AQA GCSE Physics | 8463

SPECIFICATION POINT 4.5.6.3.4

Factors affecting braking distance 2

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**14**
Available paper years	**2008–2025**

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.

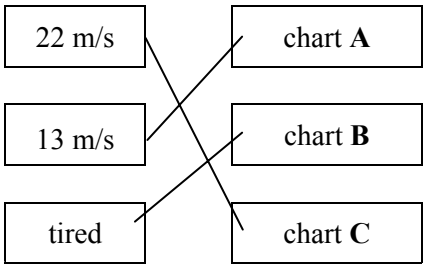
Name: _____ **Date:** _____

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

4.5.6.3.4 Factors affecting braking distance 2

Answer 01 · Mark scheme January 2008 | PHY2F | Original Q3 | Legacy

Question 3

question	answers	extra information	mark
(a)(i)	constant		1
(ii)	heat		1
(b)(i)	3 links correct  	allow **1** mark for 1 correct link if more than one line is drawn from a condition mark all lines from that condition incorrect	2
(ii)	increased		1
total			5

4.5.6.3.4 Factors affecting braking distance 2

Answer 01 · Mark scheme

January 2008 | PHY2F | Original Q3 | Legacy

PHY2F

4.5.6.3.4 Factors affecting braking distance 2

Answer 02 · Mark scheme June 2008 | PHY2F | Original Q1 | Legacy

Question 1

	answers	extra information	mark
(a)	53 (m)		1
(b)(i)	Similar shape curve drawn above existing line going through (0,0)	allow **1** mark for any upward smooth curve or straight upward line above existing line going through (0,0)	2
(ii)	rain on road car brakes in bad condition		1 1
(c)(i)	all three lines correctly labelled top line – C middle line – B bottom line – A	allow **1** mark for one correctly labelled accept 1.2 accept 0.9 accept 0.7	2
(ii)	any **two** from: • (table has) both variables are together • both (variables) could/ would affect the reaction time • cannot tell original contribution • need to measure one (variable) on its own • need to control one of the variables	 accept tired and music as named variables accept cannot tell which variable is affecting the drive (the most) accept need to test each separately	2
total			9

4.5.6.3.4 Factors affecting braking distance 2

Answer 02 · Mark scheme June 2008 | PHY2F | Original Q1 | Legacy

PHY2F

June 08

Answer 03 · Mark scheme January 2009 | PHY3F | Original Q3 | Legacy

No matching mark scheme was available in the supplied archive for this question.

4.5.6.3.4 Factors affecting braking distance 2

Answer 04 · Mark scheme

Question 8

question	answers	extra information	mark
8(a)	gravitational / gravity / weight	do **not** accept gravitational potential	1
8(b)	accelerating the distance between the drops increases but the time between the drops is the same	accept speed / velocity increases accept the time between drops is (always) 5 seconds accept the drops fall at the same rate	1 1 1
8(c)(i)	any **one** from: • speed / velocity • (condition of) brakes / road surface / tyres • weather (conditions)	 accept specific examples, eg wet / icy roads accept mass / weight of car friction is insufficient reference to any factor affecting thinking distance negates this answer	1

Question 8 continues on the next page . . .

4.5.6.3.4 Factors affecting braking distance 2

PH2FP

Question 8 continued . . .

question	answers	extra information	mark
8(c)(ii)	75 000	allow **1** mark for correct substitution, ie 3000 × 25 provided no subsequent step shown **or** allow **1** mark for an answer 75 **or** allow **2** marks for 75 k(+ incorrect unit), eg 75 kN	2
	joules / J	do **not** accept j an answer 75 kJ gains **3** marks for full marks the unit and numerical answer must be consistent	1
Total			**8**

4.5.6.3.4 Factors affecting braking distance 2

Answer 04 · Mark scheme

January 2013 | PH2FP | Original Q8 | Legacy

PH2FP

4.5.6.3.4 Factors affecting braking distance 2

Answer 05 · Mark scheme

June 2013 | PH2FP | Original Q6 | Legacy

Question 6

question	answers	extra information	mark
6(a)	time force	correct order only	1 1
6(b)	The car tyres being badly worn		1
6(c)(i)	braking distance increases with speed relevant further details, eg • but not in direct proportion • and increases more rapidly after 15 m/s • double the speed, braking distance increases × 4	accept positive correlation do **not** accept stopping distance for braking distance accept any speed between 10 and 20 accept numerical example	1 1
6(c)(ii)	line drawn above existing line starting at the origin	as speed increases braking distance must increase each speed must have a single braking distance	1
6(d)(i)	reaction time / reaction (of driver) does not depend on speed (of car)		1

Question 6 continues on the next page . . .

4.5.6.3.4 Factors affecting braking distance 2

PH2FP

Question 6 continued . . .

question	answers	extra information	mark
6(d)(ii)	(on the reduced speed limit roads) over the same period of time monitor number of accidents before and after (speed limit reduced)	accept a specific time, eg 1 year allow **1** mark only for record number of vehicles / cars using the (20 mph) roads **or** collect data on accidents on the (20 mph) roads to score both marks the answer must refer to the roads with the reduced speed limit	1 1
Total			**9**

4.5.6.3.4 Factors affecting braking distance 2

Answer 05 · Mark scheme

June 2013 | PH2FP | Original Q6 | Legacy

PH2FP

4.5.6.3.4 Factors affecting braking distance 2

Answer 06 · Mark scheme

June 2013 | PH3FP | Original Q6 | Legacy

Question 6

question	answers	extra information	mark
6(a)(i)	are incompressible		1
6(a)(ii)	in all directions		1
6(b)	1.6	allow **1** mark for correct substitution, ie $\frac{80}{50}$ provided no subsequent step shown an answer 0.032 gains **0** marks	2
6(c)	Pa		1
6(d)	increases		1
Total			**6**

4.5.6.3.4 Factors affecting braking distance 2

Answer 06 · Mark scheme June 2013 | PH3FP | Original Q6 | Legacy

PH3FP

Answer 07 · Mark scheme June 2014 | PH2FP | Original Q8 | Legacy

8(a)(i)	friction		1	AO1 2.1.3a

8(a)(ii)	air resistance	accept drag friction is insufficient	1	AO1 2.1.3a

8(a)(iii)	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.		**Mark** **6**	**AO spec ref**
0 marks	**Level 1 (1–2 marks)**	**Level 2 (3–4 marks)**	**Level 3 (5–6 marks)**	AO2 AO3 2.1.4c
No relevant content.	There is an attempt to explain in terms of forces A and B why the velocity of the cyclist changes between any two points **or** a description of how the velocity changes between any two points.	There is an explanation in terms of forces A and B of how the velocity changes between X and Y and between Y and Z **or** a complete description of how the velocity changes from X to Z. **or** an explanation and description of velocity change for either X to Y or Y to Z	There is a clear explanation in terms of forces A and B of how the velocity changes between X and Z **and** a description of the change in velocity between X and Z.	

4.5.6.3.4 Factors affecting braking distance 2

Answer 07 · Mark scheme

June 2014 | PH2FP | Original Q8 | Legacy

examples of the points made in the response	extra information
X to Y • at X force A is greater than force B • cyclist accelerates • and velocity increases • as cyclist moves toward Y, force B (air resistance) increases (with increasing velocity) • resultant force decreases • cyclist continues to accelerate but at a smaller value • so velocity continues to increase but at a lower rate **Y to Z** • from Y to Z force B (air resistance) increases • acceleration decreases • force B becomes equal to force A • resultant force is now zero • acceleration becomes zero • velocity increases until… • cyclist travels at constant / terminal velocity	accept speed for velocity throughout

Question	Answers	Extra information	Mark	AO spec ref
8(b)(i)	3360	allow **1** mark for correct substitution, ie 140 × 24 provided no subsequent step accept 3400 for **2** marks if correct substitution is shown	2	AO1 AO2 2.2.1b
	joule / J	do **not** accept j do **not** accept Nm	1	
8(b)(ii)	decreases	accept an alternative word / description for decrease do not accept slows down	1	AO1 2.1.3e
	temperature	accept thermal energy accept heat	1	
Total			**13**	

4.5.6.3.4 Factors affecting braking distance 2

Answer 08 · Mark scheme

June 2016 | PH3FP | Original Q3 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
3(a)	The pressure at X is the same as at Y		1	AO1 3.2.3a
3(b)	larger than		1	AO1 3.2.3b
3(c)(i)	3 (N/mm^2)	accept 3 000 000 Pa (correct unit must be given) allow **1** mark for correct substitution, ie $\frac{24}{8}$ provided no subsequent step	2	AO2 3.2.3c
3(c)(ii)	pascal		1	AO1 3.2.3c
3(d)	the brakes would not work	allow the vehicle (car/bike etc) would not stop accept they would freeze solid **or** seize up	1	AO3 3.2.3
Total			6	

4.5.6.3.4 Factors affecting braking distance 2

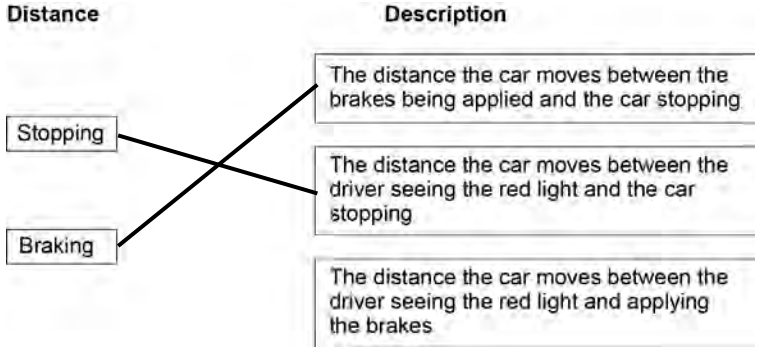
Answer 08 · Mark scheme

June 2016 | PH3FP | Original Q3 | Legacy



4.5.6.3.4 Factors affecting braking distance 2

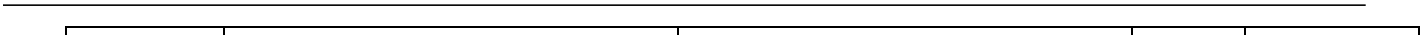
Answer 09 · Mark scheme June 2017 | PH2FP | Original Q2 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(a)	 If more than one line goes from a 'distance' box, all those lines are incorrect		2	AO1 2.1.3c
2(b)(i)	0.8s		1	AO2 2.1.3c
2(b)(ii)	increases thinking distance so increases (overall) stopping distance	 takes longer to stop more likely to have an accident is insufficient	1 1	AO1 2.1.3c, d
2(b)(iii)	$\frac{1}{2} \times 750 \times 8^2$		1	AO2 2.2.1g
2(b)(iv)	decrease(s) increase(s)	correct order only	1 1	AO1 2.1.3e
Total			8	

4.5.6.3.4 Factors affecting braking distance 2

Answer 09 · Mark scheme

June 2017 | PH2FP | Original Q2 | Legacy



4.5.6.3.4 Factors affecting braking distance 2

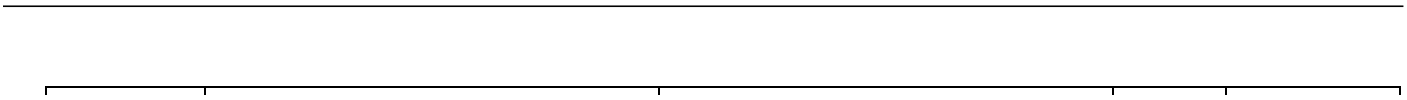
Answer 10 · Mark scheme June 2018 | 8463/1F | Original Q1

Question	Answers	Extra information	Mark	AO/ Spec. Ref
01.1	chemical kinetic	in this order only	1 1	AO1 4.1.1.1
01.2	$E_k = 0.5 \times 80 \times 12^2$ $E_k = 5760$ (J)	an answer of 5760 (J) scores **2** marks	1 1	AO2 4.1.1.2
01.3	E = 0.040 × 480 × 50 E = 960 (J)	an answer of 960 (J) scores **2** marks	1 1	AO2 4.1.1.3
01.4	increased		1	AO1 4.3.2.1
Total			**7**	

4.5.6.3.4 Factors affecting braking distance 2

Answer 10 · Mark scheme

June 2018 | 8463/1F | Original Q1



4.5.6.3.4 Factors affecting braking distance 2

Answer 11 · Mark scheme

June 2019 | 8463/2F | Original Q10

Question 10

Question	Answers	Mark	AO/ Spec. Ref
10.1	**Level 3**: Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	5–6	AO1/1 AO2/1 4.5.6.3.2 4.5.6.3.3
	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 • reaction time explained in terms of longer reaction times increase thinking distance (from a given speed) • taking drugs • drinking alcohol • tiredness • age • distractions explained in terms of effect on driver's reaction time • speed explained in terms of the faster the vehicle the greater the distance travelled in the driver's reaction time (or converse) **OR** explained in terms of increased speed increases KE so increases work done to stop the vehicle • condition of the tyres • condition of road surface • wet/icy roads explained in terms of condition of tyres and road surface (including weather considerations) affecting <u>friction</u> (between tyres and road) • condition of brakes explained in terms of effect on braking force (applied to the wheels) or reduced <u>friction</u>		

4.5.6.3.4 Factors affecting braking distance 2

Answer 11 · Mark scheme June 2019 | 8463/2F | Original Q10

	• mass / weight of vehicle explained in terms of deceleration force or kinetic energy or change in momentum answers do not need to reference thinking / braking distance a Level 1 answer would list factors only **or** one factor with one linked explanation a Level 2 answer lists at least three factors with one linked explanation **or** two factors with two linked but different explanations a Level 3 answer lists at least three factors with at least two linked but different explanations			
10.2	work (done) = force × distance	allow W = F s	1	AO1/1 4.5.2
10.3	900 000 = 60 000 × distance distance = $\frac{900\,000}{60\,000}$ distance = 15 (m)	an answer 15 (m) scores **3** marks	1 1 1	AO2/1 4.5.2
10.4	brakes overheating **or** brakes locking (causing) loss of control **or** (causing) a skid	allow brake fade allow wheels locking allow increasing the stopping / braking distance **ONLY** if the first marking point scored ignore any effects on passengers or possible accidents	1 1	AO1/1 4.5.6.3.4
Total			**12**	

4.5.6.3.4 Factors affecting braking distance 2

Answer 12 · Mark scheme

November 2021 | 8463/2F | Original Q8

Question 8

Question	Answers	Mark	AO/ Spec. Ref
08.1	**Level 2:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	3–4	AO1 4.5.6.3.3 4.5.6.3.4 4.1.1.2
	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 Factors • poor condition of tyres • poor road surface • wet or icy road • poor/worn brakes Explanation • because of decreased friction Factors • increased mass of car/passengers Explanation • increases kinetic energy of car • more work needs to be done to stop car • increases momentum of the car Factor • road slopes downhill Explanation • (a component of) gravity opposes the braking force • resultant (braking) force is reduced allow answers in terms of reducing braking distance throughout A single factor with no related explanation is insufficient to score a mark		

4.5.6.3.4 Factors affecting braking distance 2

Answer 12 · Mark scheme

08.2	resultant force = mass × acceleration		1	AO1 4.5.6.2.2
08.3	7200 = 1600 × *a* $a = \frac{7200}{1600}$ *a* = 4.5 (m/s^2)	ignore negatives throughout	1 1 1	AO2 4.5.6.2.2
08.4	15 (m) 38 (m) = 53 (m)	two correct values identified allow the correct addition of a misread braking distance and /or a misread thinking distance taken from the graph	1 1	AO3 4.5.6.3.1
08.5	$p = \frac{F}{A}$		1	AO1 4.5.5.1.1
08.6	120 000 = $\frac{60}{A}$ $A = \frac{60}{120\,000}$ *A* = 0.0005 *A* = 5 (.0) × 10^{-4} m^2	 allow an answer given to 2 sig figs from an incorrect calculation using the given data	1 1 1 1 1	AO2 AO2 AO2 AO2 AO1 4.5.5.1.1
Total			**16**	

4.5.6.3.4 Factors affecting braking distance 2

Answer 13 · Mark scheme

June 2023 | 8463/2F | Original Q2

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	kinetic thermal	this order only	1 1	AO1 4.5.6.3.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	(minimum braking) distance increases with increasing speed	allow positive correlation	1	AO2 4.5.6.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	increases		1	AO1 4.5.6.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	12.5 – 5.0 = 7.5 (m/s) $t = \frac{7.5}{0.25}$ t = 30 (s)	 this mark may be awarded if the change in velocity is incorrectly calculated allow a correctly calculated answer using a change in velocity incorrectly calculated	1 1 1	AO2 4.5.6.1.5

4.5.6.3.4 Factors affecting braking distance 2

Answer 13 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	*F* = 1600 × 0.25 *F* = 400 (N)		1 1	AO2 4.5.6.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	initial height of the ruler above the person's hand		1	AO3 4.5.6.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.7	there will be more variation in distances	allow reaction times for distances allow the three students tested are not typical	1	AO3 4.5.6.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.8	carry out the experiment listening to music then not listening to music (and compare the results)	 allow compare with original results	1 1	AO3 4.5.6.3.2

Total Question 2	13

4.5.6.3.4 Factors affecting braking distance 2

Answer 14 · Mark scheme

June 2025 | 8463/2F | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	car **X** has a smaller maximum acceleration		1	AO3 4.5.6.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	$F = 900 \times 2.5$ 2250 (N)	 allow 2300 (N)	1 1	AO2 4.5.6.2.2

Question	Answers	Mark	AO / Spec. Ref.
04.3	**Level 2:** Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account.	3–4	AO2 AO3 4.5.1.4 4.5.6.1.5 4.5.6.2.1 4.5.6.2.2
	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 • driving force increases • driving force has a maximum value • driving force is greater than air resistance • there is a resultant forward force • air resistance increases (as speed increases) • resultant force decreases • air resistance becomes equal to the driving force (at maximum speed) • resultant force is zero For **Level 2** answers must include how both driving force and air resistance change.		

4.5.6.3.4 Factors affecting braking distance 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	time		1	AO1 4.5.6.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	force		1	AO1 4.5.6.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.6	(thinking distance =) 20 **and** (braking distance =) 60 stopping distance = 20 + 60 80 (m)	subsequent marks may be awarded if incorrect reading(s) are taken from the graph	1 1 1	AO2 4.5.6.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.7	the driver becoming tired driving on a wet road		1 1	AO1 4.5.6.3.2 4.5.6.3.3

Total Question 4	**14**

4.5.6.3.4 Factors affecting braking distance 2

Answer 11 · Examiner comments

June 2019 | 8463/2F | Original Q10

Question 10 (Standard demand)

10.1 Although there was no need to do this, most students divided their answer into a consideration of thinking distance and a consideration of braking distance. Factors often given were to do with alcohol or drugs but rarely were they related to the effect on reaction time. A common error was to describe reaction time as being reduced and that leading to an increase in the thinking / stopping distance. Condition of the roads / tyres was common as was icy / wet roads. However these factors were rarely linked to a reduction in friction. A description in terms of less grip or traction was not acceptable. Weaker answers tended to describe what is meant by thinking distance and stopping distance without stating what changes either of these two distances.

10.2 This equation was well known, with 70% of students scoring the mark.

10.3 Just over 83% of the students scored all three marks.

10.4 There were few answers in terms of brakes overheating and the driver losing control of the car. Answers which did not score generally referred to the danger to passengers of whiplash, of hitting the windscreen or of cars behind crashing into the back of the car.

4.5.6.3.4 Factors affecting braking distance 2

Answer 11 · Examiner comments

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.

4.5.6.3.4 Factors affecting braking distance 2

Answer 13 · Examiner comments June 2023 | 8463/2F | Original Q2

02.1

22 % of students scored 1 mark and 61 % of students scored both marks for identifying the energies

02.2

The majority of the students identified the correct relationship between the speed and the braking distance. Those that didn't described the graph rather than mentioning braking distance or speed, or used incorrect phrases eg 'directly proportional'.

02.3

84% of students knew that braking distance increases when a road becomes icy.

02.4

This 3-mark question required students to calculate the change in velocity then use this correctly to determine the time taken. Many students failed to show how they calculated the change in velocity and could not be awarded any marks.

Answer 13 · Examiner comments June 2023 | 8463/2F | Original Q2

02.5

86 % scored 2 marks for calculating the resultant force. Common mistakes involved dividing instead of multiplying, or calculating 1600 x 0.25^2, the squared apparently being inferred from the unit of deceleration (m/s^2).

02.6

77% of students were able to identify the control variable for the investigation.

02.7

Many students correctly stated that there would be a greater number of results, which could lead to a change in the mean. But some simply stated that different people have different reaction times. Credit was also given for those that stated the reaction times of 3 children tested may not be representative of the whole class. However, some only answered by saying 'only 3 children were tested' which was insufficient to get the mark.

02.8

30 % scored 1 mark and only 33 % scored 2 marks. Rather than describing a change to the experiment students would state how they thought music would affect the reaction time, or why music would affect the reaction time.
Many who got 1 mark suggested they did the experiment with music on but did not say to compare with previous results or do it with music off.

4.5.6.3.4 Factors affecting braking distance 2

Questions matter

GCSE
Physics
8463/2F

Report on the examination

Version: 1.0
June 2025

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4.5.6.3.4 Factors affecting braking distance 2

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Report on the examination – GCSE - Physics – 8463/2H – June 2025

General comments

Students should pay attention to the number of options that need to be ticked when doing multiple choice questions. They should make sure they cross out wrong options when they change their minds, as marks cannot be awarded where there are multiple ticks instead of one.

Many students demonstrated good maths skills, although there are always issues with rearrangements. Formula triangles are not always helpful. Students who had correctly written down an equation in a previous question and then tried to use a formula triangle often scored no marks, because they don't understand how to use them. If they had substituted into the equation from the equations sheet they would have scored the 1st mark.

Students had access to the equations sheet for this examination series. A minority of the students however did not use them to find the appropriate equation.

Levels of demand

Questions are set at two levels of demand on this paper:

- Low demand questions are targeted at students working at grades 1–3.
- Standard demand questions are targeted at students working at grades 4–5.

A student's final grade, however, is based on their attainment across the qualification, not just on questions that may have been targeted at the level at which they are working.

01.1

Over 90 % of the students knew that a protractor is used to measure angles. The phonetic spelling of protractor was allowed.

01.2

Almost 70% of the students scored all four marks for completing the graph. Despite a clear instruction a significant number did not label the y-axis. A number of the students did not use a ruler to draw the line of best fit.

01.3

Most of the students correctly identified the relationship between the angle of incidence and the angle of reflection.

01.4

Half of the students knew which measurement was the amplitude of a wave. Most of the others thought the vertical distance between a peak and a trough was the amplitude.

01.5

About 80 % of the students knew which line showed the wavelength of the wave. The most common incorrect answer was the distance showing half the wavelength.

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4.5.6.3.4 Factors affecting braking distance 2

Report on the examination – GCSE - Physics – 8463/2H – June 2025

01.6

Over 90 % of the students correctly calculated the wavelength. Those who did not achieve full marks mainly did so by not choosing the correct unit for wavelength, with Pa being a popular incorrect choice.

01.7

This was well answered, with most of the students scoring both marks. A few inverted the equation and thus calculated the period incorrectly.

02.1

Most of the students correctly calculated the weight of coal.

02.2

Just over 90% of the students were able to use the work done equation correctly. Those that did not get full marks tended to put an additional step into the calculation by dividing the answer 68 000 000 by 4; the number of engines in total.
Occasionally a student would attempt to convert the number calculated into standard form. Whilst not being penalised, this was not required.

02.3

Well answered by most students. As with part 02.2, occasionally a student would attempt to convert the number calculated into standard form.

02.4

Nearly 90% of the students could identify that friction was a contact force.

02.5

Most of the students identified the correct distance-time graph for constant speed.

02.6

This was the 1st calculation that was more challenging for many students. A common error was to use only one of the quoted velocities to calculate the acceleration rather than using the difference between the velocities. However just over 80 % did score full marks, with 10 % scoring zero or not attempting the question.

03.1

Approximately 60% of the students scored both marks. Often students did not know the correct word for a natural satellite. However, many correctly identified ‘star’ for the second word.

03.2

Most of the students knew that we are part of the Milky Way galaxy.

03.3

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4.5.6.3.4 Factors affecting braking distance 2

Only about 40 % of the students knew that the Sun will eventually become a black dwarf. The most popular wrong answer was that it would become a black hole.

03.4

Just fewer than 40 % of the students knew that a very distant galaxy moves faster than a nearer galaxy.

03.5

About 70 % of the students knew that an increase in the wavelength of light from a distant galaxy is called red-shift.

03.6

About 60 % of the students selected the correct word to describe the beginning of the universe.

03.7

Almost 80 % of the students knew that the universe is expanding.

04.1

Just over 70 % of the students were able to make the connection between the mass of a vehicle and how it would affect the maximum acceleration.

04.2

Over 90 % of the students scored full marks for calculating the resultant force using F = ma. However, some of the students thought that the value of acceleration needed to be squared and then multiplied by mass.

04.3

This level of response question proved too challenging for many. Only just over 1 % of the students scored full marks. Most identified that the driving force would increase, but fewer recognised that as this happened the air resistance would also increase, with many stating that the air resistance would decrease as the cars speed increased.

04.4

Most of the students knew that the thinking distance is affected by the driver's reaction time.

04.5

Just fewer than 70 % of the students were aware that the braking distance is the distance travelled under the braking force.

04.6

Only just over 20 % of the students scored full marks for using the graph of distance against speed to find the stopping distance. The correct distances were often identified from the graph. However, these were then either subtracted from each other, divided or multiplied rather than added.

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4.5.6.3.4 Factors affecting braking distance 2

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04.7

Nearly 80 % of the students identified factors that would increase the stopping distance of a car. Despite two being emboldened twice in the question, some students only ticked one box.

05.1

The principal focus was correctly identified by just over 60 % of the students.

05.2

About 80 % of the students knew that the change in direction of light as it enters a lens is called refraction.

05.3

Nearly 70 % the students recognised the shape of a convex lens.

05.4

Under a half of the students managed to correctly measure the object height and image height. This may have been due to a lack of skill or a lack of equipment.

05.5

This was much more successfully answered than part 05.4 with nearly 90 % of the students scoring both marks. These students used their values from part 05.4 to calculate magnification.

05.6

Just fewer than 50 % of the students knew that magnification is a ratio, but almost the same number thought it is a power.

05.7

This was a challenging question. Most of the students that did score a mark were awarded only the first mark point. This was for explaining that white light is transmitted through colourless glass. A lot of the students think of white light as an entity in itself rather than the result of the colours of the visible light combined. Few used the word transmitted but rather described it as passing through or goes through.
For the 2nd and 3rd mark points many of the students decided that white light was reflected or refracted, reinforcing the misconception that white light is a single entity rather than being made up of a combination of wavelengths. The idea that filters would absorb different wavelengths of light seemed to be difficult for the students to express, with very few achieving the third mark.

06.1

Only just over 30 % of the students could identify two magnetic materials from the list, with about 60 % being able to identify one. Again, a number of students ticked just one box or more than two boxes.

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4.5.6.3.4 Factors affecting braking distance 2

06.2
Just over 70 % of the students correctly named the iron nails as induced magnets.

06.3
Just fewer than 40 % of the students knew the direction of the magnetic field.

06.4
Nearly 80 % of the students recognised the shape of the magnetic field around a current carrying wire.

06.5
Very few of the students could give two changes that would increase the magnetic field strength. 'Increasing the current' was a common correct response. Many of the students answered 'increasing the number of coils' as such they were implying the wire was already coiled and not answering the question asked, which was about the straight wire shown in Figure 10.

07.1
Nearly 60 % of the students understood what is meant by the moment of a force. The most common incorrect option was 'The direction of the force.'

07.2
The correct resultant moment was selected by just over 80 % of the students.

07.3
Students generally answered this well, identifying position 7 and on which side of the balance the tag should be placed. Some indicated this on the diagram which was an accepted alternative response, provided what was written did not contradict it.

07.4
Some students wrote the equation for the moment of a force in words and then in symbols. This risks not gaining the mark if either is incorrect. Also, correct use of symbols should be stressed, especially when they are given in the question. It was surprising that some of the students scored zero or did not attempt to write down an equation despite having the equations sheet.

07.5
Almost three quarters of the students were able to rearrange the equation and then calculate the distance between the pivot and the tag on the balance.

08.1
Most of the students found this level of response question difficult to answer. Only just over 1 % gave a level 2 answer. Many of the students scored 2, 1 or 0 marks. Of those that scored a mark the most common response was light travels faster than sound. Many also tried to describe light and sound as transverse and longitudinal waves, with the majority getting this

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confused. Very few identified acceptable similarities. Common answers that did not gain credit included light travels at the speed of light, sound travels at the speed of sound, light can be seen and sound cannot be seen.

08.2

Just fewer than 80 % of the students choose the correct equation for calculating speed.

08.3

This question required students to rearrange the equation. About three quarters of the students scored all three marks.

09.1

About 65 % of the students correctly stated the independent variable in this investigation.

09.2

Just over 40 % of the students scored both marks for identifying a risk of harm and a suitable safety precaution to reduce the risk. Too few students connected a hazard, such as a falling weight, becoming a risk of harm when it hit or hurt the student.

09.3

Students were expected to clearly describe two improvements to the arrangement shown that would improve the accuracy of the results. Many had difficulty describing their ideas clearly and answers were often too vague to gain credit.

09.4

Almost 40 % of the students scored this mark usually by explaining that the spring length was not 0 cm rather than describing the relationship between spring length and force.

09.5

This was not successfully answered, with only about 2 % of the students scoring both marks and a further 13 % scoring one mark. The 1st mark point was for stating or giving a clear description of inelastic deformation. Of those who were awarded marks most of them described how the spring had reached or passed its limit of proportionality.

09.6

Over 90 % of the students selected the correct equation.

09.7

Nearly 80 % of the students scored all three marks. Those that did not often rearranged the equation incorrectly.

10.1

Only about 5% of the students correctly calculated the uncertainty correctly from either the range or the mean.

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4.5.6.3.4 Factors affecting braking distance 2

10.2

Just over 40 % of the students identified that a random error had caused the variation in this investigation. A greater proportion of the students thought there was a systematic error but this would not have accounted for the variation in the results.

10.3

This mark was awarded for a clear description of variation in the way the ball was dropped. For example, through different heights, at different speeds, or a different delay each time. Common answers giving reaction time or human error were too vague, to be awarded marks unless qualified.

10.4

Just fewer than 30 % of the students scored all three marks. Many of the students took only one value from the graph rather than a corresponding pair of values and so scored 0. Those that used a pair of correct values often then used them the wrong way round when calculating the gradient.

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4.5.6.3.4 Factors affecting braking distance 2

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Mark Ranges and Award of Grades

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

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