AQA GCSE Biology | 8461

SPECIFICATION POINT 4.5.4.1

Control and coordination

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**11**
Available paper years	**2012–2025**

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.

4.5.4.1 Control and coordination

Answer 01 · Mark scheme

Question 2

question	answers	extra information	mark
2(a)	diagram to show root growing down	allow single lines **or** not attached **or** open ends for both marks all branches must go down	1
	diagram to show shoot growing up	all branches must go up	1
2(b)	gravity		1
2(c)	Auxin		1
2(d)(i)	rooting / cuttings	accept other suggestions, eg fruit set / ripening do **not** accept weed killers	1
2(d)(ii)	any **three** from: • light • water / moisture • nutrients / ions / minerals • space / area	 ignore sun / energy accept one named mineral ignore nutrition / food ignore soil / land / territory / volume ignore reference to gases	3
Total			**8**

4.5.4.1 Control and coordination

Answer 01 · Mark scheme

January 2012 | BL1FP | Original Q2 | Legacy

BL1FP

4.5.4.1 Control and coordination

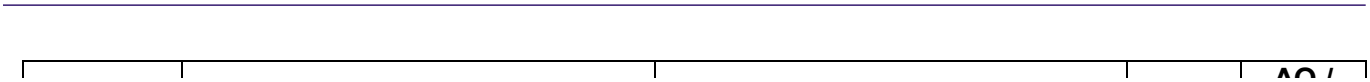
Answer 02 · Mark scheme June 2014 | BL1FP | Original Q2 | Legacy

Question	Answers	Extra information	Mark	AO / spec ref.
2(a)(i)	in the direction of the force of gravity		1	AO2 1.2.3a
2(a)(ii)	against the force of gravity		1	AO2 1.2.3a
2(b)(i)	diagram completed to show stem bending / leaning towards the window	the bend / lean can be at / from any point above pot level ignore any leaves	1	AO2 1.2.3a
2(b)(ii)	more light (for leaves) more photosynthesis / biomass / glucose	ignore heat ref to 'more' needed once only, eg 'more light for photosynthesis' = 2 marks if no other marks given allow 1 mark for 'to get light for photosynthesis'	1 1	AO1/ AO2 1.4.1a, b
Total			**5**	

4.5.4.1 Control and coordination

Answer 02 · Mark scheme

June 2014 | BL1FP | Original Q2 | Legacy



4.5.4.1 Control and coordination

Answer 03 · Mark scheme June 2015 | BL1FP | Original Q9 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
9(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
9(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
9(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
9(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

4.5.4.1 Control and coordination

Answer 03 · Mark scheme

June 2015 | BL1FP | Original Q9 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref
9(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

4.5.4.1 Control and coordination

Answer 04 · Mark scheme June 2016 | BL1FP | Original Q4 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4(a)(i)	follicle stimulating hormone / FSH		1	AO1 1.2.2c/d
4(a)(ii)	oestrogen		1	AO1 1.2.2c/d
4(b)(i)	any **one** from: • to help them have a baby / get pregnant • to stimulate egg production / release / maturation • own levels of FSH / LH / hormone (too) low	ignore to make them fertile allow to increase hormone / FSH / LH levels do not allow to increase oestrogen levels	1	AO1 1.2.2e
4(b)(ii)	through the bloodstream		1	AO1 1.2.2b
4(c)	oestrogen progesterone		1 1	AO1 1.2.2e
Total			**6**	

4.5.4.1 Control and coordination

Answer 04 · Mark scheme

June 2016 | BL1FP | Original Q4 | Legacy

4.5.4.1 Control and coordination

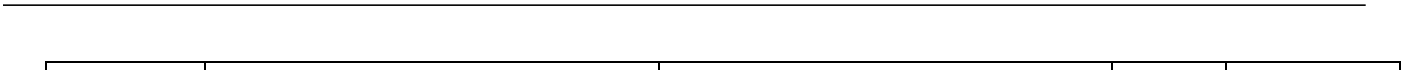
Answer 05 · Mark scheme June 2017 | BL1FP | Original Q3 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
3(a)(i)	Figure 4 completed to show downward growth of root	judgement by eye to within 45° of vertical ignore any addition to shoot ignore any lateral roots ignore at what point downward growth occurs	1	AO2 1.2.3a
3(a)(ii)	Shoots grow towards light. Shoots grow against the force of gravity.		1 1	AO1 1.2.3a
3(b)(i)	auxin		1	AO1 1.2.3b
3(b)(ii)			1	AO3 1.2.3c
Total			**5**	

4.5.4.1 Control and coordination

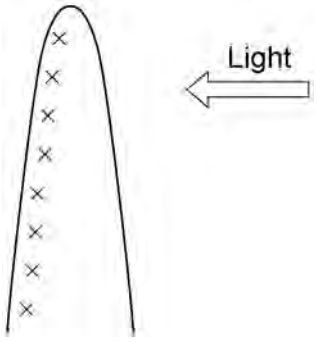
Answer 05 · Mark scheme

June 2017 | BL1FP | Original Q3 | Legacy



4.5.4.1 Control and coordination

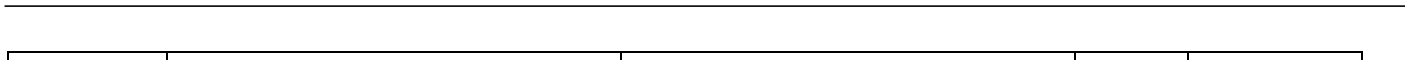
Answer 06 · Mark scheme June 2018 | 8461/2F | Original Q8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	the temperature the volume of water added to the soil		1 1	AO3 4.5.4.1
08.2	to stop light reaching the shoot		1	AO2 4.5.4.1
08.3	piece of thread (along shoot and mark length) transfer to ruler / mm-scale	allow straighten the shoot allow use of (flexible) tape measure for **2** marks	1 1	AO3 4.5.4.1
08.4	tip covered / B / removed / C grows straight up **or** does not bend (towards light) tip exposed / A / not covered / D bends (towards light)	allow tip covered / B / removed / C does not respond (to light) tip exposed / A / not covered / D does respond (to light) allow only the ones with exposed tips or only A **and** D bend towards the light for **2** marks	1 1	AO3 4.5.4.1
08.5			1	AO2 4.5.4.1
Total			**8**	

4.5.4.1 Control and coordination

Answer 06 · Mark scheme

June 2018 | 8461/2F | Original Q8



4.5.4.1 Control and coordination

Answer 07 · Mark scheme

June 2019 | 8461/2F | Original Q9

Question	Answers	Extra information	Mark	AO / Spec.
09.1	named example of tropism – eg geotropism / gravitropism correct corresponding stimulus – eg gravity	allow hydrotropism **or** chemotropism **or** thermotropism allow water **or** chemical **or** 'heat'	1 1	AO1 4.5.4.1
09.2	**Level 3:** The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.		5–6	AO1 AO2 4.5.4.1
	Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the plan 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 • several seedlings in each batch **or** one pot of seedlings in each batch • measure heights of shoots • leave some in dark with light from one side / direction in box with hole • control(s) with all-round light **or** rotating on clinostat **or** in dark • control variable(s) eg same temperature / water / soil type • after suitable time (at least several hours) • record appearance of seedlings re. light direction • re-measure heights of shoots • detail of how bent shoots were measured – eg use thread or straighten them out • calculate mean height increase for each group • use ruler / protractor to estimate angle of bending for level 3 a reference to comparing the growth of plants with light from one direction with plants either in darkness or in full light along with a control variable is required			

4.5.4.1 Control and coordination

Answer 07 · Mark scheme

June 2019 | 8461/2F | Original Q9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.3	leaves / plant receive(s) / absorb(s) more light (so) more photosynthesis (so plant) produces more glucose	 allow starch / carbohydrate / sugar / organic material / other named organic substance if no other mark awarded allow **1** mark for any two of the mark points with no reference to 'more'	1 1 1	AO2 4.5.4.1 4.7.2.1 4.4 4.4.1.2 AO1
Total			**11**	

4.5.4.1 Control and coordination

Answer 08 · Mark scheme November 2020 | 8461/2F | Original Q2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	put all the dishes the same distance from the radiator use equal numbers of seedlings in each dish		1 1	AO3 4.5.4.1 RPA8
02.2	the height of the seedlings		1	AO1 4.5.4.1 RPA8
02.3	any **two** from: • light • water • mineral(s) / ions / salts	allow nitrate / magnesium / nitrogen / nutrients allow space ignore food ignore carbon dioxide / oxygen ignore heat	2	AO2 4.7.1.2
02.4	side **P** has grown less than side **Q**		1	AO3 4.5.4.1 RPA8
02.5	phototropism		1	AO1 4.5.4.1 RPA8
02.6	auxin		1	AO1 4.5.4.1
Total			**8**	

4.5.4.1 Control and coordination

Answer 08 · Mark scheme

November 2020 | 8461/2F | Original Q2

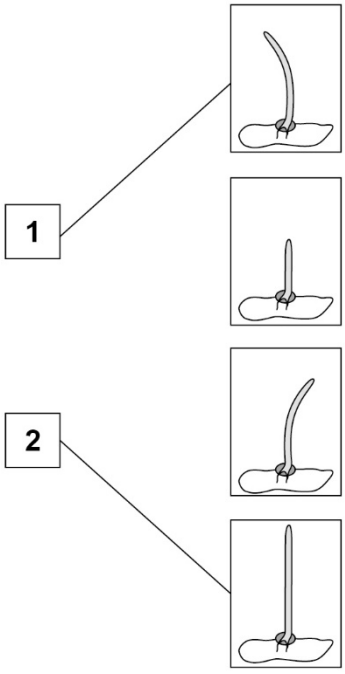
4.5.4.1 Control and coordination

Answer 09 · Mark scheme

June 2022 | 8461/2F | Original Q3

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	tropism		1	AO1 4.5.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	 do **not** accept more than one line from a box on the left		1 1	AO3 4.5.4.1 RPA8

4.5.4.1 Control and coordination

Answer 09 · Mark scheme

June 2022 | 8461/2F | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	to show the response in experiment **1** is caused by (1-sided) light **or** as a control	allow to compare with experiment **1** allow to show the difference between (1-sided) light and no light do **not** accept control variable	1	AO3 4.5.4.1 RPA8

4.5.4.1 Control and coordination

Answer 09 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	shine light from all sides on the third seedling		1	AO3 4.5.4.1 RPA8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	keep each seedling at the same temperature		1	AO3 4.5.4.1 RPA8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.6	any **one** from: • gravity • water • chemicals / minerals / ions	allow moisture allow a named chemical such as nitrate ignore nutrients ignore light	1	AO1 4.5.4.1

4.5.4.1 Control and coordination

Answer 09 · Mark scheme

June 2022 | 8461/2F | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.7	because of variation (in results) **or** to identify / eliminate anomalies	allow example such as some may not grow	1	AO2 4.5.4.1
	to calculate a mean **or** a mean value would be more representative / typical	allow to calculate an average ignore to improve accuracy / precision / validity	1	

Total Question 3		**9**

4.5.4.1 Control and coordination

Answer 10 · Mark scheme

June 2024 | 8461/2F | Original Q6

Question 6

Question	Answers	Extra information	Mark	AO / Spec Ref.
06.1	tropism		1	AO1 4.5.4.1

Question	Answers	Extra information	Mark	AO / Spec Ref.
06.2	auxin		1	AO1 4.5.4.1

Question	Answers	Extra information	Mark	AO / Spec Ref.
06.3	nitrate ions water		1 1	AO1 4.2.3.2 4.5.4.1

4.5.4.1 Control and coordination

Answer 10 · Mark scheme

June 2024 | 8461/2F | Original Q6

Question	Answers	Mark	AO / Spec Ref.
06.4	**Level 3**: The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.	5–6	AO2
	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	AO1
	Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2	AO1
	No relevant content	0	
	Indicative content • one pot of seedlings placed in box with slit • one pot of seedlings in dark • one pot of seedlings in full light • measure heights of shoots • remeasure heights of shoots • record a feature of appearance of seedlings • detail of how bent shoots were measured eg use thread or straighten them out • calculate mean height increase for each group • compare results (for each group of seedlings) • control variable(s) o same temperature o same volume of water o same soil type o same age of seedlings o same species / type of plant o same time left for For **Level 3**, a method comparing the growth of plants in light from one direction with plants in full light / darkness along with a control variable is required		4.5.4.1 RPA8

Total Question 6	10

4.5.4.1 Control and coordination

Answer 11 · Mark scheme

June 2025 | 8461/2F | Original Q10

Question 10

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.1	growth (response) due to gravity	ignore direction of growth	1 1	AO1 4.5.4.1

4.5.4.1 Control and coordination

Answer 11 · Mark scheme

June 2025 | 8461/2F | Original Q10

Question	Answers	Mark	AO / Spec. Ref.
10.2	**Level 3:** The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.	5–6	AO1 4.5.4.1 RPA8
	Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the plan 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 • place a seedling in box with slit • place a seedling in darkness **or** in all-round light • measure initial heights of shoots • measure final heights of shoots **or** measure shoots with a ruler **or** measure the growth of shoots • record a named feature of appearance of seedlings • detail of how bent shoots are measured eg use thread or straighten them out • repeat with several seedlings • calculate mean height increase for each condition • compare results (for each condition) *control variable(s)* o same number of seedlings (per pot / condition) o same temperature o same volume of water o same soil type / volume o same age of seedlings o same species / type of plant o same time left for For **Level 3**, a method comparing the growth of plants in light from one direction with plants in full light / darkness along with control variables is required.		

4.5.4.1 Control and coordination

Answer 11 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.3	auxin		1	AO1 4.5.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.4	there is an uneven distribution of the hormone		1	AO1 4.5.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.5	leaves / plant receive(s) / absorb(s) more light (so) more photosynthesis (which produces) more glucose	 allow (which produces) more starch / carbohydrate / sugar allow (which produces) more (named) organic material / other named organic substance if no other marks awarded allow **1** mark for any two of the mark points with no reference to 'more'	1 1 1	AO2 4.5.4.1 4.4.1.1 4.4.1.3

Total Question 10	**13**

4.5.4.1 Control and coordination

Answer 08 · Examiner comments

November 2020 | 8461/2F | Original Q2

Question 2 (low demand)

This question was about phototropism. In **02.2**, fewer than half of the students correctly identified the dependent variable. Of the majority giving an incorrect response, the most common, by far, was the temperature of the room. For **02.3** most students gave at least one correct response, usually identifying light or water as factors being competed for; although many students gave both of these. The other most commonly suggested allowable response was 'space'. In **02.4**, a large proportion of students gave the incorrect answer, that side P (facing the light) grows more than side Q – an obvious misconception about the effect of more or faster growth on one side of the shoot. Given the clear bend in the shoot, a large number suggested that the two sides had grown equally.

Answer 09 · Examiner comments

June 2022 | 8461/2F | Original Q3

Question 3

This question was about an investigation into phototropism.

03.1 Just over half correctly selected *tropism* as the name of the response by a plant shoot to light shining from one side.

4.5.4.1 Control and coordination

Answer 09 · Examiner comments

June 2022 | 8461/2F | Original Q3

03.2 Only a quarter of students knew that a shoot exposed to one-sided light would grow towards the light and that a shoot is darkness would increase in length as well as remaining vertical.

03.3 The most common answer to this was simply to 'see how the plant grows in the dark', so there were relatively few who explained the purpose of experiment **2** as an experimental control. The term 'control', so often seen in previous examinations, was noticeable for its almost complete absence, and even the idea of it being a comparison was not common.

03.4 Almost three-quarters of the students selected the suggestion of shining light from all sides on an extra seedling as a means of increasing the validity of the investigation.

03.5 Almost three-quarters also chose keeping each seedling at the same temperature as a suitable control variable.

03.6 Despite *gravity* being referred to in the Specification, by far the most common correct answer for a stimulus to which plant roots are sensitive was 'water'. 'Light' was not an unusual answer, despite it being specifically excluded by the question.

03.7 Considering that students would have completed questions 02.4 and 02.5 not long before they answered this question, it was surprising how few could give correct answers here for reasons why scientists often repeat investigations several times. Reference to calculating a *mean* (or sometimes 'average') often gained a mark, but reference to *anomalies* was much less common. Ideas about validity, accuracy and repeatability were not uncommon, but were not credited.

4.5.4.1 Control and coordination

Answer 10 · Examiner comments

June 2024 | 8461/2F | Original Q6

Question 6 (low and standard demand)

06.1 Just under 50% of students could name a plant's growth response as a tropism.

06.2 60% of students knew that auxin is the substance that controls the response to light in plant shoots.

06.3 Around 40% of students could identify two substances that are absorbed by roots, with a further 50% identifying at least one substance. It was common to see only one box ticked in this question; students are reminded to read the instructions given in the question carefully.

06.4 This was an extended response question involving 3 marking levels. It was clear that many students had an understanding of the Required Practical Activity on tropisms assessed in this question. Almost 40% of students reached Level 3, with the majority of those gaining full marks. Those that did, successfully described investigating at least 2 light regimes as well as measuring/observing results and giving a control variable.

Descriptions of measurement/observation were often vague, but the idea of seeing how much the seedlings had grown after a period of time was considered enough of an implication that measurements must have been taken.

© 2024 AQA and its licensors. All rights reserved.

4.5.4.1 Control and coordination

Answer 11 · Examiner comments

June 2025 | 8461/2F | Original Q10

Question 10 (Standard demand)

10.1

Only a quarter of students gained a mark in this question, with less than 10% of students able to fully define geotropism and gain both available marks. Of those students who did not achieve both marks most of them were clear that a tropism affected the growth of the plant but were unclear of the link between geotropism and gravity, with references to geographical features being a common incorrect response. 30% of students did not attempt this question.

10.2

Around 25% of students did not attempt a response to this question.

This extended response question required students to plan an investigation, with some examples of equipment suggested. It was clear that many students had carried out the required practical on tropisms which was assessed in this question. Around 10% of students reached Level 3, with the majority of those gaining full marks. Those that did successfully described investigating at least 2 light regimes as well as measuring/observing results and giving several control variables.

Some students that did not gain full marks did so for predicting the results, rather than describing how to take final measurements and/or observations in the investigation. Many students scored some marks due to being able to list relevant control variables. Some students thought placing seedings on a windowsill would give them all-round light and therefore provide a comparison with the seedings placed in the box with a slit. In this case, both sets of seedlings experienced unilateral light. Around a quarter of students were limited to level 1 mostly due to being unable to provide a comparison between the effects of unilateral light and all-round/no light.

4.5.4.1 Control and coordination

Answer 11 · Examiner comments

10.3

This question was not attempted by around 30% of students, however, 25% of students were able to name the hormone auxin. Where incorrect responses were seen, it was usually for naming a human hormone such as insulin or progesterone.

10.4

A third of students knew that an uneven distribution of the hormone controlled the plant's responses to the direction of light.

10.5

15% of students did not attempt this question.

The question required students to explain how a plant's response to light aided survival. Many students used up much of the available space explaining how a plant responds to light, describing how unilateral light influences the uneven distribution of auxin, resulting in uneven growth of the stem. Despite sometimes showing good detail, this was not required, as the question asked how this response was advantageous to the plant. These students then often omitted more than passing reference to the focus of the question, perhaps stopping at the idea that this allowed the plant to 'receive light'. Many students seemed unaware that even if the leaves are directed away from the light source, they will still be able to absorb light. What was required in responses was that by facing the light source, leaves could absorb *more* light, allowing *more* photosynthesis resulting in *more* glucose being produced. Those students who did not incorporate the idea of 'more' into their answers could gain one mark for linking two of the critical processes of light absorption, photosynthesis and glucose production.

Only 25% of students gained any marks in this question, usually for making a connection between plants absorbing light allowing photosynthesis to happen – thus gaining the compensation mark - as they neglected to mention these factors were increased or maximised. Mark point 3 was least commonly seen.

4.5.4.1 Control and coordination

Mark Ranges and Award of Grades

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