number / rate of) mutation(s)	allow DNA is damaged / mutated / changed allow genes / alleles / chromosomes are damaged / mutated / changed ignore cell mutation	1	AO2 4.3.3.10 4.3.3.2 4.3.2.6 4.3.2.7

Total Question 5		**8**

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1 view with Figure 8	nucleus		1	AO1 4.4.3.1 4.1.3.2 4.1.3.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	any **two** from: • two strands • helix • long • polymer	allow twisted / spiral allow double helix for **2** marks	2	AO1 4.4.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	egg(s) / ova / ovum		1	AO1 4.4.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	sperm cell contains half the (number of) chromosomes	allow sperm cell contains half the DNA allow 23 (chromosomes) instead of 46 allow liver cell contains pairs of chromosomes allow sperm cell is haploid and liver cell is diploid	1	AO1 4.4.3.1 4.1.3.5

Question	Answers	Mark	AO / Spec. Ref.
06.5	**Level 2:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	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	AO2
	No relevant content	0	
	Indicative content **observation** • sperm (in **Figure 9**) contains Y (chromosome) • sperm (in **Figure 9**) does not contain X (chromosome) **recall and application** • females have XX • (so) eggs always contain X • males have XY • offspring will inherit X from egg / mother • offspring will inherit Y from this sperm • the offspring will have XY **reasoning** • therefore offspring will be male for **Level 2** there must be some recall and application of knowledge		4.4.3.2 4.4.3.1 4.1.3.5

Total Question 6		**9**

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	(Neutron) 0 (Proton) +(1)	allow neutral **or** no (charge) allow positive	1 1	AO1 4.1.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2	plum pudding model		1	AO1 4.1.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.3	two neutrons and two protons		1	AO1 4.3.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4	$\frac{8\ 289\ 864}{7\ 920}$ = 1046.7	 allow 1047	1 1	AO2 4.1.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.5	40 **:** 1		1	AO2 4.1.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.6	alpha particles following path **C** are bounced back		1	AO3 4.1.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.7	**W**		1	AO2 4.1.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.8	**X** and **Y**		1	AO2 4.1.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.9	1.82×10^{-10} (m) **or** 0.000 000 000 182 (m)	allow 0.182×10^{-9} (m)	1	AO2 4.1.2.2

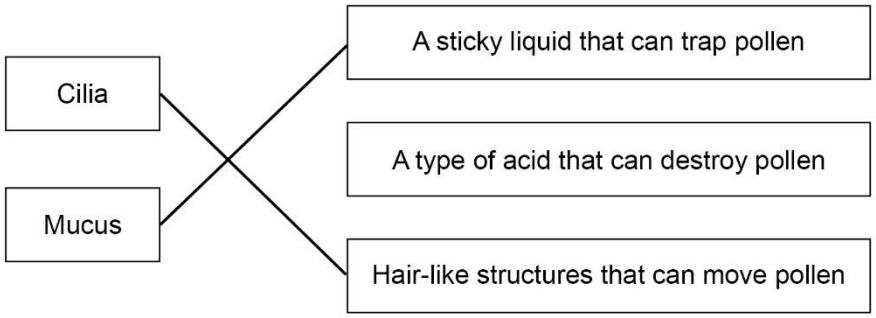
Total Question 7		**11**

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	white blood cells		1	AO1 4.3.3.4 4.2.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.2	antitoxin(s)		1	AO1 4.3.3.4 4.2.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.3	phagocytosis	allow phonetic spelling	1	AO1 4.3.3.4 4.2.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.4	**Adaptation** **Description**  do **not** accept more than **one** line from a box on the left		1 1	AO1 4.3.3.3 4.3.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.5	any **two** from: • (worsening of) asthma • rash • sneezing • runny nose • difficulty breathing • cough • itchy / scratchy / watering eyes • headache	allow blocked nose	2	AO1 4.3.3.10

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.6	any **one** from: • pollen is not a (type of) bacteria • antibiotics treat infection by bacteria	allow antibiotics kill bacteria	1	AO3 4.3.3.6 4.3.3.10

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.7	(bacteria evolve) antibiotic resistance therefore (future) infections will not be able to be treated	allow bacteria become resistant	1 1	AO1 AO3 4.3.3.6 4.4.4.3

Total Question 8		**10**

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	(ultraviolet radiation) any **one** from: • sunbeds • water purification • fluorescent lamps (infrared radiation) any **one** from: • heaters • cooking • (infrared) cameras	allow any reasonable answer allow sterilising allow killing bacteria allow security marking of banknotes allow detecting blood (in forensics) allow identifying chemicals / pigments / bacteria allow a descriptive use of an infrared camera allow remote control(s)	1 1	AO1 4.1.4.3 4.4.1.8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.2	light is emitted		1	AO2 4.3.2.1 4.1.2.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.3	3.0×10^8 m/s		1	AO2 4.1.4.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.4	(wave) speed = frequency × wavelength **or** $v = f\lambda$		1	AO1 4.1.4.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.5	$300\,000\,000 = 750\,000 \times \lambda$		1	AO2
	$\lambda = \frac{300\,000\,000}{750\,000}$		1	AO2
	$\lambda = 400$		1	AO2
	metres	allow m	1	AO1 , 4.1.4.2

Total Question 9		**9**

Question 10

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.1	any **two** from: • temperature • (no) skin on potato • surface area (of potato pieces) • volume of salt solution • type of potato **or** same potato	ignore mass ignore time allow shape / dimensions (of potato pieces) ignore size / volume (of potato pieces) ignore amount of salt solution	2	AO1 4.1.3.3 RPA4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.2 view with Table 3	$\frac{(-)0.26 + (-)0.35 + (-)0.32}{3}$ (–)0.31 = –0.31	allow $\frac{(-)0.93}{3}$	1 1 1	AO2 4.1.3.3 RPA4

Question	Answers	Mark	AO / Spec. Ref.
10.3	**Level 3:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	5–6	AO2 4.1.3.2 4.1.3.3 RPA 4
	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 • water enters the cell / potato • by osmosis / diffusion • (water moves in) through (cellulose) cell wall • as it is permeable • (water moves in) through cell membrane • as it is partially permeable • and allows small molecules / water to pass • water moves into cytoplasm • (because) concentration (of salt solution) in cytoplasm is greater than concentration (of salt solution) outside cells • concentration of salt solution in cytoplasm is greater than 0.2 mol/dm^3 • so water moves from an area of higher water concentration to an area of lower water concentration (or expressed as water potential) **or** so water moves from a dilute solution to a more concentrated solution **Level 3** answers refer to explanations linked to cell structure(s)		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.4	any **one** from: • high(er) resolution • more detail (in cells) • high(er) magnification	allow 3D image ignore clearer ignore reference to colours	1	AO2 4.1.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.5	1.2 cm = 12 mm $\frac{12}{0.008}$ = (×) 1500	allow 0.008 mm = 0.0008 cm allow $\frac{1.2}{0.0008}$ allow a correct use of incorrect / no conversion of image diameter	1 1 1	AO2 4.1.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.6	starch molecules are insoluble		1	AO1 4.2.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.7	(starch broken down) to produce glucose by carbohydrase	allow (starch broken down) to produce sugar / maltose allow by amylase ignore enzyme unqualified	1 1	AO1 4.2.1.5

Total Question 10		**18**