AQA GCSE Biology | 8461

SPECIFICATION POINT 4.5.4.2

Use of plant hormones (HT only)

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**6**
Available paper years	**2013–2024**

Using this booklet

1. Booklet answer numbers match the question booklet.
2. Use the original question number within marking tables.
3. Examiner comments are included where available.

Name: _____ **Date:** _____

Where a precise marking extract is unavailable, the full source document is included in an appendix. Any missing mark scheme is explicitly identified.

4.5.4.2 Use of plant hormones (HT only)

Answer 01 · Mark scheme

June 2013 | BL1HP | Original Q5 | Legacy

Question 5

question	answers	extra information	mark
5(a)	auxin	accept other named plant hormones	1
5(b)(i)	any **three** from: • no (fusion of) gametes / fertilisation • only one parent • no mixing of genetic material • no genetic variation **or** genetically identical offspring	 allow no meiosis **or** new cells only produced by mitosis allow not two parents allow clones	3
5(b)(ii)	more / many offspring / plants (produced from one parent plant)	allow less damage to parent plant ignore speed / cost	1
Total			**5**

4.5.4.2 Use of plant hormones (HT only)

Answer 02 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
3(a)(i)	any **one** from: • (same) (type of) weed killer • (same) volume / 5dm^3 of solution used (on each area) • effect on daisies (not other weeds / plants) • (same) area / 10m^2 • (same) time **or** (effect after) two weeks	ignore references to same lawn / weather / soil, which are not given in the question. allow amount of solution used do **not** allow amount / volume / concentration of weed killer do **not** allow number of daisy plants	1	AO2 1.2.3d
3(a)(ii)	more (daisies) growing after use of weed killer **or** after two weeks	allow it does not fit pattern (of other results)	1	AO3 1.2.3d
3(a)(iii)	any **one** from: • as a control • to compare (to the other areas) • to check other factor(s) are not affecting the results / daisies	ignore to see if it / water has an effect do **not** allow as a control variable	1	AO2 1.2.3d
3(a)(iv)	80 (arbitrary units of weed killer) also killed all the daisies	allow ref to possible experimental design flaws such as 'only tested once' or 'not repeated' or 'different number of daisies in each area at first' allow idea that other weed species may not respond in the same way as daisies allow idea that 100 (units) may also kill wanted species / grass	1	AO3 1.2.3d

4.5.4.2 Use of plant hormones (HT only)

Answer 02 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref
3(b)			6	AO1 1.2.3a/b/c

Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5 and apply a 'best-fit' approach to the marking.

0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)
No relevant content.	Reference to at least one environmental factor plants respond to **or** at least one response **or** a named hormone	Reference to at least one environmental factor plants respond to **and** at least one associated response **or** reference to a named hormone **and** at least one associated response	Reference to at least one environmental factor plants respond to **and** at least one associated response **and** reference to a named hormone

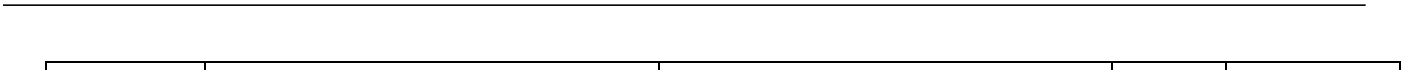
examples of biology points made in the response:	extra information
environmental factors	
• light	allow phototropism
• (direction of the force of) gravity	allow gravi/geotropism
• moisture / water	allow hydrotropism
effects on direction of growth	
• shoots grow upwards	allow reference to 'positive' and 'negative' in terms of tropisms as indicating direction of growth
• shoots grow towards light	
• shoots grow against (the force of) gravity	
• roots grow downwards	
• roots grow towards moisture	
• roots grow towards (the force of) gravity	
hormone	
• reference to auxin	allow other named hormone(s)
• unequal distribution of hormone causes unequal growth (rates)	allow higher concentration of hormone causes faster growth in shoots allow higher concentration of hormone causes slower growth in roots

Total		10

4.5.4.2 Use of plant hormones (HT only)

Answer 02 · Mark scheme

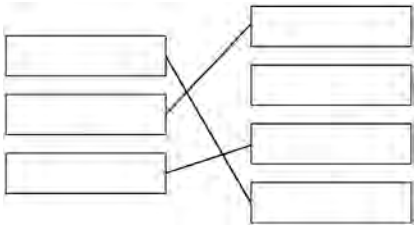
June 2015 | BL1HP | Original Q3 | Legacy



4.5.4.2 Use of plant hormones (HT only)

Answer 03 · Mark scheme

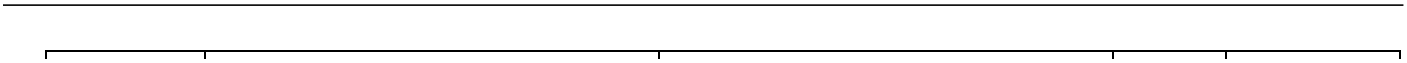
June 2018 | 8461/2H | Original Q6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	to prevent water affecting the direction of root growth		1	AO3 4.5.4.1
06.2	gravity acts evenly on all sides	allow cancel out the effect of gravity do **not** accept there is no gravity	1	AO3 4.5.4.1
06.3	(mean) includes the (anomalous) result for seedling 4	allow (mean) includes the (anomalous) result which only grew 1 mm	1	AO3 4.5.4.1
06.4	calculate (mean) from just seedlings 1, 2, 3 and 5 **or** repeat the investigation **and** recalculate (a new mean)	allow omit seedling 4 from (mean) calculation	1	AO3 4.5.4.1
06.5	uneven distribution of hormone in (root / seedling of) A even distribution of hormone in B (so) top grows fast(er) (than bottom) in (root / seedling of) A (and equal growth in B)	allow reference to auxin allow more hormone at bottom do **not** accept more hormone at the top allow B does not have an uneven distribution of hormone allow (more) cell elongation or cell division on top of A allow converse for lower surface	1 1 1	AO1 4.5.4.1 AO1 4.5.4.1 AO3 4.5.4.1
06.6		extra line for a hormone cancels mark for that hormone	1 1 1	AO1 4.5.4.2
Total			**10**	

4.5.4.2 Use of plant hormones (HT only)

Answer 03 · Mark scheme

June 2018 | 8461/2H | Original Q6



4.5.4.2 Use of plant hormones (HT only)

Answer 04 · Mark scheme

November 2020 | 8461/2H | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	to increase fruit size to promote flower production		1 1	AO1 4.5.4.2
03.2	any **two** from: • keep temperature the same (for all dishes) • use equal numbers of seedlings (in each dish) • use seedlings of the same (initial) height • use more seedlings in each dish • give all dishes the same volume of water • use seed(ling)s of the same species • measure light intensity	allow move equal distance **or** away from radiator **or** turn off radiator **or** use heat shield between lamp and seedlings allow use seedlings of the same (initial) size allow give all dishes the same amount of water allow use seed(ling)s of the same type allow measure distance from lamp allow put lamp above each dish and use different light intensity **or** power for each allow same concentration of mineral ions **or** named example ignore nutrients / food do **not** accept keep the same light intensity	2	AO3 4.5.4.1 RPA8
03.3	any **one** from: • use a piece(s) of thread / string **and** measure length of thread (with ruler) • straighten seedling / shoot **and** measure (with ruler) • measure with a flexible ruler **or** a tape measure	allow use a piece of thread **and** (put the thread against) a ruler allow straighten seedling against a ruler allow use a flexible ruler **or** a tape measure	1	AO2 4.5.4.1 RPA8

4.5.4.2 Use of plant hormones (HT only)

Answer 04 · Mark scheme

03.4		reference to side only needed once		4.5.4.1 RPA8
	(side nearest the lamp) receives more light (on side P)	allow side Q receives less light allow side Q is in the shade ignore side P is in the light	1	AO2
	(therefore) unequal distribution of auxin	allow more auxin on side Q allow (so) more auxin present on side away from the lamp do **not** accept more auxin on light side **or** side P	1	AO1
	(auxin causes) more growth on side away from the lamp	allow more growth on side Q allow (auxin causes) cell elongation on side away from the light ignore mechanism of auxin action	1	AO2
03.5	ethene is released from bananas	allow ethylene is released from bananas allow the hormone is ethene / ethylene	1	AO2 4.5.4.1 4.5.4.2
Total			**9**	

4.5.4.2 Use of plant hormones (HT only)

Answer 04 · Mark scheme

November 2020 | 8461/2H | Original Q3

4.5.4.2 Use of plant hormones (HT only)

Answer 05 · Mark scheme

June 2022 | 8461/2H | Original Q9

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	any **two** from: • (same volume of) water • (same) temperature • (same) species / type of plant • (same) age of shoot	allow (same amount of) water allow (amount of) minerals / ions / salts ignore (same) time ignore (same) height of shoot ignore carbon dioxide (concentration) do **not** accept light	2	AO3 4.5.4.1 RPA8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.2	**B** shows response (in **A**) is due to light (as **B** has no light)	allow **B** gives a comparison between no light and (one-sided) light ignore **B** shows the effect of no light	1	AO2 4.5.4.1 RPA8
	C shows response (in **A**) is due to one-sided light (as **C** has light from all sides)	allow **C** gives a comparison between all-round light and one-sided light ignore **C** shows the effect of light from all sides	1	

4.5.4.2 Use of plant hormones (HT only)

Answer 05 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.3		ignore reference to auxin ignore reference to left and right sides		AO3 4.5.4.1 RPA8
	growth / elongation occurs (just) behind / below / at the tip	allow no growth **or** very little growth at the base ignore shoot is taller	1	
	bending occurs (just) behind / below / at the tip **or** more growth on the side away from the light		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.4	phototropism / phototropic	allow positive phototropism ignore tropism do **not** accept negative phototropism do **not** accept phototrophic / phototrophism	1	AO1 4.5.4.1 RPA8

4.5.4.2 Use of plant hormones (HT only)

Answer 05 · Mark scheme

June 2022 | 8461/2H | Original Q9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.5		ignore references to **D** and **E** ignore references to left and right sides unless at least one is identified as side nearer to or further from the light		AO3 4.5.4.1
	in **F** there is more auxin in the side furthest from the light		1	
	in **G** there is the same mass of auxin in each side		1	
	in **F** auxin can move through the shoot but in **G** the glass prevents this		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.6	all four (blocks) have (approximately) the same mass of auxin	allow examples such as mass of auxin in **D** / **E** is (about) the same as in **F** / **G** **or** those in light have same mass of auxin as those in dark	1	AO3 4.5.4.1

Total Question 9		11

4.5.4.2 Use of plant hormones (HT only)

Answer 06 · Mark scheme

June 2024 | 8461/2H | Original Q4

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

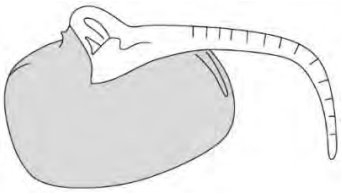
Question	Answers	Extra information	Mark	AO / Spec Ref.
04.2	to prevent water affecting the direction of root growth to provide enough water for root growth		1 1	AO3 4.5.4.1 RPA8

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

4.5.4.2 Use of plant hormones (HT only)

Answer 06 · Mark scheme

June 2024 | 8461/2H | Original Q4

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

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 (so) upper side grows faster / more (than lower)	allow more auxin on the lower side ignore more auxin on upper side allow lower side grows slower / less (than upper)	1 1	AO1 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

4.5.4.2 Use of plant hormones (HT only)

Answer 06 · Mark scheme

June 2024 | 8461/2H | Original Q4

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

4.5.4.2 Use of plant hormones (HT only)

Answer 04 · Examiner comments — November 2020 | 8461/2H | Original Q3

Question 3 (standard & standard/high demand)

This question was about plant hormones and in **03.2** most students understood that the given investigation was inadequate due to the presence of the radiator nearer to some of the seedlings than to others. Many also suggested that the same number of seedlings should have been used in each dish. A few suggested that equal amounts of water should have been provided in each dish or that the light intensity could actually have been measured. A common incorrect answer was that the seedlings should have been subjected to the same light intensity (this being the independent variable).

Answer 04 · Examiner comments — November 2020 | 8461/2H | Original Q3

In **03.3** suggestions for how the length of the curved seedling might be measured were often inadequate – eg 'with a ruler'. Successful students realised that the seedling would either need to be straightened before measuring or that a flexible device such as a tape measure or a piece of thread would need to be employed. And in **03.4** students were very confused about differential growth rates on the two sides of a seedling for bringing about the phototropic response. A substantial proportion thought that the seedling grew more on the side facing the light, sometimes citing an increased rate of photosynthesis on that side to fuel extra growth.

4.5.4.2 Use of plant hormones (HT only)

Answer 05 · Examiner comments

June 2022 | 8461/2H | Original Q9

Question 9

This question was about investigations involving phototropism and the redistribution of auxin.

09.1 The amount of water given, the temperature and the type of plant were common correct answers for control variables in the investigation shown in **Figure 13**. 'Light' was an inappropriate suggestion as this was different in each of the three experiments. 'Time' was not rewarded as this was given as 12 hours in the diagram. More than three-quarters of students were able to suggest at least one correct control variable, with almost one third giving two.

09.2 Most responses to this question were very weak, with only one in eight scoring any marks. Most answers simply described experiments **B** (in the dark) and **C** (with all-round light) rather than stating these could be compared with experiment **A** (one-sided light) to show that light caused the effect in experiment **A** and that this light had to come from one side.

09.3 Careful inspection of **Figure 13** was necessary to answer this question – which showed the ink marks just behind the tip of the shoot were further apart in all three seedlings after 12 hours and that this region was also the part that bent towards the light in experiment **A**. Hence growth and response/bending occurred in this region. Both points were evident to only one in 20 students.

09.4 Nearly three-quarters of students knew that the response shown by seedling **A** was called *phototropism*. There was the inevitable confusion with the term 'phototropism', and 'tropism' unqualified was considered inadequate. Some correctly used the term 'positive phototropism' but the qualification 'negative' cancelled what would otherwise have been worth the mark.

09.5 This question, and the next, examined the ability to select appropriate information from **Figure 14** about the distribution of auxin in shoot tips under different light regimes. Most answers (two-thirds of students) correctly referred to shoot tip **F** which showed that a higher amount of auxin had moved into the agar beneath the side receiving less light. Far fewer students chose to compare this with the situation in shoot tip **G** where auxin was prevented from moving sideways through the shoot by the thin sheet of glass and thus resulted in equal amounts of auxin in the agar beneath the shaded and the illuminated sides. Many made inappropriate references to the results from the shoot tips kept in the dark (**D** and **E**).

4.5.4.2 Use of plant hormones (HT only)

Answer 05 · Examiner comments

09.6 The hypothesis that light causes the breakdown of auxin was easily refuted by the observation that all four blocks of agar, whether beneath shoot tips in the light or in the dark, contained approximately equal amounts of auxin. Only one fifth of students made relevant observations about the shoot tips in the light compared with those in the dark, while many simply focused on the results for shoot tip **G** and did not gain credit.

4.5.4.2 Use of plant hormones (HT only)

Answer 05 · Examiner comments

June 2022 | 8461/2H | Original Q9

Use of statistics

Statistics used in this report may be taken from incomplete processing data. However, this data still gives a true account on how students have performed for each question.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.

4.5.4.2 Use of plant hormones (HT only)

Answer 06 · Examiner comments June 2024 | 8461/2H | Original Q4

Question 4 (standard, standard/high and high demand)

04.1 Just over half of students knew why the student placed both sets of apparatus in the dark. Many answers referred to preventing phototropism to gain the marking point. Some students referenced control variables, which was insufficient to gain the mark. Many incorrect responses did include references to gravity, however the response was not qualified with 'only gravity' as per the mark scheme, so therefore could not be awarded the marking point. Vague responses such as 'to keep it a fair test' or 'to make sure nothing affects the investigation' also could not be credited. Other students did not refer to results/growth, for example, 'so light doesn't affect them'.

04.2 A third of students identified two reasons for surrounding the seedings with damp blotting paper, gaining full marks. A noticeable number of students only ticked one box and students are reminded to read the question carefully.

04.3 Around 45% of students gained one mark on this question, with a further 10% gaining both available marks. Marking point 1 was by far the most commonly awarded mark, with many students realising that Apparatus B was for a comparison. Marking point 2 was awarded much less often as many students lacked detail in their responses and could not be given credit. For example, many responses referenced that Apparatus B 'removes' or 'cancels' gravity rather than the *effect* of gravity. However, the correct representation of this alternative point was by far the most common seen for marking point 2. Some students only described the distribution of auxin which didn't answer the question, so were not credited.

04.4 In this question students were asked to complete a diagram of the root after 24 hours to show both the appearance and the ink marks expected. Almost one third of students gained full marks for their diagram. Students that drew the root completely straight were restricted to 1 mark, assuming they had drawn the root longer. The spacing of the ink marks in marking point 3 proved challenging for many students, often drawing them all equal, or adding in spaces before the bend which negated this mark.

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4.5.4.2 Use of plant hormones (HT only)

Answer 06 · Examiner comments June 2024 | 8461/2H | Original Q4

04.5 55% of students knew that the root would grow straight and gained the mark. However, a minority of students suggested that the root would grow 'straighter', which implies some bending and therefore, could not be credited.

04.6 Students were asked to explain how auxin causes the results in Apparatus A. Over 50% of students did not score anything on this question, with 20% gaining both available marks. Many students conveyed the idea of uneven distribution of auxin, but several students became confused as to which side of the root had the most growth. Other responses lacked comparative language when explaining the direction of growth and could not gain credit for marking point 2. Some responses referenced light affecting the auxin and just wrote about what they knew about auxin rather than addressing the question.

04.7 Just over 30% of students gained at least one mark for giving a use of auxin, with a further quarter of students gaining two marks. The use of auxin as weed killer, or a rooting powder were by far the most common correct answers given by students. Some responses just stated that auxins were used for growth, which was too vague at this level of demand. Many responses showed confusion between the roles of auxin and gibberellin (which was the focus of question 04.8).

04.8 15% of students gained full marks for knowing two reasons why the farmer sprayed the apple tree with gibberellin, with 45% of students being awarded at least one mark usually for the idea of 'more' or 'bigger' fruit. Many responses were awarded the fallback mark for referring to an increase in yield. Of the three alternative answers to this question, the promotion of flowering (bullet point 1) was the least common correct response.

A lot of responses referred to 'ending seed dormancy' which does not answer the question and therefore could not be credited. As with question 04.7, there was evident confusion between the roles of gibberellin and auxin.