GCSE
BIOLOGY
8461/1H

Paper 1 Higher Tier

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.

No student should be disadvantaged on the basis of their gender identity and/or how they refer to the gender identity of others in their exam responses.

A consistent use of 'they/them' as a singular and pronouns beyond 'she/her' or 'he/him' will be credited in exam responses in line with existing mark scheme criteria.

Further copies of this mark scheme are available from aqa.org.uk

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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 do not form 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 a 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 should be awarded for a correct numerical answer, without any working shown.
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 or three 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	arteries		1	AO1 4.2.2.2 4.2.2.4

Question	Answers	Extra information	Mark	AO / Spec Ref.
01.2	pushes / moves blood to get <u>oxygen</u> around the body	 allow description of getting <u>oxygen</u> around the body, such as through blood vessels **or** to get <u>oxygen</u> to a named organ do **not** accept to get oxygen to the lungs ignore reference to restarting the heart ignore reference to the pacemaker	1 1	AO2 4.2.2.2 4.4.2.1

Question	Answers	Extra information	Mark	AO / Spec Ref.
01.3	provides oxygen (for respiration)	allow idea of carbon dioxide triggering breathing to restart	1	AO2 4.2.2.2 4.4.2.1

Question	Answers	Extra information	Mark	AO / Spec Ref.
01.4	statin(s)	allow named statin	1	AO1 4.2.2.4

Question	Answers	Extra information	Mark	AO / Spec Ref.
01.5	(stent) opens / widens (blocked blood) vessel	allow (stent) keeps (blocked blood) vessel open allow a description of the blood vessel being opened ignore type of blood vessel ignore unblocks (blood) vessel	1	AO1 4.2.2.4
	to allow (more) blood to flow **or** to allow (more) glucose / oxygen to the heart (cells / tissue / muscle)		1	

Question	Answers	Extra information	Mark	AO / Spec Ref.
01.6	any **two** from: • smoking increases the (%) risk of **all** types of (cardiovascular) disease • smoking increases the (%) risk of having (disease) **H** more than any other type of (cardiovascular) disease • smoking increases the (%) risk of having (disease) **E** less than any other type of (cardiovascular) disease	ignore smoking causes (cardiovascular) disease allow not smoking decreases the risk of **all** types of (cardiovascular) disease allow if you smoke, you are **most** likely to get (disease) **H** allow if you smoke, you are **least** likely to get (disease) **E** allow a comparison of the effect of smoking on the risk of two (cardiovascular) diseases allow two comparisons of the effect of smoking on the risk of two (cardiovascular) diseases for **2** marks	2	AO3 4.2.2.6

Question	Answers	Extra information	Mark	AO / Spec Ref.
01.7	*y*-axis labelled **'**Percentage / % increase in risk (compared to people who have never smoked)**'**		1	AO2 4.2.2.6
	correct scale of 1 cm = 5% on *y*-axis		1	
	all bars plotted correctly	allow a tolerance of ±½ small square ignore bars touching ignore width of bars	1	
	all bars correctly labelled		1	

Question	Answers	Extra information	Mark	AO / Spec Ref.
01.8	any **one** from: • poor diet	ignore obesity allow descriptions of poor diet eg diet high in (saturated) fat / cholesterol ignore diet unqualified	1	AO1 4.2.2.6
	• lack of exercise	allow descriptions of lack of exercise allow high alcohol intake allow other correct lifestyle factors such as having a stressful job		

Total Question 1	**14**

Question 2

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.1	nucleus	allow chromosome ignore in the DNA	1	AO1 4.1.1.2 4.1.2.1

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.2	**A**, **D** and **E**		1	AO1 4.2.2.1 4.2.2.2

Question	Answers	Mark	AO / Spec Ref.
02.3	**Level 3:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a 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	AO2
	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	4.2.2.1 4.4.2.1 4.4.2.3

	Indicative content:
	
	Difficulty digesting food
	• less / no lipase
	• (so) less / no fat broken down
	  ○ into fatty acids
	  ○ into glycerol
	
	• less / no carbohydrase / amylase
	• (so) less / no carbohydrate / starch broken down
	  ○ into glucose / sugar
	
	• less / no protease
	• (so) less / no protein broken down
	  ○ into amino acids
	
	Difficulty gaining body mass
	• less / no absorption
	  ○ of small / soluble molecules
	  ○ of fatty acids
	  ○ of glycerol
	  ○ of glucose / sugar
	  ○ of amino acids
	
	• fewer molecules **or** fewer amino acids available for building protein / muscle / cells / tissues
	• less fat stored
	• less respiration
	• less energy
	• (so less energy) for building new molecules / cells / tissues
	
	For **Level 3** details of difficulty digesting food **and** difficulty gaining body mass are needed.		

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.4	large surface / area	allow large surface / area to volume (ratio)	1	AO1 4.1.3.1 4.2.2.2
	(large) capillary network **or** good / efficient blood supply	allow many capillaries	1	
	walls are thin **or** walls are one cell thick	ignore references to membranes ignore alveoli are thin ignore alveoli are one cell thick do **not** accept thin cell walls ignore references to alveoli being moist ignore steep concentration gradient	1	

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.5	less (aerobic) respiration	allow (more) anaerobic respiration	1	AO2 4.4.2.1 4.4.2.2
	(so) less energy (released)	do **not** accept less energy produced / made / created	1	4.4.2.3
	(results in) less muscle contraction **or** (results in) reduced metabolism **or** (results in) increased breathing rate / depth **or** (results in) increased heart rate	allow relevant named metabolic processes allow (results in) person getting out of breath	1	
	OR (more) anaerobic respiration (1) (so) lactic acid produced (1)			
	(results in) <u>muscle</u> fatigue **or** (results in) less <u>muscle</u> contraction **or** (results in) increased breathing rate / depth **or** (results in) increased heart rate (1)	allow <u>muscle</u> ache / cramp / tiredness / pain allow (results in) person getting out of breath		

Total Question 2	**14**

Question 3

Question	Answers	Mark	AO / Spec Ref.
03.1	**Level 3**: The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.	5–6	AO1 4.2.2.1 RPA4
	Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced.	3–4	
	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 • iodine solution tests for starch • iodine changes from yellow / orange / brown • to blue-black **or** black **or** dark blue (to show starch is present when added to cake) • Benedict's (reagent) tests for sugar / glucose • heat (to at least 60 °C) / boil cake with Benedict's (reagent) • Benedict's (reagent) changes from blue • to green / yellow / orange / brown / (brick) red (to show sugar / glucose is present when added to cake) • risk of skin burns from flame (when heating) **or** risk of skin burns from hot glass **or** risk of scald / burn from boiling water o use a water bath o wait for equipment to cool before touching • risk of Benedict's (reagent) spitting into face / eyes when heating o wear eye protection o point test tube away from face(s) when heating • risk of Benedict's (reagent) as an irritant **or** risk of iodine (solution) as an irritant o clean up spills immediately o wear (protective) gloves **or** wear eye protection o use a dropper bottle (to reduce chance of spills) (allow answers in terms of bread) For **Level 3** answers should include the reagents used to test for starch and sugar with correct positive results, and a risk assessment.		

Question	Answers	Extra information	Mark	AO / Spec Ref.
03.2	time taken (for bread) to taste / become sweet	ignore time unqualified	1	AO2 4.2.2.1

Question	Answers	Extra information	Mark	AO / Spec Ref.
03.3	any **one** from: • size / mass of bread • surface area of bread • location of bread on tongue • clean mouth between tests	allow amount of bread allow position of bread in mouth allow a method of cleaning the mouth between tests ignore temperature of bread ignore use the same student	1	AO3 4.2.2.1

Question	Answers	Extra information	Mark	AO / Spec Ref.
03.4	bread contains <u>starch</u> (starch is) broken down into sugar by amylase (in saliva)	 allow (starch is) broken down into glucose / maltose ignore by carbohydrase (in saliva) allow (sugar / glucose) solution reaches taste receptors (on tongue) **alternative route**: bread contains sugar / glucose (1) sugar / glucose dissolves in saliva (in mouth) (1) (sugar / glucose) solution reaches taste receptors (on tongue) (1)	1 1 1	AO2 4.2.2.1

Question	Answers	Extra information	Mark	AO / Spec Ref.
03.5	any **one** from: • investigation not repeated (by the same / different student(s)) • (results) rely on student's (perception of) taste **or** taste is subjective • amount of saliva / amylase produced is variable	ignore mean not calculated ignore reference to control variables	1	AO3 4.2.2.1

Total Question 3	**12**

Question 4

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.1		must be in this order		AO1 4.1.2.3 4.2.3.1
	palisade (mesophyll / layer / cells)	do **not** accept reference to a single cell, once only	1	
	spongy mesophyll / layer		1	
	meristem		1	

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.2	lignin	ignore cellulose	1	AO1 4.1.1.3 4.2.3.1 4.2.3.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.3	translocation	ignore active transport	1	AO1 4.2.3.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.4	(permanent) vacuole		1	AO3 4.1.1.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.5	(cell **X** contains) mitochondria		1	AO3
	for (aerobic) respiration	do **not** accept anaerobic respiration	1	AO2
	(mitochondria / respiration) releases energy	do **not** accept energy produced / made / created	1	AO2
	<u>energy</u> needed to move (dissolved) **sugar(s)** against / up the concentration gradient	allow <u>energy</u> needed to move (dissolved) **sugar(s)** from a low concentration to a high concentration	1	AO2
	by active transport		1	AO2 4.1.3.3 4.1.1.2 4.4.2.1

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.6	any **one** from: • loss of cytoplasm • loss of nucleus • loss of mitochondria • loss of ribosomes • loss of sub-cellular structures • end walls become perforated	ignore description of a phloem cell allow reference to sieve plate formation allow cell walls form allow (larger) vacuole forms ignore reference to change in size / shape	1	AO2 4.1.2.3 4.1.1.4 4.2.3.2

Total Question 4	**12**

Question 5

Question	Answers	Mark	AO / Spec Ref.
05.1	**Level 3:** The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.	5–6	AO1 4.1.3.2 RPA3
	Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced.	3–4	
	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 and) record mass of potato pieces
	• place potato pieces into different concentrations of salt solution
	  ○ use at least 3 different concentrations of salt solution
	• leave potato pieces in salt solutions
	• remove potato pieces from salt solutions
	• blot potato pieces dry
	• (measure and record mass of potato pieces and) calculate change in mass
	• repeat each concentration
	  ○ repeat each concentration 2 **more** times
	• calculate mean change in mass
	
	Control variables
	• use same size / mass potato pieces
	• use same potato **or** use same type of potato
	• use same blotting technique
	• ensure no skin on potato pieces
	• keep potato pieces in solution for the same amount of time (≥10 minutes)
	• keep potato pieces in solutions at the same temperature
	
	For **Level 1**, the method must allow the determination of the change in mass for a piece of potato.
	For **Level 3**, the method must allow the production of the graph in **Figure 4**.		

Question	Answers	Extra information	Mark	AO / Spec Ref.
05.2	(pieces) lost mass because <u>water</u> left cells / potato		1	AO2 4.1.3.2 RPA3
	(because) the solution in the cells / potato is less concentrated than outside **or** (because) the solution in the cells / potato is more dilute than outside	allow (because) the solution outside the cells / potato is more concentrated than inside allow (because) the solution outside the cells / potato is less dilute than inside allow correct references to <u>water concentration</u> / <u>potential</u> ignore reference to amount of water or salt do **not** accept water moves from an area of high (solute) concentration to an area of low (solute) concentration	1	
	water left cells / potato by osmosis	allow water left cells by diffusion through a partially / selectively / semi permeable membrane	1	

Question	Answers	Extra information	Mark	AO / Spec Ref.
05.3	(pieces at 1.0 mol/dm^3) lost more mass because more water left potato / cells	(pieces at 1.0 mol/dm^3) lost more mass because more osmosis occurred out of the potato / cells	1	AO3
	(because) there is a steeper concentration gradient (at 1.0 mol/dm^3)	allow there is a greater difference in the concentration between inside and outside the cells / potato at 1.0 mol/dm^3	1	AO2 4.1.3.1 4.1.3.2 RPA3

Total Question 5	**11**

Question 6

Question	Answers	Extra information	Mark	AO / Spec Ref.
06.1	penicillin	allow other named antibiotics ignore penicillium	1	AO1 4.3.1.3 4.3.1.8

Question	Answers	Extra information	Mark	AO / Spec Ref.
06.2	the bacterium is killed (by antibiotic **C**)	allow there is a zone of inhibition (around antibiotic **C**)	1	AO2 4.3.1.8 4.1.1.6 RPA2
	if the bacterium was resistant, bacteria would be right up to the (edge of the) antibiotic disc	allow resistance means that the bacterium is not killed (by antibiotic(s)) allow if the bacterium was resistant there would be no zone of inhibition ignore no white area	1	

Question	Answers	Extra information	Mark	AO / Spec Ref.
06.3	any **two** from: • current / available antibiotics do not kill (certain) bacteria • diseases become more common **or** there will be some diseases that cannot be cured / treated • new antibiotics need to be developed which takes time / money	allow current / available antibiotics have no effect on (certain) bacteria ignore more people become ill allow some diseases become more difficult to treat	2	AO2 4.3.1.8

Question	Answers	Extra information	Mark	AO / Spec Ref.
06.4	viruses **only** exist / reproduce inside (living) cells	allow viruses **need** (living) cells to exist / reproduce allow viruses exist / reproduce inside (living) cells **and** agar is not made of cells ignore names of cell types	1	AO2 4.3.1.8 4.3.1.1

Question	Answers	Extra information	Mark	AO / Spec Ref.
06.5	(these) drugs (can) damage (body) cells / tissues **or** it is hard to get (these) drugs into (living) cells	allow viruses often / frequently mutate (giving resistance to these drugs)	1	AO1 4.3.1.8

Question	Answers	Extra information	Mark	AO / Spec Ref.
06.6	AIDS		1	AO1 4.3.1.2

Total Question 6	**8**

Question 7

Question	Answers	Extra information	Mark	AO / Spec Ref.
07.1	***Leaf 1 or covered with black paper*** no light so no photosynthesis (occurs)	ignore reference to water ignore reference to carbon dioxide	1	AO3
	Leaf 2 or covered with transparent plastic no carbon dioxide so no photosynthesis		1	AO3
	Leaf 3 or not covered light and carbon dioxide present so leaf can photosynthesise	ignore no limiting factors	1	AO3
	for either Leaf 1 / 2 (so) <u>glucose</u> not made	allow converse for **Leaf 3**	1	AO2
	(and therefore) glucose / sugar cannot be converted to starch		1	AO2
		if neither marking points 4 and 5 awarded, allow starch (previously present) has been broken down for **1** mark		4.4.1.1 4.4.1.2 4.4.1.3

Question	Answers	Extra information	Mark	AO / Spec Ref.
07.2	(green) starch / present / positive **and** (white) no starch **or** not present **or** negative	both required for **1** mark allow blue-black / black **or** dark blue allow yellow / orange / brown	1	AO3 4.4.1.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
07.3	green part contains chlorophyll **and** white part does not (so) light is absorbed by green part (but not by white part) so photosynthesis occurs and starch can be formed	ignore chloroplasts allow (so) light is absorbed by chlorophyll / chloroplasts so photosynthesis occurs and starch can be formed allow converse for white part ignore colours of starch test if referenced	1 1	AO2 AO1 4.4.1.1 4.4.1.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
07.4	magnesium	allow Mg / Mg^{2+} allow nitrate / iron allow other correct named ions	1	AO1 4.3.3.1

Question	Answers	Extra information	Mark	AO / Spec Ref.
07.5	chlorosis		1	AO1 4.3.3.1

Question	Answers	Extra information	Mark	AO / Spec Ref.
07.6	(measure the) volume (of oxygen) released / produced in a given time **or** (count / number of) bubbles released / produced in a given time	allow answers in terms of a specific time ignore measure the amount (of oxygen) released in a given time	1	AO1 4.4.1.2 4.4.1.1 RPA6

Question	Answers	Extra information	Mark	AO / Spec Ref.
07.7	(a factor that) if increased would increase the rate (of a reaction) **or** (a factor that) prevents the rate (of a reaction) increasing	allow answers in terms of (a) named factor(s) allow (a factor that) prevents the maximum rate (of a reaction) being reached	1	AO1 4.4.1.2 4.4.1.1

Question	Answers	Extra information	Mark	AO / Spec Ref.
07.8	increasing temperature while keeping the carbon dioxide (concentration) constant increases the rate (of photosynthesis)	allow increasing the carbon dioxide (concentration) while keeping temperature constant increases the rate (of photosynthesis)	1	AO3 4.4.1.2 4.4.1.1
	increasing the temperature increases the movement of the molecules / particles / substrate **or** increasing the temperature increases the rate of enzyme activity	allow increasing the temperature increases the kinetic energy of the molecules / particles / substrate allow increasing the temperature increases the frequency of collisions between molecules / particles	1	
	increasing carbon dioxide concentration increases (the concentration of) substrate / reactants		1	
	all rates plateau at a certain point due to another factor being limiting	allow all rates plateau at a certain point due to chlorophyll being limiting do **not** accept all rates plateau at a certain point due to light being limiting	1	

Question	Answers	Extra information	Mark	AO / Spec Ref.
07.9	light intensity $\propto \frac{1}{\text{distance}^2}$		1	AO2 4.4.1.2

Total Question 7	**17**

Question 8

Question	Answers	Extra information	Mark	AO / Spec Ref.
08.1	any **one** from: • (cell **or** sub-cellular structures) grows • increase in (number of) sub-cellular structures • increase in (number of) mitochondria • increase in (number of) ribosomes	do **not** accept nucleus ignore increase in cell parts / components allow increase in respiration allow increase in protein (synthesis) do **not** accept changes that occur as the cell divides	1	AO1 4.1.2.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
08.2	(cell) membrane		1	AO1 4.1.2.2 4.1.1.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
08.3		allow use of π button on calculator for 3.14 allow use of $\frac{22}{7}$ for 3.14		AO2 4.1.1.5
	substitution length = $\frac{24\ 500\ 000}{3.14 \times 125^2}$		1	
	(length =) 499.363 (nm)	allow 499 (nm)	1	
	recall of equation magnification = $\frac{\text{image size}}{\text{real size}}$		1	
	correct conversion of mm to nm **or** nm to mm (4 mm = 4 000 000 nm)	allow conversion at any point	1	
	$\frac{4\ 000\ 000}{499.363}$	allow use of correctly rounded calculated value for length	1	
	×8010	allow ×8010.205 do **not** accept if unit given allow an answer consistent with an incorrectly rounded / calculated value for length	1	

Question	Answers	Extra information	Mark	AO / Spec Ref.
08.4	chromosomes cannot be pulled (by the fibres) to each end of the cell	ignore chromosomes cannot be separated unqualified	1	AO3 4.1.2.2
	(so) nucleus cannot divide	allow **two** (genetically identical) cells cannot be formed ignore cytokinesis ignore the cell cannot divide	1	

Question	Answers	Extra information	Mark	AO / Spec Ref.
08.5	tumour cannot grow / proliferate / spread	allow stops secondary tumours forming allow stops metastasis ignore stops uncontrolled cell division do **not** accept the cancer / tumour cannot become malignant	1	AO2 4.1.2.2 4.2.2.7

Question	Answers	Extra information	Mark	AO / Spec Ref.
08.6	testing the drugs on live tissues in a laboratory		1	AO1 4.3.1.9

Total Question 8	**12**