
GCSE
BIOLOGY
8461/2H

Paper 2 Higher Tier

Mark scheme

June 2024

Version: 1.0 Final



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](https://www.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 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 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 **not** 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	a change in: - DNA - base code or nucleotide sequence - base (in DNA) - gene / allele - part of a chromosome - number of chromosomes - genetic code / material	ignore genetic information / variation ignore reference to amino acids or proteins	1	AO1 4.6.2.1

Question	Answers	Extra information	Mark	AO / Spec Ref.
01.2	any three from: - variation (between members of a species) - better adapted survive (better adapted or survivors) reproduce - pass on (favourable) allele(s) / gene(s) / mutation(s)	allow in terms of an example ignore mutation allow survival of the fittest allow converse ignore passing on genetic material or chromosomes or characteristic	3	AO1 4.6.2.1 4.6.2.2 4.6.3.1

Question	Answers	Extra information	Mark	AO / Spec Ref.
01.3	Alfred Wallace and Charles Darwin		1	AO1 4.6.2.2 4.6.3.1 4.6.3.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
01.4	hoverfly looks like a wasp	allow pattern of the markings is similar (on the hoverfly and wasp) ignore predator / animal thinks the hoverfly is a wasp	1	AO3 4.6.3.2 4.7.1.1 4.7.1.4
	predator / animal avoids wasps so it does not get stung		1	
	(so) predator / animal does not attack / eat hoverfly	allow correctly named predator ignore bite / harm	1	

Total Question 1	8
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Question 2

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.1	lack of oxygen for (aerobic) respiration	do not accept ref to respiration in dead plants	1	AO3
	(so) less / no energy (released)	do not accept energy produced / made / created	1	AO2
	(for) microorganisms / bacteria / fungi / microbes / decomposers		1	AO2
	OR			4.2.2.1 4.4.2.1 4.7.1.2 4.7.2.3
	low pH denatures enzymes (1)	allow low pH / acidity reduces enzyme activity		
	(so) less / no (chemical) reactions / metabolism / respiration or less / no energy released (1)	do not accept energy produced / made / created		
	in microorganisms / bacteria / fungi / microbes / decomposers (1)			

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.2	34 g/m ² /year		1	AO2 4.7.4.3

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.3	DNA		1	AO1 4.6.1.5 4.7.1.2 4.7.1.4

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.4	protein		1	AO1 4.4.1.1 4.4.2.1 4.4.2.3 4.7.1.2 4.7.1.4

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.5	increase in temperature	allow global warming allow heat (energy) is trapped ignore reference to greenhouse gases	1	AO3
	(because) carbon dioxide is released (from the peat bog)		1	AO2
	(because) carbon dioxide is produced by burning / decay of peat	ignore methane is released from burning / decay of peat allow fewer plants to take in carbon dioxide (for photosynthesis)	1	AO2
	(because) methane is released (from the peat bog)		1	AO2 4.4.2.1 4.7.2.3 4.7.3.3 4.7.3.5
Total Question 2			10	

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	any one from: • collect more samples each time • collect samples more frequently • use a bigger bucket / sample • do not return tadpoles until after the fourth sample • sample at the same time of day • randomise collecting positions • collect at range of depths • standardised sweeps with a net instead of a bucket	allow suggested time interval allow a method to avoid double counting tadpoles	1	AO3 4.7.2.1 RPA9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	6	if no answer on line, allow answer in Table 1	1	AO2 4.7.2.1 RPA9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	correct linear scale and axis labelled weeks	scale must use at least half available space	1	AO2 4.7.2.1 RPA9
	all points plotted correctly	allow a tolerance of $\pm\frac{1}{2}$ small square allow 4 or 5 correct plots for 1 mark	2	
	curved line of best fit	ignore line drawn point to point	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	correct value at 0 and 4 weeks from line on student's graph, eg 60 and 22	allow a tolerance of $\pm \frac{1}{2}$ small square	1	AO2 4.7.2.1
	<i>correct calculation eg</i> $\frac{22}{60} \times 100$		1	
	36.7	allow 37 or 36.6... allow correct calculation using values from the student's graph if no line drawn on Figure allow a calculation based on values of 60 and 24 for up to full marks if line drawn on Figure but data from table used (60 and 24) only mp2 and mp3 can be awarded	1	

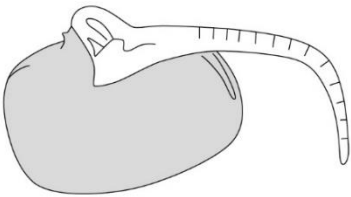
Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	any two from: - disease / (named) pathogens - being eaten or predators - lack of food - low oxygen (concentration in water) - change in temperature - change in pH (some of the) pond dried out - toxic chemical	allow competition for food ignore competition unqualified allow eutrophication allow lack of space allow named example such as sewage / fertiliser ignore pollution ignore waste	2	AO2 4.7.1.2 4.7.1.3
Total Question 3			11	

Question 4

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.1	to prevent (direction of) light affecting the results or to prevent (direction of) light affecting growth (of roots)	allow to prevent phototropism ignore ref to shoot allow so only gravity affects results / growth ignore as a control variable	1	AO3 4.5.4.1 RPA8

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.2	to prevent water affecting the direction of root growth		1	AO3 4.5.4.1 RPA8
	to provide enough water for root growth		1	

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.3	to compare (with apparatus A)	allow to see the difference (between B and A)	1	AO3 4.5.4.1 RPA8
	(so) it shows that <u>gravity</u> caused the results in apparatus A or (because) <u>gravity</u> acted equally in all directions (in apparatus B) or to cancel out the (one-sided) effect of <u>gravity</u>	ignore reference to auxin ignore to cancel out gravity	1	

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.4	root drawn bending downwards		1	AO2 4.5.4.1 RPA8
	root drawn longer than at start		1	
	ink marks spread out in bent region	do not accept ink marks spread out before the bend example: 	1	

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.5	(in B) horizontal	allow (grows) straight (out) allow not bent (at all)	1	AO2 4.5.4.1 RPA8

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.6	uneven distribution of auxin	allow more auxin on the lower side ignore more auxin on upper side	1	AO1
	(so) upper side grows faster / more (than lower)	allow lower side grows slower / less (than upper)	1	AO3 4.5.4.1 RPA8

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.7	any two from: - weed killers - rooting (powders) (promoting) growth in tissue culture	allow to grow plants from cuttings ignore reference to shoots allow inhibiting lateral buds	2	AO1 4.5.4.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.8	any two from: • promote / start / initiate / force flowering • more fruit • bigger fruits	allow to grow more flowers } if neither given allow bigger yield (of apples) allow idea of fruits ripening simultaneously	2	AO2 4.5.4.2

Total Question 4	15
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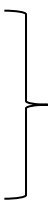
Question 5

Question	Answers	Extra information	Mark	AO / Spec Ref.
05.1	any two from: • same starting position of rule(r) • more precise scale • repeat and calculate mean or repeat and eliminate anomalies • convert distance to time • student (B) rests hand / arm on table	allow ensure the starting position of rule(r) is at 0cm allow other control variables allow two control variables for 2 marks allow rule(r) with mm scale ignore more accurate scale	2	AO3 4.5.2.1 RPA7

Question	Answers	Extra information	Mark	AO / Spec Ref.
05.2	any two from: <i>endocrine system:</i> • (hormones) via blood • chemical transmission • slower • longer-lasting	allow converse if clearly referring to nervous system allow not via neurones / cells allow not (electrical) impulses allow not electrical signals ignore messages ignore hormones } answers must be comparative ignore reference to target organs	2	AO1 4.5.2.1 4.5.3.1

Question	Answers	Extra information	Mark	AO / Spec Ref.
05.3	thyroxine	do not accept thyroxide ignore reference to TSH / TRH	1	AO1 4.5.3.1 4.5.3.7

Question	Answers	Extra information	Mark	AO / Spec Ref.
05.4	any one from: - insulin - glucagon		1	AO1 4.5.3.1 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
05.5	any two from: - increases heart rate - increases breathing rate - increases oxygen delivery to cells / tissues / organs - increases glucose delivery to cells / tissues / organs - increases respiration / metabolism - increases sweat(ing)	allow increases blood flow  allow examples of cells / tissues / organs allow increases energy release do not accept energy produced / made / created allow dilation of pupils allow vasoconstriction in skin or vasoconstriction in digestive system allow raises blood sugar / glucose level or increase conversion of glycogen to glucose allow vasodilation in (skeletal) muscles / brain allow increased blood pressure allow slows digestion allow other correct effects of adrenaline if no other marks awarded allow 1 mark for prepares for 'fight or flight'	2	AO1 4.5.3.7

Question	Answers	Mark	AO / Spec Ref.
05.6	Level 3: Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	5–6	AO1 4.5.3.4 4.5.3.5 4.5.3.6
	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 contraception: • use of hormones oestrogen and progesterone or progesterone (only) ○ inhibition of FSH (production / release) - lack of FSH prevents follicle / egg development / maturation - therefore there is no egg to fertilise ○ inhibition of LH (production / release) - lack of LH prevents ovulation - therefore there is no egg to fertilise • contraceptive methods include oral contraceptive pill, injection, implant, skin patch, IUD / IUS with hormones treatment of infertility: • use of FSH ○ (FSH) stimulates maturation of (several) egg(s) / follicle(s) - (FSH) increases number of eggs matured • use of LH ○ (LH) stimulates ovulation - (LH) allows eggs / follicles to be collected (from ovary) - (so) increased chance of fertilising an egg - IVF and insertion of embryo(s) into uterus • use of progesterone ○ (to) maintain uterus lining - increased chance of implantation For Level 3, details of both contraception and infertility treatment are required.		

Total Question 5

14

Question 6

Question	Answers	Extra information	Mark	AO / Spec Ref.
06.1	(an allele) that is always expressed or (an allele) that is expressed even when the other / recessive allele is present or (an allele) that is expressed in the heterozygote or (an allele) that is expressed when only one copy is present	allow always shows in the phenotype ignore stronger	1	AO1 4.6.1.6

Question	Answers	Extra information	Mark	AO / Spec Ref.
06.2	(person 1) has polydactyly so must have D has offspring / (person) 5 who does not have polydactyly so must have d from person 1 or person 5 does not have polydactyly so must be dd and must inherit d from person 1	allow an annotated genetic diagram for up to 2 marks allow (person 1) has polydactyly so must have a dominant allele	1 1	AO3 4.6.1.6 4.6.1.7

Question	Answers	Extra information	Mark	AO / Spec Ref.
06.3	Female / 6's gametes correct D + d	} allow 1 mark for both sets of gametes if parents not identified	1	AO2 4.6.1.6 4.6.1.7
	Male / 7's gametes correct d + d		1	
	correct derivation of offspring genotypes: Dd Dd dd dd	derivation must be consistent with parental gametes	1	
	Dd correctly identified as polydactyly in only half of offspring	mp4 only awarded if mp3 is correct	1	

Question	Answers	Extra information	Mark	AO / Spec Ref.
06.4	CF allele is recessive	allow CF is recessive	1	AO1
	to have CF, must have 2 CF alleles		1	AO2
	chance of having one CF allele is $\frac{1}{50}$	ignore chance of having one CF allele is one in 50	1	AO2
	(chance of having two CF alleles is) $\frac{1}{50} \times \frac{1}{50} = \frac{1}{2500}$	ignore $50 \times 50 = 2500$	1	AO2 4.6.1.6 4.6.1.7

Total Question 6	11
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Question 7

Question	Answers	Extra information	Mark	AO / Spec Ref.
07.1	46 000 or 16 400 or 12.8 or 0.8		1	AO2 4.7.2.1 4.7.4.3 4.7.5.2
	46 000 and 16 400 or 262 400		1	
	46 000 and 209 920 or 3593.75		1	
	2191.3 or $\frac{46\,000 \times 10\,000}{209\,920}$ or $\frac{3593.75 \times 10\,000}{16\,400}$		1	
	2190		1	

Question	Answers	Extra information	Mark	AO / Spec Ref.
07.2	suitable scale, symmetrical around 0		1	AO2 4.7.4.2
	labels for x-axis and for bars	(biomass in) kg (bars) maize and chickens	1	
	correct values plotted: chickens 2200 maize 4200	allow a tolerance of $\pm\frac{1}{2}$ small square ignore height of bars	1	

Question	Answers	Extra information	Mark	AO / Spec Ref.
07.3	<u>2200</u> 4200		1	AO2 4.7.4.2
	= 0.5238... : 1 or 11 : 21 or 1 : 1.9	allow rounded value	1	

Question	Answers	Extra information	Mark	AO / Spec Ref.
07.4	lost via egestion / faeces	ignore urine / excretion / waste ignore not digested do not accept respiration do not accept not eaten do not accept movement or as heat or for keeping warm	1	AO1 4.7.4.3

Question	Answers	Extra information	Mark	AO / Spec Ref.
07.5	lysine and tryptophan		1	AO3 4.4.2.3 4.7.5.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
07.6	any one from: - chickens need low amounts of leucine (for growth) (chicken) proteins contain low amount / proportion of leucine	do not accept leucine is not needed (for growth)	1	AO3 4.4.2.3 4.7.5.2

Total Question 7	13
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Question 8

Question	Answers	Extra information	Mark	AO / Spec Ref.
08.1	regulation / control / maintenance of internal conditions	allow keeping internal conditions the same	1	AO1 4.5.1
	for optimum conditions for cell(s) / enzyme(s) (activity)	allow a description of optimum functioning of cell / body	1	

Question	Answers	Extra information	Mark	AO / Spec Ref.
08.2	glucose and urea are filtered (out of the blood)	allow a description of filtration of glucose and urea (out of the blood)	1	AO1 4.5.1 4.5.3.3
	protein is not filtered (out of the blood)		1	
	all glucose reabsorbed	allow all glucose absorbed back into the blood	1	
	urea (mostly) not reabsorbed or urea passes out in urine	allow urea not absorbed back into the blood	1	

Question	Answers	Extra information	Mark	AO / Spec Ref.
08.3	(increased / high) ADH increases water reabsorption or (increased / high) ADH increases permeability to water	allow converse for decreased / low / no ADH	1	AO1
	(water reabsorption) from kidney tubules		1	AO1
	(so) ADH increases the concentration (of urine)		1	AO1
	(so) ADH decreases the <u>volume</u> (of urine)		1	AO2
				4.5.1 4.5.3.3
Total Question 8			10	

Question 9

Question	Answers	Mark	AO / Spec Ref.
09.1	Level 3: Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	5–6	AO1 4.2.3.2 4.4.1.1 4.4.1.3 4.6.2.4 4.7.1.1 4.7.2.4 4.7.5.4
	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 • glyphosate kills weeds but does not harm GM soya • (so) less competition for light / water / ions / (named) minerals / (named) salts / space • more light / water for <u>photosynthesis</u> ○ (so) more glucose produced • more glucose for ○ respiration for energy ○ cellulose for cell walls ○ starch for stored energy / glucose (in soya beans) ○ protein for cell structure / storage (in soya beans) ○ lipids for energy storage (in soya beans) • more water for ○ turgor / support ○ transport ○ medium for reactions ○ hydrolysis / digestion of (stored) organic substances • more magnesium ○ for chlorophyll • more nitrate ○ for amino acids / proteins • more phosphate ○ for DNA For Level 3, answers must include detail of factors that increase the yield of GM maize.		

Question	Answers	Extra information	Mark	AO / Spec Ref.
09.2	any two from: - do not know effects on animals / humans (when eaten) - gene / allele may be transferred to other (wild) plants - reduce biodiversity - increased cost of seed (for farmers) or increased cost to consumer (for product) - may affect flavour / taste (of product)	ignore reference to ethical concerns or religion allow do not know side effects on animals / humans (when eaten) ignore cost unqualified	2	AO2 4.6.2.4
Total Question 9			8	