AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 6.5.4.1.2

Speed

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**33**
Available paper years	**2018–2025**

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.

6.5.4.1.2 Speed

Answer 01 · Mark scheme

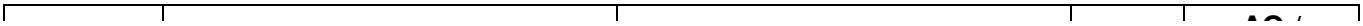
June 2018 | 8464/P/1F | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1		an answer of 1960 scores **2** marks		AO2 6.1.1.2
	$E_p = 50 \times 9.8 \times 4.0$		1	
	$E_p = 1960$ (J)	allow an answer rounded to 2000 (J) allow a maximum of **1** mark if g = 10 N/kg is used	1	
03.2		an answer of 1225 scores **2** marks		AO2 6.1.1.2
	$E_k = 0.5 \times 50 \times 7^2$		1	
	$E_k = 1225$ (J)	allow 1200 or 1230 (J)	1	
03.3	some energy is wasted		1	AO2 6.1.2.1
	the g.p.e of the girl is not zero		1	
03.4	reduces the amount of friction	do **not** accept reference to friction between the wheels and the ramp	1	AO2 6.1.2.1
	so more energy is usefully transferred	allow less energy is wasted **or** less heating	1	AO1 6.1.2.1
	greater kinetic energy		1	AO2 6.1.2.1
Total			**9**	

6.5.4.1.2 Speed

Answer 01 · Mark scheme

June 2018 | 8464/P/1F | Original Q3



6.5.4.1.2 Speed

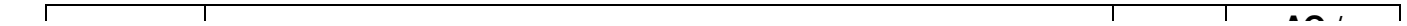
Answer 02 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	electron atom nucleus orbit		1 1 1 1	AO1 6.4.1.3 5.1.1.3
06.2	positive charge is provided by protons (every atom of the same element contain the) same number of protons	 do **not** accept same number of protons and neutrons ignore reference to electrons	1 1	AO1 6.4.1.2 6.4.1.3
06.3	$v = 300\ 00\ 000 \times \left(\frac{7}{100}\right)$ v = 21 000 000 (m/s)	an answer of 21 000 000 scores **2** marks allow any correct method of determining 7% of 300 000 000 allow 2.1×10^7 (m/s)	 1 1	AO2 6.4.1.3
06.4	$r = 6 \times 2.5 \times 10^{-11}$ $r = 1.5 \times 10^{-10}$ (m)	an answer in the range 1.4×10^{-10} to 1.6×10^{-10} scores **2** marks allow a ratio in the range of 5.7–6.3 or measurements that would give this range, correctly substituted allow 1.4×10^{-10} to 1.6×10^{-10} their ratio $\times 2.5 \times 10^{-11}$ correctly calculated scores **1** mark	 1 1	AO2 6.4.1.1
Total			**10**	

6.5.4.1.2 Speed

Answer 02 · Mark scheme

June 2018 | 8464/P/1F | Original Q6



6.5.4.1.2 Speed

Answer 03 · Mark scheme

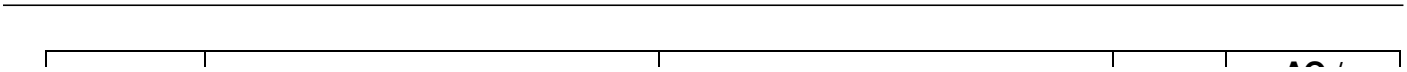
June 2018 | 8464/P/2F | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	distance		1	AO1 6.5.1.1
01.2	BC		1	AO3 6.5.4.1.5
01.3	DE		1	AO3 6.5.4.1.5
01.4	5.0 (s)	allow 5 (s)	1	AO2 6.5.4.1.5
01.5	6.0 (m/s)	allow 6 (m/s)	1	AO2 6.5.4.1.5
01.6	6.0 / 5.0 = 1.2 (m/s^2)	an answer of 1.2 scores **2** marks allow ecf from questions **01.4** and **01.5**	1 1	AO2 6.5.4.1.5
01.7	about four times faster		1	AO2 6.5.4.1.2
Total			**8**	

6.5.4.1.2 Speed

Answer 03 · Mark scheme

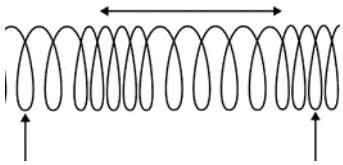
June 2018 | 8464/P/2F | Original Q1



6.5.4.1.2 Speed

Answer 04 · Mark scheme

June 2018 | 8464/P/2F | Original Q2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	 rarefaction compression		3	AO1 6.6.1.1
02.2	longitudinal		1	AO1 6.6.1.1

6.5.4.1.2 Speed

Answer 04 · Mark scheme

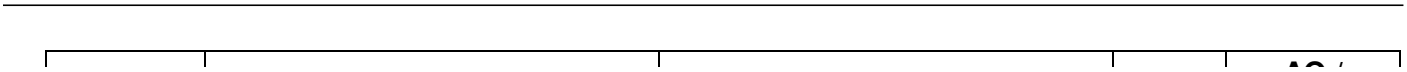
June 2018 | 8464/P/2F | Original Q2

Question	Answers	Mark	AO / Spec. Ref.
02.3	**Level 2:** The method would lead to the production of a valid outcome. Key steps are identified and logically sequenced.	3–4	AO2
	Level 1: The method would not necessarily 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 • measure the distance between the student with the bricks and the wall • trundle wheel or tape measure • measure the time taken from banging the bricks to the echo • double the measured distance to give the distance travelled or half the time • use: speed = $\frac{\text{distance travelled}}{\text{time}}$ • repeat timings • remove anomalies • calculate a mean		6.6.1.2
Total			**8**

6.5.4.1.2 Speed

Answer 04 · Mark scheme

June 2018 | 8464/P/2F | Original Q2



6.5.4.1.2 Speed

Answer 05 · Mark scheme

June 2019 | 8464/P/1F | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
05.1	to stop the metal case of the toaster becoming live if a fault occurs		1	AO1.1 6.2.3.2	A
05.2	yellow brown blue		1 1 1	AO1.1 AO1 in isolation 6.2.3.2	G
05.3	E = 850 ×120 E = 102 000 (J)	an answer of 102 000 (J) scores **2** marks	1 1	AO2.1 6.2.4.2 6.1.1.4 WS 3.3	E
05.4	elastic potential kinetic		1 1	AO1.1 6.1.1.1	G
05.5	gravitational potential energy = mass × gravitational field strength × height or $E_p = m\ g\ h$	allow gpe allow any correct re-arrangement	1	AO1.1 AO1 in isolation 6.1.1.2	E
05.6	$0.049 = 0.050 \times 9.8 \times h$ $h = \frac{0.049}{0.050 \times 9.8}$ h = 0.10 (m)	an answer of 0.10 (m) scores **3** marks	1 1 1	AO2.1 6.1.1.2 WS 3.3	E
Total			**12**		

6.5.4.1.2 Speed

Answer 05 · Mark scheme

June 2019 | 8464/P/1F | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID

6.5.4.1.2 Speed

Answer 06 · Mark scheme

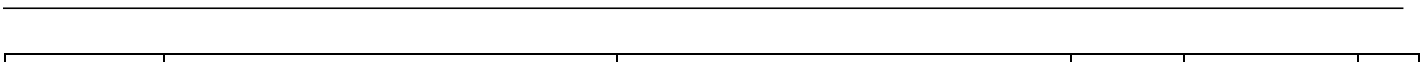
June 2019 | 8464/P/2F | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
03.1	there is a resultant force on the ball		1	AO1 6.5.4.2.1	A
03.2	s = 11 × 0.25 s = 2.75 (m)	an answer of 2.75 scores **2** marks allow 2.8 (m)	1 1	AO2 6.5.4.1.2	E
03.3	$\frac{75}{100}$ × 30.0 22.5 (cm) (25.1 > 22.5) therefore the ball can be used OR $\frac{25.1}{30.0}$ ×100 (1) 84 % (1) (84% > 75%) therefore the ball can be used (1)	allow any correct method of determining 75% of 30 this mark can only be awarded if a supporting calculation has been done allow any correct supported conclusion allow a conclusion consistent with an incorrect percentage calculation this mark can only be awarded if a supporting calculation has been done allow any correct supported conclusion allow a conclusion consistent with an incorrect percentage calculation	1 1 1	AO3 6.5.4.1.2	E
03.4	the smaller ball has a smaller area (so) air resistance is less (on the smaller ball)		1 1	AO2 6.5.4.2.1	E
Total			**8**		

6.5.4.1.2 Speed

Answer 06 · Mark scheme

June 2019 | 8464/P/2F | Original Q3



6.5.4.1.2 Speed

Answer 07 · Mark scheme

June 2019 | 8464/P/2F | Original Q4

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
04.1	(thinking distance) will double any correct pair of points from graph eg (200,6) and (400,12)	 allow graph shows direct proportionality (after 200 ms) allow **1** mark for thinking distance increases with supporting data.	1 1	AO3 6.5.4.3.2	E
04.2	(most) people cannot react any quicker than 200 ms		1	AO1 6.5.4.3.2	E
04.3	there is variation in the measurements	allow the data is not very precise allow lots of random error ignore references to accuracy / reliability / average	1	AO3 6.5.4.3.2	E
04.4	(258+265+302+248+327) / 5 280 (ms)	an answer of 280 gains **2** marks	1 1	AO2 6.5.4.3.2	E
04.5	8.4 (m)	allow 7.9 (m) to 8.9 (m) allow ecf from **04.4**	1	AO2 6.5.4.3.2	E
04.6	any **two** from: • (material of) road surface • condition of the tyres • speed of the car • wet / icy road surface • gradient of road • mass / weight of the car	 Ignore any reference to brakes	2	AO1 6.5.4.3.3	
04.7	work done = force × distance (along the line of action of the force)	allow W = F s allow any correct re-arrangement	1	AO1 6.5.2	

6.5.4.1.2 Speed

Answer 07 · Mark scheme

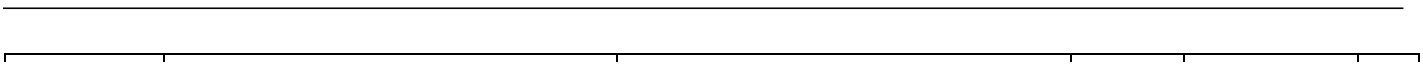
June 2019 | 8464/P/2F | Original Q4

04.8	F = 6000 N W = 6000 × 75 W = 450 000 (J)	an answer of 450 000 scores 3 marks allow a correct substitution using an incorrectly / not converted value of F allow a correct calculation using an incorrectly / not converted value of F	1 1 1	AO2 6.5.2	
Total			**13**		

6.5.4.1.2 Speed

Answer 07 · Mark scheme

June 2019 | 8464/P/2F | Original Q4



6.5.4.1.2 Speed

Answer 08 · Mark scheme

June 2019 | 8464/P/2F | Original Q6

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
06.1	(4 - 0) + (10 - 7) **or** 4 + 3 **or** 10 - 3 7 (s)	an answer of 7 (s) gains **2** marks	1 1	AO2 6.5.4.1.5	E
06.2	gradient = $\frac{0-2}{24-14}$ (-) 0.2 (m/s^2)	an answer of 0.2 (m/s^2) gains **2** marks allow readings from any two points correctly substituted allow correct use of $a = \frac{\Delta v}{t}$	1 1	AO2 6.5.4.1.5	E
06.3	(there are no wires) to get tangled / disconnected	allow easier to move arms allow wires are inconvenient allow easier to transfer data	1	AO3 6.6.2.4	E
06.4	wave speed = frequency × wavelength	allow v = f λ allow any correct re-arrangement	1	AO1 6.6.1.2	E
06.5	300 000 000 = 2 400 000 000 × λ λ = $\frac{300\,000\,000}{2\,400\,000\,000}$ λ = 0.125 (m)	an answer of 0.125 (m) or 0.13 (m) scores **3** marks allow λ = 0.13 (m)	1 1 1	AO2 6.6.1.2	E
06.6	range is far enough (for most uses) power is not too great so the battery will not drain quickly	allow power not too great so the phone will not overheat allow the range per milliwatt is greatest or 4 metres	1 1	AO3 6.6.2.4	E

6.5.4.1.2 Speed

Answer 08 · Mark scheme

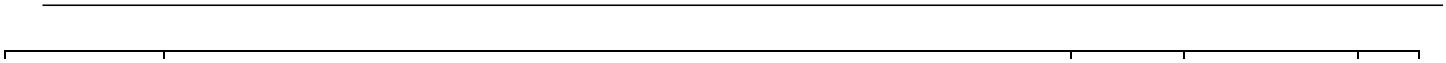
June 2019 | 8464/P/2F | Original Q6

Total			**11**		

6.5.4.1.2 Speed

Answer 08 · Mark scheme

June 2019 | 8464/P/2F | Original Q6



6.5.4.1.2 Speed

Answer 09 · Mark scheme

June 2019 | 8464/P/2F | Original Q7

Question	Answers	Mark	AO / Spec. Ref.	ID
07.1	**Level 3:** The design/plan would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	5–6	AO1 6.6.1.2	E
	Level 2: The design/plan 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 design/plan 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 • if two quantities have been determined, v = f λ can be used to find the third. **Frequency** • use a stopclock • count the number of waves passing a point in a fixed time period • divide the time by the number of waves to determine the time for one wave, T • f = 1/T • read the frequency off the oscillator **Wavelength** • use a camera to freeze the image • use a metre rule to measure the distance between two wavefronts • count the number of waves between the wavefronts • divide distance by the number of waves to determine λ **Velocity** • determine a mean value of frequency • determine a mean value of wavelength • measure the time it takes one wavefront to travel the length of the screen • measure the length of the screen • speed = distance / time To access Level 3 there must be a description of how frequency, wavelength and velocity can be determined			

6.5.4.1.2 Speed

Answer 09 · Mark scheme

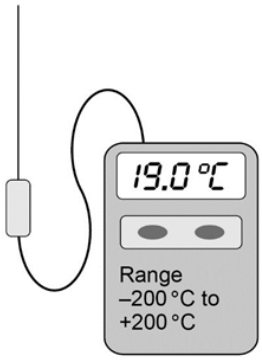
June 2019 | 8464/P/2F | Original Q7

07.2	(the duck) moves perpendicular to the direction of wave travel	duck moves up and down is insufficient	1	AO2 6.6.1.1	E
07.3	mean maximum height = 511 **and** mean minimum height = 500 511 – 500 = 11 11 / 2 = 5.5 (mm)	an answer of 5.5 (mm) gains **3** marks 1 allow a calculated difference from incorrect means allow their difference divided by 2 any correct method of determining the mean amplitude can score 3 marks	1 1 1	AO2 6.6.1.2	E
Total			**10**		

6.5.4.1.2 Speed

Answer 10 · Mark scheme

November 2020 | 8464/P/1F | Original Q4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	at random speeds in random directions		1	AO1 6.3.3.1
04.2	3rd thermometer ticked  ☐		1	AO2 6.3.2
04.3	to prevent (frost/cold) burns **or** to prevent injury from the cold nitrogen	allow to prevent frostbite	1	AO3 6.3.2.2
04.4	decreased decreased		1 1	AO1 6.3.2.1 6.3.3.1
04.5	860 = 0.00320 × c × 215 $c = \frac{860}{0.00320 \times 215}$ c = 1250 (J/kg°C)		1 1 1	AO2/1 4-5 6.3.2.2 6.1.1.3

6.5.4.1.2 Speed

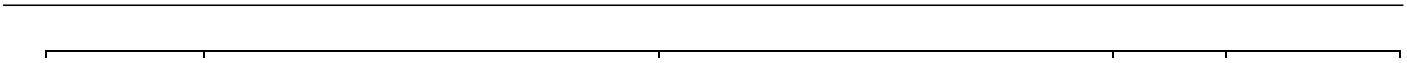
Answer 10 · Mark scheme

04.6	temperature stays the same		1	AO2 6.3.2.3
04.7	a change of state from liquid to gas		1	AO1 6.3.2.3
04.8	1440 = 0.0072 × L $L = \frac{1440}{0.0072}$ L = 200 000 (J/kg)		1 1 1	AO2 6.3.2.3
Total			**13**	

6.5.4.1.2 Speed

Answer 10 · Mark scheme

November 2020 | 8464/P/1F | Original Q4



6.5.4.1.2 Speed

Answer 11 · Mark scheme

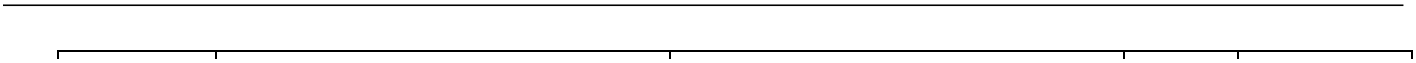
November 2020 | 8464/P/2F | Original Q4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	gradient = $\frac{250 - 0}{50 - 0}$ speed = 5.0 m/s	allow any correct pair of values substituted allow 5 (m/) allow the use of s = v t	1 1	AO2 6.5.4.1.4
04.2	gravitational force		1	AO1 6.5.1.2
04.3	W = 30 × 250 W = 7500 J		1 1 1	AO2 AO2 AO1 6.5.2
04.4	frictional kinetic chemical		1 1 1	AO1 6.5.2
Total			**9**	

6.5.4.1.2 Speed

Answer 11 · Mark scheme

November 2020 | 8464/P/2F | Original Q4



6.5.4.1.2 Speed

Answer 12 · Mark scheme

November 2021 | 8464/P/1F | Original Q2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	kinetic chemical	answers must be in this order	1 1	AO1 6.1.1.1
02.2	gravitational potential energy increases		1	AO1 6.1.1.1
02.3	$E_p = 50 \times 9.8 \times 3.0$ $E_p = 1470$ (J)	 allow 1500 (J)	1 1	AO2 6.1.1.1 6.1.1.2
02.4	speed = $\sqrt{2 \times \frac{1600}{50}}$ speed = 8 m/s	allow 8.0	1 1 1	AO2 AO2 AO1 6.1.1.1 6.1.1.2
02.5	energy has been transferred from the athlete to the air		1	AO3 6.1.2.1
02.6	the rate at which the athlete transfers energy		1	AO1 6.1.1.4

6.5.4.1.2 Speed

Answer 12 · Mark scheme

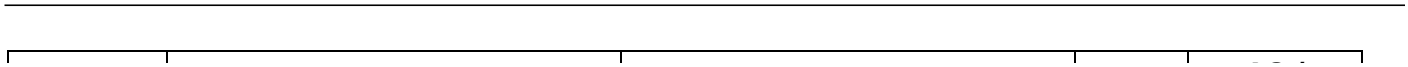
November 2021 | 8464/P/1F | Original Q2

02.7	more than less than	answers must be in this order	1 1	AO1 6.1.1.4
Total			**12**	

6.5.4.1.2 Speed

Answer 12 · Mark scheme

November 2021 | 8464/P/1F | Original Q2



6.5.4.1.2 Speed

Answer 13 · Mark scheme

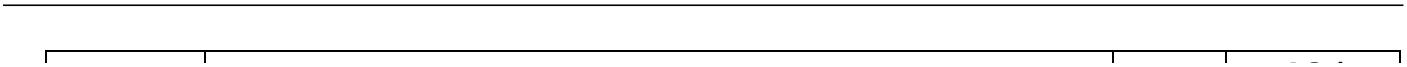
November 2021 | 8464/P/2F | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	taking drugs tiredness		1 1	AO1 6.5.4.3.2
03.2	24 (years)		1	AO3 6.5.4.3.2
03.3	0.55 (s)	allow answer in range 0.54 to 0.56	1	AO3 6.5.4.3.2
03.4	decreases increases	this order only	1 1	AO1 6.5.4.3.4
03.5	braking distance = $\frac{(12)^2}{(2 \times 3)}$ braking distance = 24 unit = m		1 1 1	AO1 AO2 AO2 6.5.4.1.5
03.6	so they know how far behind another car they should drive **or** so they can stop safely if the car in front stops		1	AO3 6.5.4.3.3
Total			**10**	

6.5.4.1.2 Speed

Answer 13 · Mark scheme

November 2021 | 8464/P/2F | Original Q3



6.5.4.1.2 Speed

Answer 14 · Mark scheme

November 2021 | 8464/P/2F | Original Q4

Question	Answers	Mark	AO / Spec. Ref.
04.1	**Level 2:** The design would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	3–4	AO1 6.6.1.2
	Level 1: The design 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 **Wavelength** • place a metre rule at the side of the screen perpendicular to the wave fronts • use the metre rule to measure the length of the screen • take a photograph of the shadow on the screen • count the number of complete waves on the screen • determine the wavelength by dividing the length of the by the number of complete waves **or** • place a metre rule at the side of the screen perpendicular to the wave fronts • take a photograph of the shadow on the screen • use the metre rule to measure the distance between two wave front **Frequency** • count the number of waves that pass a given point • time how long it takes for the waves to pass that point using a stop clock • frequency is number of waves divided by time taken **or** • put a stop clock on the screen • use a digital video camera to record the waves passing a point • replay in slow motion and count the number of waves passing a point in 1 second There must be a description of both frequency and wavelength measurement to access level 2		

6.5.4.1.2 Speed

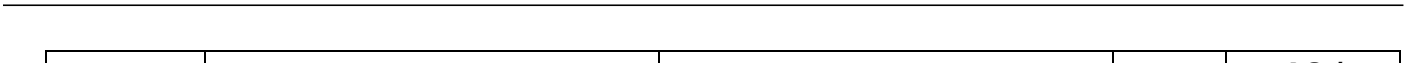
Answer 14 · Mark scheme

04.2	12.5 (Hz)		1	AO2 6.6.1.2
04.3	to reduce the effect of random errors		1	AO1 6.6.1.2
04.4	period = $\frac{1}{20}$ period = 0.05 (s)	allow 0.050 (s)	1 1	AO2 6.6.1.2
04.5	v = 20 × 0.012 v = 0.24 (m/s)		1 1	AO2 6.6.1.2
Total			**10**	

6.5.4.1.2 Speed

Answer 14 · Mark scheme

November 2021 | 8464/P/2F | Original Q4



6.5.4.1.2 Speed

Answer 15 · Mark scheme

November 2021 | 8464/P/2F | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	(air resistance) increases		1	AO1 6.5.4.1.5
05.2	less than		1	AO3 6.5.4.1.5
05.3	s = 35 × 14 s = 490 (m)		1 1	AO2 6.5.4.1.2
05.4	work done = force × distance **or** W = Fs		1	AO1 6.5.2
05.5	54 000 000 = F × 270 $F = \frac{54\,000\,000}{270}$ F = 200 000 (N)		1 1 1	AO2 6.5.2

6.5.4.1.2 Speed

Answer 15 · Mark scheme

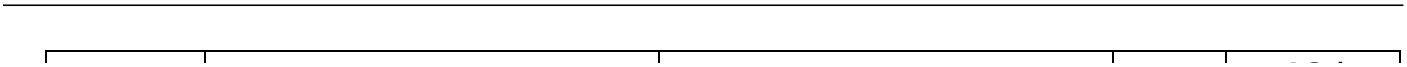
November 2021 | 8464/P/2F | Original Q5

Question	Answers	Mark	AO / Spec. Ref.
05.6	**Level 2:** Scientifically relevant features are identified; the way(s) in which they are similar/different is made clear and (where appropriate) the magnitude of the similarity/difference is noted.	4–6	AO3 6.5.4.1.2
	Level 1: Relevant features are identified and differences noted.	1–3	
	No relevant content	0	
	Indicative content • distance travelled is the same for each aeroplane • time in the air is much greater for jet aeroplane • speed of rocket plane is much greater • speed of rocket plane is 32 times greater • radiation dose each hour greater for rocket aeroplane • radiation dose each hour is 2 times greater for rocket aeroplane • overall radiation dose is less for rocket plane • dose in jet aeroplane is 16 times greater overall • much higher risk in jet aeroplane • increased risk of skin cancer • increased risk of gene mutation and cancer To access level 2, there must be a relevant calculation.		
Total			**14**

6.5.4.1.2 Speed

Answer 15 · Mark scheme

November 2021 | 8464/P/2F | Original Q5



6.5.4.1.2 Speed

Answer 16 · Mark scheme

June 2022 | 8464/P/1F | Original Q2

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	the same distance as the lift		1	AO2 6.1.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	it decreases		1	AO2 6.1.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	E = 1300 × 9.8 × 4.0 E = 50960 (J)	 allow 51000 (J)	1 1	AO2 6.1.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	kinetic internal	this order only	1 1	AO1 6.1.1.1 6.3.2.1

6.5.4.1.2 Speed

Answer 16 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	the distance moved by the lift the weight of the people in the lift		1 1	AO2 6.1.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2.6	$E_e = 0.5 \times 880\,000 \times 0.015^2$ $E_e = 99$ (J)		1 1	AO2 6.1.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2.7	less energy is transferred		1	AO1 6.1.2.2

Total Question 2		11

6.5.4.1.2 Speed

Answer 17 · Mark scheme

June 2022 | 8464/P/2F | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	tiredness of the driver using a mobile phone		1 1	AO1 6.5.4.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	increases reaction time so increases the thinking distance so more likely to have a collision	 allow travels a greater distance before stopping (in an emergency)	1 1 1	AO1 AO1 AO3 6.5.4.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	23 m/s		1	AO2 6.5.4.3.2

6.5.4.1.2 Speed

Answer 17 · Mark scheme

June 2022 | 8464/P/2F | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	directly proportional	allow **1** mark for as speed increases thinking distance increases	2	AO3 6.5.4.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	straight line from the origin with a greater gradient through (15,21)	 allow a line that passes within half a small square of (15,21) dependent on MP1	1 1	AO2 6.5.4.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.6	$v^2 - 0^2 = 2 \times 5.0 \times 45$ $v^2 = 450$ **or** $v = \sqrt{450}$ v = 21.21320343 v = 21 (m/s)	 allow a correctly rounded value of v calculated using the correct equation	1 1 1 1	AO2 6.5.4.1.5

Total Question 5		14

6.5.4.1.2 Speed

Answer 18 · Mark scheme

June 2022 | 8464/P/2F | Original Q6

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	**A** = rarefaction **B** = wavelength		1 1	AO1 6.6.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	f = 4000 Hz		1	AO2
	$T = \frac{1}{4000}$	allow a correct substitution using an incorrectly / not converted value of f	1	AO2
	T = 0.00025	allow a correct calculation using an incorrectly / not converted value of f	1	AO2
	seconds **or** s		1	AO1 6.6.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	wave speed = frequency × wavelength **or** $v = f\lambda$		1	AO1 6.6.1.2

6.5.4.1.2 Speed

Answer 18 · Mark scheme

June 2022 | 8464/P/2F | Original Q6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	$v = 348$	allow a value in the range 347 to 348 subsequent marks may only be awarded if value for v is in the range 343 to 349	1	AO2 6.6.1.2
	$348 = 300 \times \lambda$	allow a correct substitution using an incorrect value of v read from graph	1	
	$\lambda = \frac{348}{300}$	allow a correct rearrangement using an incorrect value of v read from graph	1	
	1.16 (m)	allow 1.2 (m) allow a correct calculation using an incorrect value of v read from graph allow a maximum of **2** marks for use of v = 330 m/s	1	

Total Question 6		**11**

6.5.4.1.2 Speed

Answer 19 · Mark scheme

June 2022 | 8464/P/2F | Original Q7

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	work done = force × distance (along the line of action of the force) **or** $W = F\ s$		1	AO1 6.5.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2	3 360 000 = F × 42 000 $F = \frac{3\ 360\ 000}{42\ 000}$ F = 80 (N)		1 1 1	AO2 6.5.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.3	distance travelled = speed × time		1	AO1 6.5.4.1.5

6.5.4.1.2 Speed

Answer 19 · Mark scheme

June 2022 | 8464/P/2F | Original Q7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4	42 000 = v × 5600 $v = \frac{42\,000}{5600}$ v = 7.5 (m/s)		1 1 1	AO2 6.5.4.1.2

6.5.4.1.2 Speed

Answer 19 · Mark scheme

June 2022 | 8464/P/2F | Original Q7

Question	Answers	Mark	AO / Spec. Ref.
07.5	**Level 2:** Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account.	3–4	AO3 6.5.4.1.2
	Level 1: Relevant points (reasons/causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.	1–2	
	No relevant content	0	
	Indicative content the effect on speed must be consistent with the cause of the change • competitors accelerate at the start • so speed increases • the road is not flat • so speed increases going downhill and / or speed decreases going uphill • the competitor goes round a bend • so speed decreases • competitors may tire towards the end (so the force they exert decreases) • so they slow down • competitors may sprint during the race • causing speed to increase • may get a puncture • so speed would decrease or they would stop • resistive forces on competitors may increase/decrease • so speed would decrease/increase		

Total Question 7		**12**

6.5.4.1.2 Speed

Answer 20 · Mark scheme

June 2023 | 8464/P/1F | Original Q2

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	decreases		1	AO1 6.1.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	increases		1	AO 1.1 6.1.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	$E_p = 2.5 \times 9.8 \times 3.4$ $E_p = 83.3$ (J)	 allow 83 (J)	1 1	AO2 6.1.1.1 6.1.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	$E_k = 0.5 \times 2.5 \times 4.8^2$ $E_k = 28.8$ (J)	 allow 29 (J)	1 1	AO2 6.1.1.1 6.1.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	some energy is transferred to the surroundings		1	AO1 6.1.1.1 6.1.2.1

6.5.4.1.2 Speed

Answer 20 · Mark scheme

June 2023 | 8464/P/1F | Original Q2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	speed will increase (because work done against) friction decreases		1 1	AO1 6.1.2.1

Total Question 2	9

6.5.4.1.2 Speed

Answer 21 · Mark scheme

June 2023 | 8464/P/2F | Original Q2

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	the line is straight		1	AO2 6.5.4.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	64 **and** 84 read from graph braking distance = 20 (m)	 do not accept if readings from the graph are incorrect	1 1	AO3 6.5.4.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	$a = \frac{16}{2.5}$ a = 6.4 (m/s^2)	 ignore negative signs	1 1	AO2 6.5.4.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	the brakes on the car can overheat the driver may lose control of the car		1 1	AO1 6.5.4.3.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	the greater the speed the greater the braking distance		1	AO1 6.5.4.3.1

Total Question 2	8

6.5.4.1.2 Speed

Answer 22 · Mark scheme

June 2023 | 8464/P/2F | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	compression rarefaction	this order only	1 1	AO1 6.6.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	longitudinal waves transfer energy		1	AO1 6.6.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	amplitude		1	AO2 6.6.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	340 (m/s)	allow answers in the range 339 to 340 (m/s)	1	AO2 6.6.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	$s = 340 \times 0.20$ $s = 68$ m	 allow ecf from question **04.4**	1 1	AO2 6.6.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.6	the higher the temperature the greater the speed (so) time taken is less	do not accept the greater the speed the higher the temperature	1 1	AO3 6.6.1.2

Total Question 4	9

6.5.4.1.2 Speed

Answer 23 · Mark scheme

June 2023 | 8464/P/2F | Original Q6

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	**A** radio waves **B** microwaves **C** X-rays	allow **1** mark if 2 correct	2	AO1 6.6.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	**Similarity** any **one** from: • same speed (in a vacuum) • both transfer energy • both transverse **Difference** any **one** from: • gamma has a higher frequency • gamma has a shorter wavelength • gamma is more ionising • gamma is more penetrating	allow both can travel through a vacuum allow both are ionising allow both can harm living tissue allow both can be used for medical treatment / imaging allow gamma has more energy	1 1	AO1 6.6.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	refraction		1	AO1 6.6.2.2

6.5.4.1.2 Speed

Answer 23 · Mark scheme

June 2023 | 8464/P/2F | Original Q6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	wave speed = frequency × wavelength **or** $v = f\lambda$		1	AO1 6.6.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.5	$3.0 \times 10^{8} = f \times 5.0 \times 10^{-7}$ $f = \frac{3.0 \times 10^{8}}{5.0 \times 10^{-7}}$ $f = 6 \times 10^{14}$ (Hz)	 allow a correct rearrangement using incorrect powers of 10 allow a correct calculation of f using incorrect powers of 10 allow 6.0×10^{14} (Hz)	1 1 1	AO2 6.6.1.2

Total Question 6	9

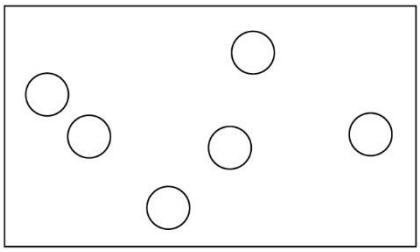
6.5.4.1.2 Speed

Answer 24 · Mark scheme

June 2024 | 8464/P/1F | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	metal has a high thermal conductivity		1	AO1 6.1.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	6 particles all spread apart irregularly within the box e.g. 		1	AO1 6.3.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	air particles collide with the walls of the container		1	AO1 6.3.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	decreases		1	AO1 6.3.3.1

6.5.4.1.2 Speed

Answer 24 · Mark scheme

June 2024 | 8464/P/1F | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	(the pressure) decreased as temperature decreased (the pressure) increased as temperature increased	 allow **2** marks for it decreased then increased	1 1	AO1 6.3.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.6	90 (m^3)		1	AO2 6.3.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.7	density = $\frac{\text{mass}}{\text{volume}}$ **or** $\rho = \frac{m}{V}$		1	AO1 6.3.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.8	$1100 = \frac{m}{90}$ mass = 90 × 1100 99 000 (kg)	allow ecf from question **05.6**	1 1 1	AO2 6.3.1.1

Total Question 5	**11**

6.5.4.1.2 Speed

Answer 25 · Mark scheme

June 2024 | 8464/P/1F | Original Q6

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	kinetic energy (of the beater / food) internal / thermal energy (of the surroundings / whisk / food)	ignore sound	1 1	AO1 6.2.4.2 6.1.2.1 6.1.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	power = $\frac{\text{work done}}{\text{time}}$ or $P = \frac{W}{t}$		1	AO1 6.1.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	$92 = \frac{23\,000}{\text{time}}$ $\text{time} = \frac{23\,000}{92}$ 250 (s)		1 1 1	AO2 6.1.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	$P = I^2 R$		1	AO1 6.2.4.1

6.5.4.1.2 Speed

Answer 25 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.5	I = 0.500 A		1	AO2 6.2.4.1
	$P = 0.500^2 \times 640$	allow a correct substitution of an incorrectly / not converted current	1	
	P = 160 (W)	allow a correct calculation using an incorrectly / not converted current	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.6	230 (V)		1	AO1 6.2.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.7	decreases		1	AO1 6.2.4.1

Total Question 6	12

6.5.4.1.2 Speed

Answer 26 · Mark scheme

June 2024 | 8464/P/2F | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	gravitational force		1	AO1 6.5.4.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	air resistance		1	AO1 6.5.4.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	450 (N)		1	AO2 6.5.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	0 N		1	AO1 6.5.4.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	terminal velocity		1	AO1 6.5.4.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.6	20 (s)	allow an answer in the range 18 to 21 (s)	1	AO2 6.5.4.1.5

6.5.4.1.2 Speed

Answer 26 · Mark scheme

June 2024 | 8464/P/2F | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.7	46 (m/s)		1	AO2 6.5.4.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.8	$s = 3.6 \times 25$ 90 (m)		1 1	AO2 6.5.4.1.2

Total Question 1	**9**

6.5.4.1.2 Speed

Answer 27 · Mark scheme

June 2024 | 8464/P/2F | Original Q3

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	energy		1	AO1 6.6.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	330 m/s		1	AO1 6.5.4.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	frequency amplitude		1 1	AO1 6.6.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	4000 Hz		1	AO1 6.6.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	$T = \frac{1}{4000}$ 0.00025 (s)	allow ecf from question **03.4**	1 1	AO1 6.6.1.2

6.5.4.1.2 Speed

Answer 27 · Mark scheme

June 2024 | 8464/P/2F | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.6	compression rarefaction	either order	1 1	AO1 6.6.1.1

Total Question 3	9

6.5.4.1.2 Speed

Answer 28 · Mark scheme

June 2024 | 8464/P/2F | Original Q6

Question 6

Question	Answers	Mark	AO / Spec. Ref.
06.1	**Level 2:** The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.	3–4	AO1 6.6.1.2 RPA20
	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 • use the signal generator to adjust the frequency • keep the number of masses the same • move the wooden bridge • observe a steady / stationary wave pattern • use the metre rule to measure the wavelength • repeat using different values of frequency • repeat for different stationary wave patterns		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	$v = f \times \lambda$		1	AO1 6.6.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	$35.1 = 45.0 \times \lambda$		1	AO2 6.6.1.2
	$\lambda = \frac{35.1}{45.0}$		1	
	$\lambda = 0.78$	allow 0.780	1	

Total Question 6	8

6.5.4.1.2 Speed

Answer 29 · Mark scheme

June 2025 | 8464/P/1F | Original Q3

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	**A**	must be in this order	1	AO2
	B		1	AO3 6.1.1.1 6.1.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	$E_k = 0.5 \times 60 \times 5.5^2$		1	AO2 6.1.1.2
	$E_k = 907.5$ (J)	allow 908 (J) or 910 (J)	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	$E_p = 60 \times 9.8 \times 1.5$		1	AO2 6.1.1.2
	$E_p = 882$ (J)	allow 880 (J)	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	gravitational potential energy (on the box) is greater		1	AO1 6.1.1.2
	so the kinetic energy (leaving the ground) is greater		1	
	(so must leave the ground at a) greater speed		1	

6.5.4.1.2 Speed

Answer 29 · Mark scheme

June 2025 | 8464/P/1F | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	greater velocity / speed (when hitting the ground) **or** greater force (exerted by the ground)		1	AO3 6.1.1.2

Total Question 3	10

6.5.4.1.2 Speed

Answer 30 · Mark scheme

June 2025 | 8464/P/2F | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	1.3 s		1	AO3 6.5.4.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	A		1	AO2 6.5.4.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	friction		1	AO1 6.5.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	(air resistance) increased		1	AO1 6.5.1.2 6.5.4.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	$\Delta v = 60 \times 0.35$ $\Delta v = 21$ (m/s)	 allow − 21 (m/s)	1 1	AO2 6.5.4.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.6	$F = 75 \times 60$ $F = 4500$ (N)	 allow − 4500 (N)	1 1	AO2 6.5.4.2.2

Total Question 1	**8**

6.5.4.1.2 Speed

Answer 31 · Mark scheme

June 2025 | 8464/P/2F | Original Q3

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	distance travelled = 3.0 × 20	both marks may be awarded if a length in the range 2.9 to 3.1 cm is used	1	AO3 6.5.4.1.1
	distance travelled = 60 (m)		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	weight = 15 × 9.8		1	AO2 6.5.1.3
	weight = 147 (N)	allow weight = 150 (N)	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	the line has a constant gradient	allow the line is straight do **not** accept directly proportional	1	AO2 6.5.4.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	distance travelled = $\frac{4500}{250}$		1	AO2 6.5.2
	distance travelled = 18 (m)		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	total distance travelled is greater than the displacement		1	AO1 6.5.4.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.6	distance has magnitude only		1	AO1 6.5.1.1 6.5.4.1.1

6.5.4.1.2 Speed

Answer 31 · Mark scheme

June 2025 | 8464/P/2F | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.7	total distance = 158 (km)	allow **1** mark for 56, 40 and 62 read from graph allow **1** mark for a total distance calculated using two correct values and one incorrect value from the bar chart	2	AO3 6.5.4.1.4

Total Question 3	**11**

6.5.4.1.2 Speed

Answer 32 · Mark scheme

June 2025 | 8464/P/2F | Original Q6

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	distance travelled = speed × time		1	AO1 6.5.4.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	1 500 000 = v × 670 000 $v = \frac{1\ 500\ 000}{670\ 000}$ V = 2.2… (m/s)		1 1 1	AO2 6.5.4.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	F = (6 × 370) - 520 F = 1700 (N)	if no other mark awarded allow **1** mark for 370 - 520 = (-)150 (N)	1 1	AO2 6.5.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	speed	allow velocity	1	AO1 6.5.4.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.5	friction + air resistance = pull of the rope on the sled		1	AO1 6.5.1.4 6.5.4.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.6	the force of the sled on the rope		1	AO1 6.5.4.2.3

Total Question 6	9

6.5.4.1.2 Speed

Answer 33 · Mark scheme

June 2025 | 8464/P/2F | Original Q7

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	$(0^2 -)\ 18^2 = 2 \times a \times 24$	allow $18^2 = 2 \times a \times 24$	1	AO2 6.5.4.1.5
	$a = \frac{(-)18^2}{2 \times 24}$		1	
	$a = (-)\ 6.75\ (m/s^2)$	allow $(-)\ 6.8\ (m/s^2)$	1	

6.5.4.1.2 Speed

Answer 33 · Mark scheme

Question	Answers	Mark	AO / Spec. Ref.
07.2	**Level 3:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	5–6	AO2
	Level 2: Relevant points (reasons / causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.	3–4	AO1
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	AO1
	No relevant content	0	6.5.4.2.2 6.5.4.3.1 6.5.4.3.3 6.5.4.3.4
	Indicative Content **Thinking distance** • condition of brakes and tyres does not affect thinking distance • speed does not affect reaction time • decreased speed decreases thinking distance **Braking distance** • condition of tyres affects friction between tyres and road • poor condition of tyres and brakes increases braking distance • decreased speed decreases braking distance **Safety** • stopping distance = thinking distance + braking distance • poor condition of brakes and tyres increases stopping distance • decreased speed decreases stopping distance • decreased speed decreases the chance of the driver losing control of the vehicle • decreased speed decreases the chance of a collision • decreased speed decreases the risk of injury during a collision for **Level 3,** answers must include references to brakes / tyres, speed, thinking distance, braking distance, and safety.		

6.5.4.1.2 Speed

Answer 33 · Mark scheme

June 2025 | 8464/P/2F | Original Q7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.3	frictional / braking force is greater (for the faster car) **or** the faster car has more kinetic energy		1	AO1
	(so) more work done (by the brakes to stop the faster car)	allow so more energy is transferred (by the brakes to stop the faster car) ignore more heating	1	AO3
	(so) the risk of the brakes overheating is greater (for the fast car)	allow (at greater speed) there is a risk of overheating MP3 dependent on MP1 or MP2	1	AO3 6.5.4.3.4

Total Question 7	**12**

6.5.4.1.2 Speed

Answer 05 · Examiner comments — June 2019 | 8464/P/1F | Original Q5

Question 5

05.1 Just under half the students knew the function of the earth wire.

05.2 Nearly 80% of students gained at least one mark and around 37% gained all three marks for knowing the colours of the wires in a plug.

05.3 Over 90% of students gained at least 1 mark and the vast majority of these gained 2 marks for a calculation using a given formula. A few students incorrectly converted the time in seconds into minutes.

05.4 More than half of the students gained both marks for correctly identifying both energy stores from the given list. Around a quarter of the students made one correct choice. Often, the correct energies were chosen but placed in the wrong order.

05.5 About 30% of students could write an equation linking gravitational field strength, gravitational potential energy, height and mass. Some kept the order in which quantities were written the same and inserted incorrect mathematical operators into the given

Answer 05 · Examiner comments — June 2019 | 8464/P/1F | Original Q5

sequence (GFS = GPE × h × g was a very common incorrect answer, as was GFS = GPE ÷ h × g without brackets around h × g). 15% of students did not attempt the question. For this examination, the abbreviations GFS and GPE were acceptable, as were upper and lower case letters E for energy, h for height and m for mass. A capital G was not acceptable for g, as G is the universal gravitational constant which has a different meaning to g, the gravitational field strength.

05.6 Students found rearrangement of $E_p = mgh$ difficult, even if they had written the correct equation in the previous question. About 15% of students scored marks on this question and about 10% did not attempt it. Many students just multiplied all of the numbers in the question together. Some students produced answers that could not be reasonable for the change in height of the toast – such as 1mm or less, and 1 000m.

6.5.4.1.2 Speed

Answer 12 · Examiner comments November 2021 | 8464/P/1F | Original Q2

Question 2 (Low demand)

02.1 Almost a quarter of students gained both marks, with about 45% giving one correct answer only.

02.2 Just over half of all students answered correctly. Almost a quarter of students stated that the gravitational potential energy of the athlete would decrease.

02.3 Nearly 90% calculated this correctly. A small minority tried to convert 50kg to g before calculating their answer, allowing them to gain a maximum of 1 mark.

02.4 Many students were unable to correctly recall the unit for speed. Many students made no attempt to use the square root sign when substituting values into the equation. Those who did use the sign often did not take the square root of the denominator, and some students merely took the square root of 2 before multiplying by kinetic energy and dividing by mass. The question differentiated well, with just over a quarter gaining full marks, about 20% gaining 2 marks, and roughly 25% gaining 1 mark.

02.5 More than three quarters of students gave the correct answer to this question.

02.6 Less than a quarter of all students gave the correct answer, with nearly half of the students thinking that power is the same as total energy transfer.

02.7 Around a quarter of the students gained both marks, with about 40% of students gaining one mark.

Answer 13 · Examiner comments November 2021 | 8464/P/2F | Original Q3

Question 3 (Low demand)

03.1 This question was very well answered. Over 90% of students were able to identify one factor that affected the reaction time of the driver. Over 75% of students were able to identify both factors.

03.2 This question was also well answered. 80% of students were able to correctly read the age of 24 from the graph.

03.3 This question was not as well answered as the previous part. 50% of students were able to read the value of 0.55 for the lowest mean reaction time from the graph.

03.4 The vast majority of students scored at least 1 mark on this question. 90% were able to score 1 mark, and over 50% scored 2 marks. Of those that scored one mark, there was a mix of correct answers.

03.5 Over 40% of students scored full marks on this question - 2 marks for the calculation and 1 for the unit.

Many students were able to correctly substitute the values into the equation, but could not correctly evaluate the answer. If they correctly selected the unit, they were awarded 2 of the

6.5.4.1.2 Speed

Answer 13 · Examiner comments

November 2021 | 8464/P/2F | Original Q3

3 marks. This is a good example of why students should be encouraged to show their working, even for low demand calculations.

03.6 Less than 15% of students answered this correctly. Moss incorrect answers merely stated that the reason was to prevent accidents, without giving the reason why it would prevent an accident.

Answer 14 · Examiner comments

November 2021 | 8464/P/2F | Original Q4

Question 4 (Low demand)

04.1 Very few students demonstrated a good understanding of this Required Practical Activity. 15% of students did not attempt the question, and over 60% of students' answers contained no relevant content. Approximately 15% of students were able to suggest an appropriate measurement using correct equipment, but did not give any description of what these measurements were for. Fewer students wrote level 2 answers that would produce a valid outcome. It is important that students know how to carry out the Required Practical Activities.

04.2 Nearly 70% of students were able to calculate the mean in this question part.

04.3 60% of students knew that taking repeat readings and calculating a mean reduced the effect of random errors.

04.4 This low demand calculation was very well answered, with the vast majority of students scoring 2 marks.

04.5 This low demand calculation was also very well answered, with very few students unable to score 2 marks.

6.5.4.1.2 Speed

Answer 15 · Examiner comments

November 2021 | 8464/P/2F | Original Q5

Question 5 (Low demand and standard demand)

05.1 Over 50% of students correctly stated that the air resistance would increase. Of those that didn't, many of them failed to answer the question, and wrote answers such as 'the acceleration will overcome the air resistance'.

05.2 Only 15% of students correctly identified that the lift force on the wings will be the same as the weight of the rocket aeroplane.

05.3 This low demand calculation was very well answered, with the vast majority of students scoring 2 marks.

05.4 Over 50% of students correctly recalled the equation.

05.5 This standard demand calculation was reasonably well answered. Nearly 75% were able to substitute into the correctly rearranged equation, and the vast majority of those went on to correctly evaluate the answer and score full marks.

05.6 This question was an extended response question that was marked with a level of response mark scheme. Over 10% of students did not attempt the question. Of those that did 35% did not write any relevant content. Nearly all these students failed to include any

Answer 15 · Examiner comments

November 2021 | 8464/P/2F | Original Q5

information from the question. Where students are given an additional instruction such as 'Use values from Table 2', they must do so. Of the 35% of students that did score mark the majority made simple statements that the radiation dose for the rocket aeroplane was greater. Very few appreciated that because the rocket aeroplane was much faster, it spent much less time in the air. Only a handful of students wrote level 2 answers.

6.5.4.1.2 Speed

Answer 16 · Examiner comments

June 2022 | 8464/P/1F | Original Q2

Question 02 (Low demand)

02.1 Approximately half of all students used the diagram to work out that the counterweight and the lift would move through the same distance.

02.2 Only about 40% of students realised that the gravitational potential energy of the counterweight would decrease as it moved down.

02.3 Just under 90% of students gained both marks in this calculation.

02.4 About half of all students gained at least 1 mark, with about 15% gaining both marks.

It was more common for students to identify that the kinetic energy of the lift would decrease, than to identify that the internal energy of the brakes would increase.

02.5 Nearly 90% gained at least 1 mark, with just under 40% ticking both of the correct boxes.

02.6 Just under 70% of students scored both marks.

The fact that extension should have been squared was missed or misunderstood by a fair proportion of students, who either calculated 0.5 × spring constant × extension, or calculated (0.5 × spring constant × extension)^2.

02.7 About half of all students gained this mark.

6.5.4.1.2 Speed

Answer 17 · Examiner comments June 2022 | 8464/P/2F | Original Q5

Question 5 (Low and standard demand)

05.1 65% of students scored 2 marks, and 85% scored at least 1 mark, for identifying the factors affecting thinking distance.

05.2 50% of students were able to correctly state that there would be an increased risk of a collision. Very few were able to explain why. Approximately 10% identified that the reaction time would increase, but very few explained that this would increase the thinking distance.

05.3 60% of students were able to read the correct value from the graph. Of those that did not, most read from the wrong axis.

05.4 A minority of students described the relationship as directly proportional. Fewer than half of students were able to state that as speed increases thinking distance increases.

05.5 Fewer than 10% of students scored any marks for drawing the line on the graph. 30% of students did not attempt to answer the question.

05.6 20% of students scored some marks. This was a standard demand question due to the initial velocity being zero. Most students appeared to be confused by $v^2 = 450$ and either squared 450, or wrote 450 as their final answer.

Answer 18 · Examiner comments June 2022 | 8464/P/2F | Original Q6

Question 6 (Standard demand)

06.1 Of the 60% of students that scored marks on this question the vast majority were able to identify the wavelength for 1 mark but were not able to identify the rarefaction.

06.2 60% of students scored 2 marks on this question. Only 5% of students performed the conversion from kHz to Hz. Very few students gave the correct unit.

06.3 Nearly 90% of students were able to select the correct equation.

06.4 The majority of students did not appear to understand what was required to answer this question. The vast majority of those that did understand what was required scored full marks, with 20% of students awarded four marks. Some students did read the correct value from the graph, but then wrote that as their final answer. Many students just multiplied 200 by 28.

6.5.4.1.2 Speed

Answer 19 · Examiner comments

June 2022 | 8464/P/2F | Original Q7

Question 7 (Standard demand)

07.1 Nearly 90% of students were able to write down the correct equation.

07.2 This was a relatively straightforward calculation. However, it was not attempted by nearly 20% of students, and only approximately 50% of students gained full marks.

07.3 Nearly 90% of students were able to select the correct equation.

07.4 This calculation was well answered with 75% of students gaining full marks.

07.5 This extended response question was well answered. 70% of students were able to write responses worth some credit, with most stating that the competitors may get tired. Of the students that did not get into level 2, most gave reasons why the speed may change, but did not link this to an increase or decrease in speed.

6.5.4.1.2 Speed

Answer 19 · 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.

6.5.4.1.2 Speed

Answer 20 · Examiner comments June 2023 | 8464/P/1F | Original Q2

Question 02 (Low demand)

02.1 Just below 50% of students knew that the gravitational potential energy decreases.

02.2 **About 70% of students** knew that the kinetic energy decreases.

02.3 Nearly 90% of students answered this question correctly. The most common mistake was from students who calculated 2.5 × 9.8, but did not then multiply by the height of the block above the ground.

02.4 Just over four fifths of students gained both marks in this kinetic energy calculation. The most common error was to forget to square the value for speed.

02.5 Slightly less than half the students recognised that friction transfers energy to the surroundings.

02.6 Nearly 90% of students gained at least 1 mark for this explanation, most commonly for identifying that the speed would increase. Many students were not using physics terms to describe the effects of oiling the wheel, with many just saying it would be more slippery. This was insufficient to gain marking point 2. A fair proportion of students stated that the oil would make the wheel wet, or that it would prevent rust, neither of which gained credit.
It did not matter where students thought the friction was being reduced: some stated that friction between the wheel and the zip wire would be reduced, while others had the friction between the wheel and the axle. As long as they had the idea of reduced friction, they scored marking point 2.

Answer 21 · Examiner comments June 2023 | 8464/P/2F | Original Q2

Question 2 (Low demand)

02.1 Approximately 65% of students knew that the line being straight showed that the speed was constant.

02.2 Only 40% of students interpreted the question correctly. Nearly every student that correctly read the values from the graph gave the correct braking distance.

02.3 Nearly 90% of students correctly calculated the deceleration.

02.4 A little over 20% of students selected the two correct answers. 60% of students gained one mark for one correct answer. A significant number of students only ticked one box.

02.5 20% of students were able to describe the relationship. Most correct answers stated that increasing speed increases the braking distance. Many students wrote vague statements such as ‘it increases’ or ‘speed increases the braking distance’.

6.5.4.1.2 Speed

Answer 22 · Examiner comments June 2023 | 8464/P/2F | Original Q4

Question 4 (Low demand and standard demand)

04.1 Nearly 30% of students scored two marks on this question. Of the 50% that scored one mark, the majority correctly labelled the compression.

04.2 75% of students knew that longitudinal waves transfer energy.

04.3 Approximately 40% of students knew that the amplitude changes. The most popular incorrect response was wavelength.

04.4 90% of students read the correct speed off the graph. As the line does not cross at exactly 340, a tolerance was allowed and many students picked up the mark for an answer between 339 and 340.

04.5 Over 80% of students used their value from question 04.4 in the equation and scored two marks. A small number of students did not use their value from question 04.4 despite the instruction to do so.

04.6 Approximately 25% of students identified that when the temperature of the air increases, the speed increases. Of those that did, only a very small minority of students went on to state that therefore the time would decrease. Many students contradicted themselves by stating that the speed would increase with temperature, but then said that the time would increase.

Answer 23 · Examiner comments June 2023 | 8464/P/2F | Original Q6

Question 6 (standard demand)

06.1 Fewer than 25% of students could identify all the missing parts of the spectrum. 70% of students either scored zero marks or did not attempt the question. A significant number of students wrote answers that were nothing to do with the electromagnetic spectrum.

06.2 Only 2% of students we able to give a similarity and a difference. The similarity was more accessible and was how the majority of the 15% that scored one mark got the mark. Many

6.5.4.1.2 Speed

Answer 23 · Examiner comments

June 2023 | 8464/P/2F | Original Q6

identified that they are both transverse. For the difference, most students did not refer to a property of electromagnetic waves. A little over 15% of students did not attempt the question.

06.3 Approximately 20% of students knew that the process is refraction. A little over 15% of students did not attempt the question.

06.4 This question was well answered with over 90% of students getting the mark. Students were given the equation sheet, which will have contributed to the overall performance on this question.

06.5 25% of students were able to substitute correctly and give the correct answer to the question to the correct order of magnitude. Approximately 20% of students correctly rearranged and substituted but did not use their calculator to evaluate the numbers in standard form, so scored 2 marks.

Answer 24 · Examiner comments

June 2024 | 8464/P/1F | Original Q5

Question 5 (low and standard demand)

05.1 Just under half of students correctly identified that metal has a high thermal conductivity.

05.2 The vast majority of students were able to draw a diagram to represent the arrangement of particles in a gas.

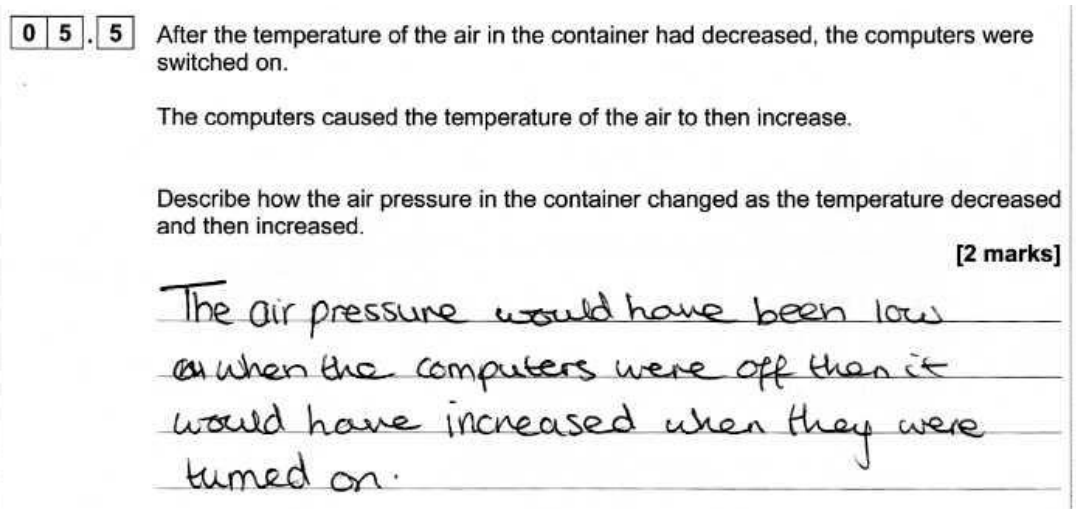
05.3 Just over 55% of students recalled that pressure on the walls of a container is caused by air particles colliding with the walls. Almost 30% of students showed the misconception that particles in a gas expand to fill the container, causing pressure on the walls.

05.4 Slightly less than two-thirds of students recalled that at lower temperatures the average speed of particles is less.

05.5 Roughly 20% of students gained both marks on this question, with about a third of students scoring one mark.

A sizeable proportion of students appeared not read the question correctly and, instead of describing how the pressure changed, gave explanations of why the pressure changed. In doing so, many of these responses did not include a description of how the pressure was affected and so scored no marks.

Misconceptions included the idea of air particles expanding as temperature increases, and the idea of pressure being caused by 'pressure particles'.



0 5 . 5 After the temperature of the air in the container had decreased, the computers were switched on.

The computers caused the temperature of the air to then increase.

Describe how the air pressure in the container changed as the temperature decreased and then increased.

[2 marks]

The air pressure would have been low as when the computers were off than it would have increased when they were turned on.

Although an ideal answer would have indicated that the pressure would initially decrease, for this question the idea that the pressure was initially low was sufficient to score the first marking point. This response scored both marks.

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6.5.4.1.2 Speed

Answer 24 · Examiner comments June 2024 | 8464/P/1F | Original Q5

0 5 . 5 After the temperature of the air in the container had decreased, the computers were switched on.

The computers caused the temperature of the air to then increase.

Describe how the air pressure in the container changed as the temperature decreased and then increased.

[2 marks]

When the tempreature decreased → less energy → less collitions.
When increased → more energy → more collitions.

This student appears to understand what is happening inside the container, but does not describe how this affects the pressure. The response scored no marks.

05.6 This question was generally well answered, with more than three-quarters of students calculating the correct volume.

For those who did not answer correctly, by far the most common error was to treat 7.5 m^2 as 7.5^2 m^2, which led to an incorrect answer of 675 m^3.

05.7 Given that students had an equation sheet, this question was well answered, with slightly less than 90% of students answering correctly.

Of those who answered incorrectly, the most common answer was caused by students who misread ρ as p, and misread V as v. This led them to the equation linking mass, momentum and velocity rather than the equation linking density, mass and volume.

05.8 The error carried forward from question 05.6 meant that even those who had incorrectly calculated the volume of the container could still score all 3 marks on this question. However, a small minority of students used the number 5.6 in their calculation instead of using their answer from question 05.6.

Rather than showing an initial substitution into the equation (eg $1100 = m \div 90$), the majority of students have a tendency to start questions such as this by writing down the calculation they intend to carry out (eg 90×1100). If they did this correctly, these students tended to score all 3 marks, but if they had rearranged incorrectly their responses tended to score 0. On this question about 50% earned 3 marks, while roughly 45% did not gain any marks. Students who substituted into the equation first, and then rearranged, were able to earn some credit even if they made a mistake somewhere along the way.

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Answer 25 · Examiner comments

Question 6 (standard demand)

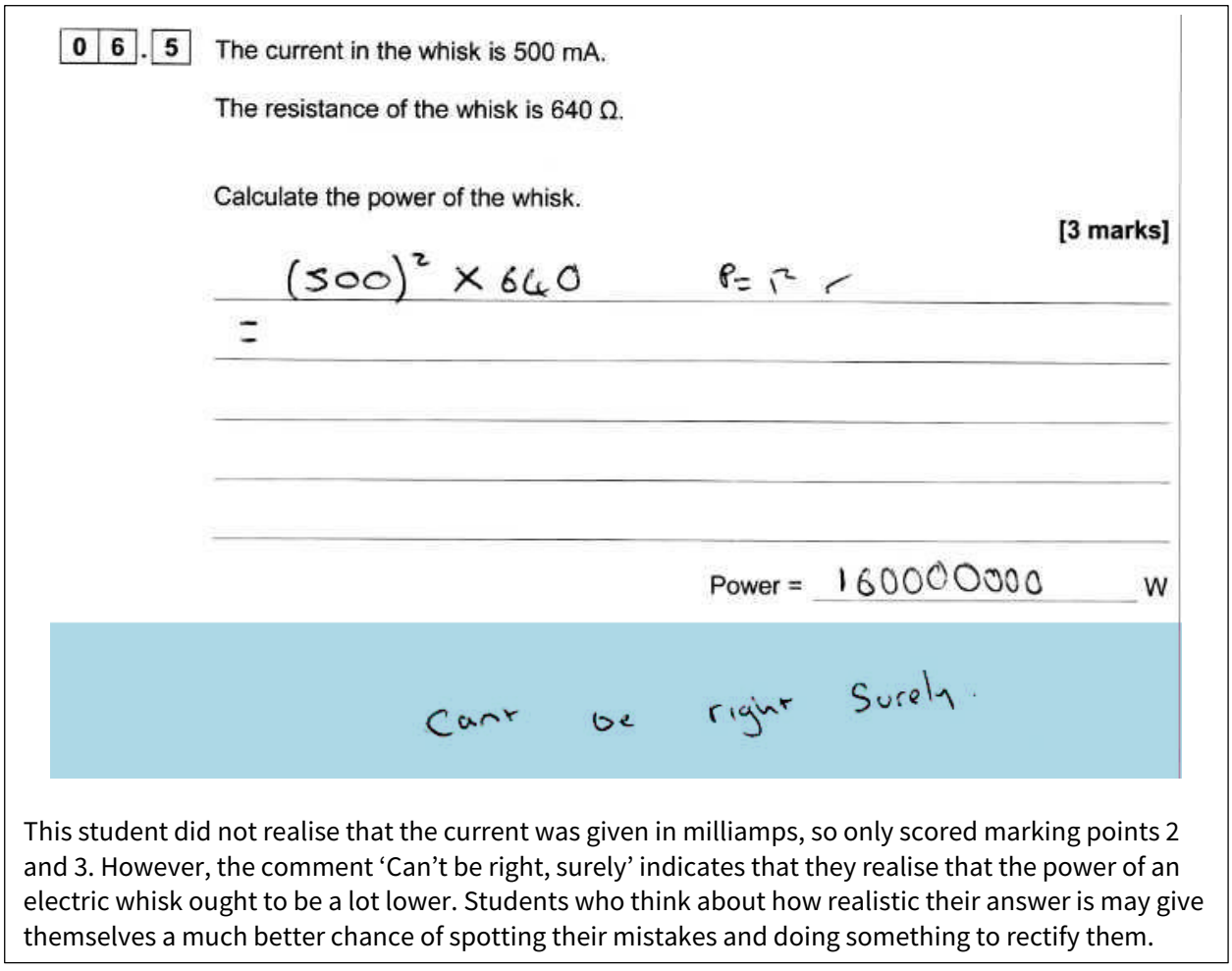
06.1 Roughly two-thirds of students gained at least 1 mark on this question, with about half of these gaining both marks. The most common incorrect answers were an increase in electrical energy and an increase in chemical energy.

06.2 Almost 90% of students wrote the correct equation.

06.3 Over half of all students arrived at the correct final answer, gaining 3 marks.

06.4 Just under 90% of students selected the correct equation.

06.5 For this calculation, very few students correctly converted the current from milliamps into amps. Some students forgot to show that the current should be squared in their substitution. Others showed a valid substitution but forgot to square the current when they entered it in their calculator. Less than 5% scored all 3 marks, but about 65% gained 2 marks on this question.



0 6 . 5 The current in the whisk is 500 mA.

The resistance of the whisk is 640 Ω.

Calculate the power of the whisk.

[3 marks]

$(500)^2 \times 640$ $P = I^2 R$

=

Power = 160000000 W

Can't be right Surely.

This student did not realise that the current was given in milliamps, so only scored marking points 2 and 3. However, the comment 'Can't be right, surely' indicates that they realise that the power of an electric whisk ought to be a lot lower. Students who think about how realistic their answer is may give themselves a much better chance of spotting their mistakes and doing something to rectify them.

06.6 The proportion of students who recalled the potential difference between the live and neutral wires was very low, with less than 15% of students answering correctly.

06.7 Slightly more than half of all students identified that an increase in current would be caused by a decrease in resistance.

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6.5.4.1.2 Speed

Answer 26 · Examiner comments

Question 1 (low demand)

01.1 This was a very accessible opening question with over 95% of students correctly selecting gravitational force as the force that causes the skydiver to accelerate.

01.2 This was more demanding but still nearly 90% of students correctly selected air resistance.

01.3 Half of students determined the resultant force acting on the skydiver correctly. The majority of students that do so just multiplied the two numbers together rather than subtracting them.

01.4 This question was not as well answered with approximately 40% of students knowing that the resultant force at constant velocity was zero. The most popular incorrect answer was 600 N.

01.5 Approximately 50% of students knew that the constant velocity reached by the skydiver is called terminal velocity. The most common incorrect answer was average velocity.

01.6 Students found reading the time off the graph quite challenging. Because it is difficult to judge when the line becomes horizontal, a wide range of values was allowed. This meant that even though most did not write 20 seconds, 40% of students did get the mark.

01.7 Approximately 40% of students correctly gave the constant velocity as 46 m/s. As there was no tolerance on this question, the common incorrect answer of 45 did not get the mark.

01.8 This simple calculation was very well answered. Over 90% of students correctly substituted into the equation and the vast majority went on to calculate the distance correctly. A small number of students did not get the second mark as they either did not have a calculator, or their calculator displayed the answer as a fraction.

6.5.4.1.2 Speed

Answer 27 · Examiner comments

June 2024 | 8464/P/2F | Original Q3

Question 3 (low demand)

03.1 Over 90% of students knew that waves transfer energy.

03.2 A little over 30% of students knew the speed of sound in air.

03.3 This question required students to compare two different waves. 80% of students gained at least 1 mark and 45% gained both marks. The majority of students that only gained 1 mark correctly stated that wave A had a greater frequency but did not identify that both waves had the same amplitude.

03.4 About three-quarters of students correctly selected 4000 Hz as the same as 4 kHz.

03.5 Just over half of students correctly calculated the period using the equation given. Students who correctly used their incorrect answer from question 03.4 were still able to gain full marks for this question.

03.6 About 80% of students scored at least 1 mark on this question, and 25% of students scored 2 marks. There was approximately an even number of 1-mark answers that selected either compression or rarefaction.

Answer 28 · Examiner comments

June 2024 | 8464/P/2F | Original Q6

Question 6 (standard demand)

06.1 Students found this question difficult, and fewer than 10% gained more than 1 mark. Although based on Required Practical Activity 20, for most students this appeared to be an unfamiliar experiment and they were unable to answer the question.

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6.5.4.1.2 Speed

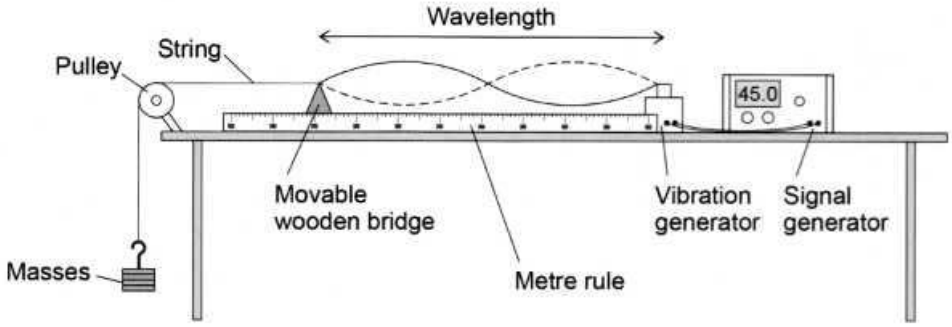
Answer 28 · Examiner comments June 2024 | 8464/P/2F | Original Q6

To access Level 2, the method needed to lead to a *valid* outcome: most students just described what was shown to them in Figure 11 and did not add anything of value. Most of the students that did score marks were able to describe changing the frequency with the signal generator or measuring the wavelength with a ruler.

0 1 A teacher demonstrated how the frequency of a wave on a string affects the wavelength of the wave.

Figure 1 shows the equipment used.

Figure 1



The frequency of the signal generator is adjusted so that the wave shown in **Figure 1** is seen.

At this frequency the string vibrates between the two positions shown in **Figure 1**.

0 1 . 1 Describe a method the teacher could use to investigate how the frequency of the wave affects the wavelength.

[4 marks]

you would first set up by putting ~~and~~ a metre ruler on the table place a signal generator and connect it to the vibration generator then connect a piece of string along the top of the vibration generator attaching it to the pulley adding masses to keep it ~~the~~ tensioned then move the movable wooden bridge to increase/decrease the string length and use the results on the signal generator to record the measurements.

In this response (from a Higher tier paper) the student has mostly written a description of the equipment set-up in the diagram. There is nothing of relevance to a method here, so no marks.

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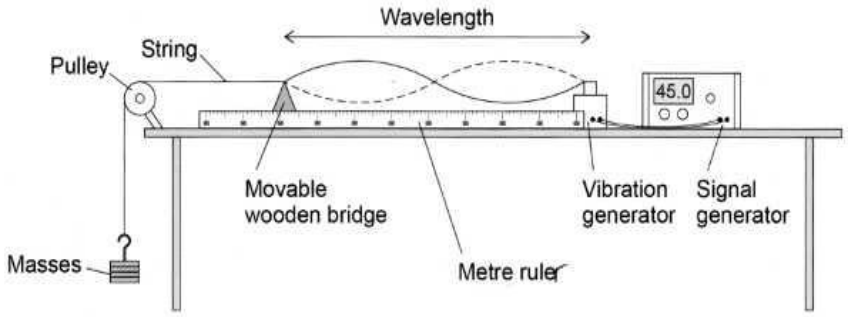
6.5.4.1.2 Speed

Answer 28 · Examiner comments June 2024 | 8464/P/2F | Original Q6

0 6 A teacher demonstrated how the frequency of a wave on a string affects the wavelength of the wave.

Figure 11 shows the equipment used.

Figure 11



The frequency of the signal generator is adjusted so that the wave shown in **Figure 11** is seen.

At this frequency the string vibrates between the two positions shown in **Figure 11**.

0 6 . 1 Describe a method the teacher could use to investigate how the frequency of the wave affects the wavelength.

[4 marks]

To investigate how the frequency of the wave-length affects the wave, the teacher could adjust the frequency of the signal generator and measure the wavelength of the string with the metre ruler, recording the results. Repeating this a few times; everytime adjusting the frequency of the signal generator, the teacher can then look at the results and see if there is any correlation between the two (the frequency of the wave and the wavelength.)

This student has described how to change the independent variable and then how to measure the dependent variable. This answer does not quite get into Level 2 as it is not clear that this is repeated at different frequencies and so would not lead to a valid outcome. However, 2 marks are awarded.

06.2 This question was well answered with the majority of students selecting the correct equation.

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6.5.4.1.2 Speed

Answer 28 · Examiner comments June 2024 | 8464/P/2F | Original Q6

06.3 This calculation proved more demanding than the ones earlier on in the paper. A little over half of students scored marks, most of whom scored all 3 marks for correctly rearranging the equation and calculating the wavelength. Of the students that did not score any marks, most just multiplied the two numbers together.

Answer 29 · Examiner comments

June 2025 | 8464/P/1F | Original Q3

Question 3 (Low demand)

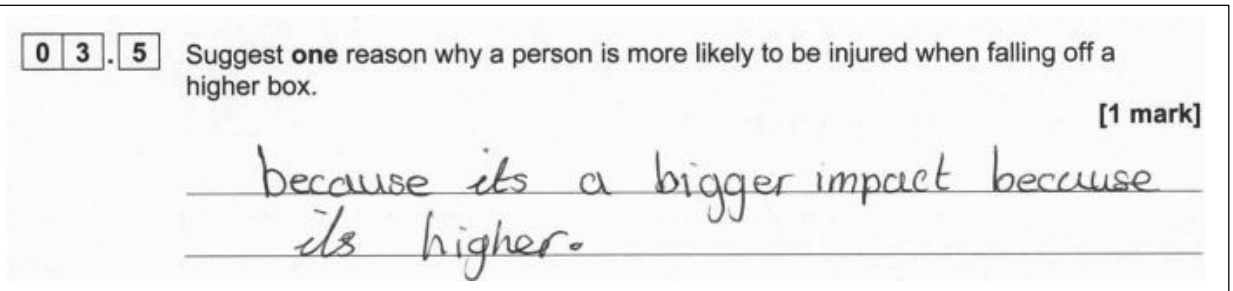
03.1 Only approximately 10% of students gained 2 marks on this question. 50% did get 1 mark for either identifying the stage with least gravitational potential energy, or the stage with the greatest kinetic energy.

03.2 This calculation was well answered. Nearly 85% of students gained both marks. The vast majority of students that correctly substituted into the equation evaluated it correctly.

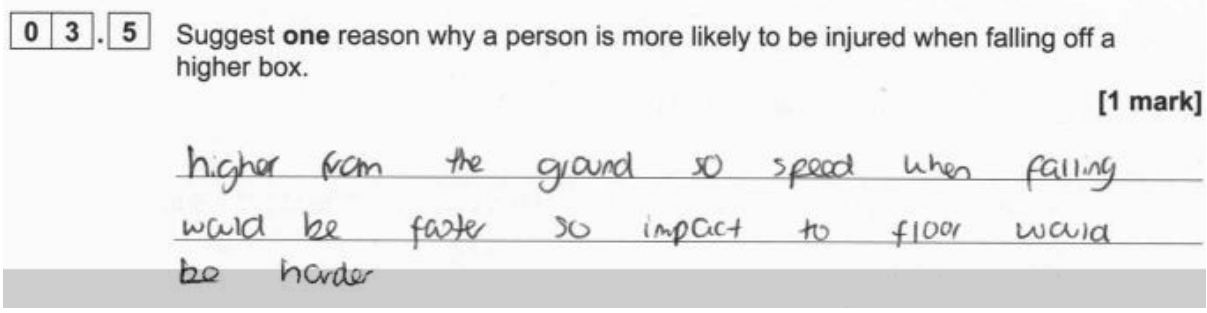
03.3 The calculation was slightly less demanding with a little over 90% of students gaining 2 marks.

03.4 Approximately half of students gained 2 marks for correctly explaining that both the gravitational potential energy and the kinetic energy increase. Only 15% also explained that this means that speed must be greater. 25% of students scored 1 mark for either the gravitational potential energy increasing or the kinetic energy increasing.

03.5 20% of students gained the mark for either greater velocity or speed or greater force. Most students did not use scientific terminology in their answer so were not able to be awarded the mark.



This is an example of a common incorrect response ‘bigger impact’ was seen numerous times and is not correct.



The word ‘impact’ is an example of a word that is ignored. This response is still awarded the mark as ‘faster’ is taken to mean the same as greater speed.

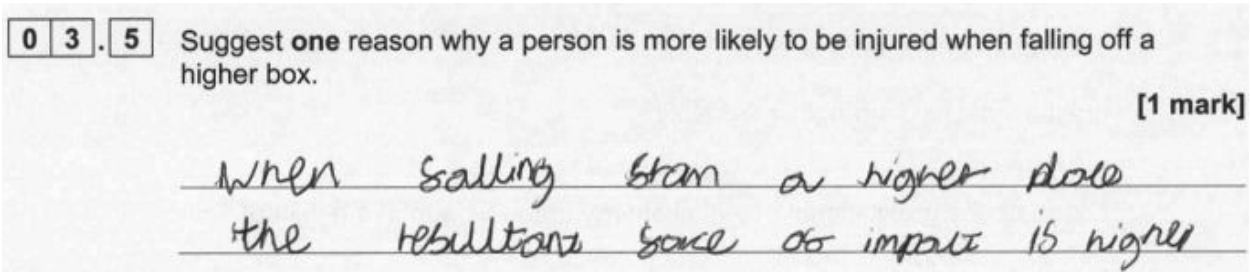
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6.5.4.1.2 Speed

Answer 29 · Examiner comments June 2025 | 8464/P/1F | Original Q3

0 3 . 5 Suggest **one** reason why a person is more likely to be injured when falling off a higher box.

[1 mark]



This is an example of a response that does gain the mark for the correct use of scientific terminology. Again, the word 'impact' is ignored.

6.5.4.1.2 Speed

Answer 30 · Examiner comments

June 2025 | 8464/P/2F | Original Q1

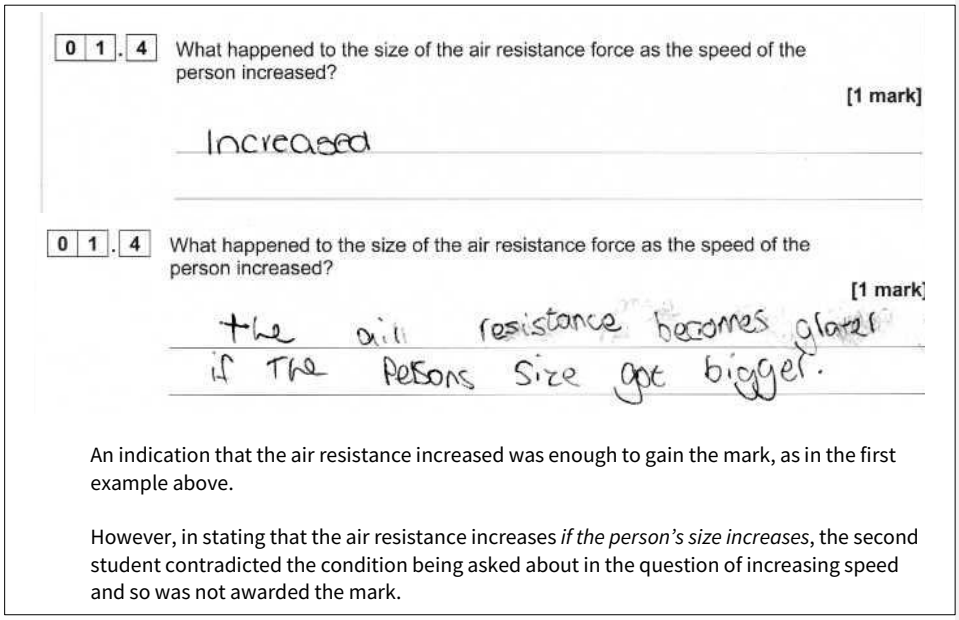
Question 1 (Low demand)

01.1 About four in five students were able to identify the anomalous result.

01.2 Slightly more than half of students identified that air resistance acts upwards on a body falling vertically downwards.

01.3 Nearly three quarters knew that friction is a contact force.

01.4 Just under two thirds of students correctly identified that air resistance increases with speed.



An indication that the air resistance increased was enough to gain the mark, as in the first example above.

However, in stating that the air resistance increases *if the person's size increases*, the second student contradicted the condition being asked about in the question of increasing speed and so was not awarded the mark.

01.5 This calculation was well answered, with nearly 90% of students gaining both marks.
For those who did not answer correctly, the unit for acceleration was often the cause of difficulty. When some of these students read '60 m/s²', they were clearly not sure what to do with the 'seconds squared', and decided to square the value of the acceleration, calculating $60^2 \times 0.35$ instead of 60×0.35

Some of these students did manage to gain the first mark for substituting into the equation and including the relevant units for all quantities, only making the error when they evaluated their calculation (i.e. '60 m/s² × 0.35 s = 12.6 m/s'). However, those who wrote '$60^2 \times 0.35 = 12.6$' did not gain any credit as their final answer did not match the calculation they had shown.

01.6 Another well answered calculation, with around 9 in 10 students gaining both marks. This question also caused issues for a minority of students who thought that 60 m/s² means that the acceleration value should be squared.

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6.5.4.1.2 Speed

Answer 31 · Examiner comments

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Question 3 (Low demand)

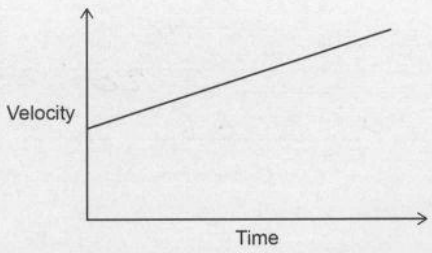
03.1 Almost two thirds of students were able to interpret the scale on the diagram and arrive at a correct answer.
Some students calculated the correct distance but then contradicted this by multiplying their answer by 20, which prevented them from scoring any marks.

03.2 The majority of students answered this calculation correctly. A small proportion of students decided that the unit for mass should be grams and ended up with an answer that was too large by a factor of a thousand, so were unable to gain one of the marks.

03.3 Only about 4 in 10 students were able to state that gradient was constant or that the line was straight, to gain the mark. Some students struggled to express the idea of a constant gradient, giving answers such as 'the line is straight and moves at a constant speed', or just giving a description of acceleration instead of referring to the graph.

0 3 . 3 **Figure 6** shows a velocity–time graph for a downhill part of the journey.

Figure 6



The gradient of the graph represents acceleration.

How does **Figure 6** show that the acceleration was constant?

[1 mark]

A straight line with a constant velocity

A proportion of incorrect answers were contradictory, by stating that the straight line had a constant velocity or a constant speed.

03.4 About 90% of students correctly calculated the distance travelled.

03.5 Nearly two thirds of students were able to identify how distance compared with displacement for the cyclist.

03.6 Only about a third of students selected the correct reason for distance being a scalar quantity.

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6.5.4.1.2 Speed

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3.7 About three quarters of students correctly determined the total distance travelled by the cyclist. Incorrect answers were often caused by misinterpreting the scale on the graph and reading, for example, 53 km instead of 56 km for the distance travelled on the Monday.

Answer 32 · Examiner comments June 2025 | 8464/P/2F | Original Q6

Question 6 (Standard demand)

06.1 Approximately 90% of students were either able to recall the equation linking distance, speed and time, or used the Physics Equations Sheet to look it up.

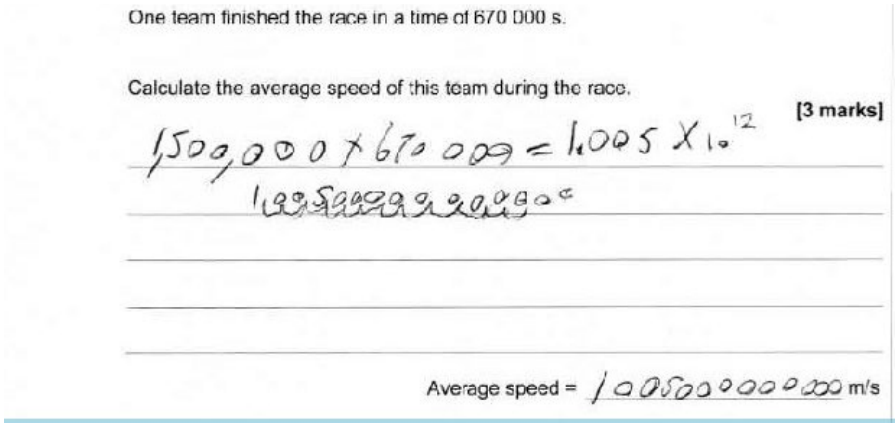
06.2 Nearly two thirds were able to correctly rearrange the equation selected and arrive at the correct answer. This was perhaps aided by some students recalling the equation as 'speed = distance / time' and arriving at the correct answer using this memorised form of the equation rather than by re-arranging the equation they selected in the previous question.

0 6 . 2 The longest dog-sled race in the world covers a distance of 1 500 000 m.

6.5.4.1.2 Speed

Answer 33 · Examiner comments

June 2025 | 8464/P/2F | Original Q7



One team finished the race in a time of 670 000 s.

Calculate the average speed of this team during the race. **[3 marks]**

1 500 000 × 670 000 = 1.005 × 10^12

Average speed = 1 005 000 000 000 m/s

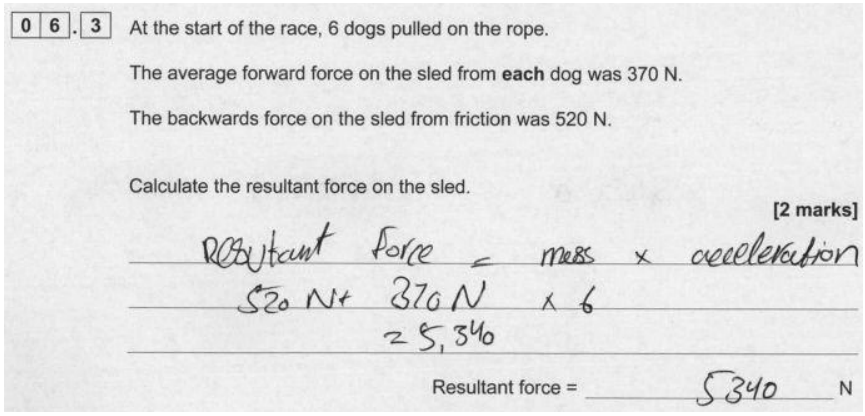
This student has arrived at a speed that should seem unlikely. In some calculations, students struggle to have an idea of what a reasonable answer should be. However, when calculating a speed, even of a relatively unfamiliar object such as a team of husky dogs, most students would probably have an idea that to move this far in one second would be faster than an animal can manage. Teaching students to consider whether an answer seems reasonable could help them decide when it might be worth going back to check their calculations for errors.

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6.5.4.1.2 Speed

Answer 33 · Examiner comments June 2025 | 8464/P/2F | Original Q7

06.3 About a third of students scored at least one mark on this question. The instruction to calculate a resultant force had many of them using the equation sheet. However, this question required students to consider the difference between the total forward force from the dogs, and the backwards force caused by friction. Students who attempted this, but only included the force from one dog, could score a mark if they showed their working.



An example of a student reading 'calculate the resultant force' and using the equation sheet. This approach was seen in a large number of responses.

06.4 Only about 10% of students were able to recall that the gradient of a distance-time graph represents speed. Many responses gave descriptions of the distance increasing with time, or the steepness of the line. A description of the trend shown in the graph is not the same as what the gradient represents, so these answers did not gain any credit. Other common incorrect answers included suggestions that the gradient shows the average speed of the sled.

06.5 Just over half of students correctly identified that at a constant speed the resultant force would be zero, so the total forward force must equal the total backwards force on the sled.

06.6 About a quarter of students were able to correctly select the Newton's third law pair to the force of the rope on the sled.

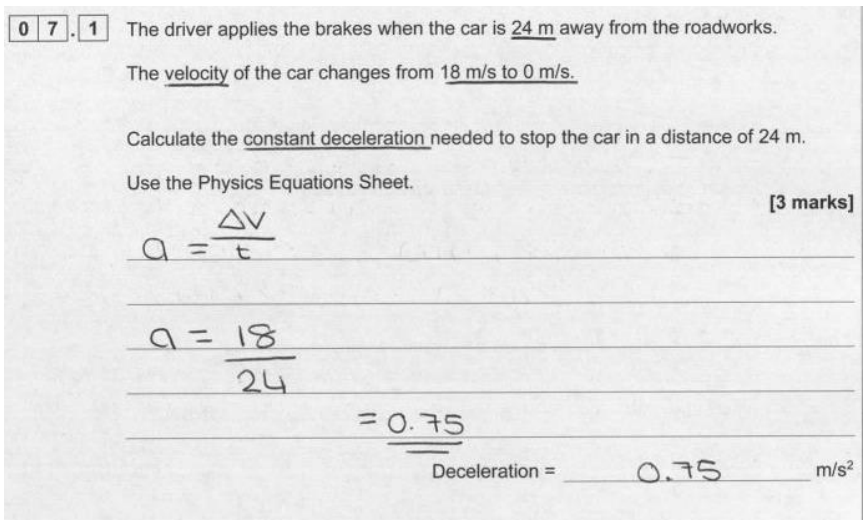
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6.5.4.1.2 Speed

Answer 33 · Examiner comments

Question 7 (Standard demand)

07.1 This calculation proved to be challenging for many students, with less than 10% gaining any credit. There may be some reasons for this. With the expanded equation sheet that has been used for the last few years, it is perhaps harder to find the correct equation, particularly when there is more than one equation dealing with acceleration. There also seemed to be a lack of understanding from some students that deceleration and acceleration are effectively referring to the same quantity. This led to many students not selecting the equation $v^2 - u^2 = 2as$ to calculate a deceleration but thinking that they needed to calculate an acceleration using $a = \frac{\Delta v}{t}$ before substituting into that equation.
For students who selected the correct equation, some forgot to square the value for the initial speed.



An example of a student selecting the wrong equation from the equation sheet and substituting incorrect values into it. Answers such as this were seen relatively often.

07.2 For these levels of response question, the majority of students were able to write a reasonable amount in their attempts to give an answer, but only about half managed to gain any credit, and few of these were able to give Level 2 responses.
Many students showed confusion with their language, often referring to braking time rather than braking distance, or giving statements which were contradictory such as 'slow down faster' or 'thinking distance affects braking distance' or 'quicker thinking distance'. Some students reverse-engineered their argument, giving answers such as if cars are slower, there will be more cars on the road so there will be more collisions.
Some students listed all the factors that can affect thinking distance or braking distance. This did not prevent them from gaining credit, but these students often did little more than this.

It was also common for answers to suggest that moving at a slower speed causes reaction time to increase, so thinking distance decreases. There was a relatively common misconception that the

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6.5.4.1.2 Speed

Answer 33 · Examiner comments June 2025 | 8464/P/2F | Original Q7

thinking distance is the maximum distance a vehicle has before the brakes must be applied in order to stop before a collision, rather than referring to the distance travelled as a driver reacts in an emergency.

0 7 . 2 As a safety measure, the speed limit on the road was reduced.

Explain how the safety of road users is affected by:

- the condition of the brakes and tyres
- reduced speed.

You should refer to thinking distance and braking distance.

[6 marks]

Firstly, the safety of road users is affected by the condition of the brakes and tyres. If they are in bad condition and do not work very well, braking distance increases. This means that vehicles may not be able to stop quickly enough to avoid accidents. This decreases the safety of road users. However, reduced speed on vehicles shortens the braking distance (as less force is needed to stop the vehicles) and so more accidents can be avoided. It also helps to reduce the effects of thinking distance, as this can make the driver stop the vehicle too late to avoid accidents. Therefore, reduced speed increases the safety of road users.

Extra space

This student referred to braking distance and refers to both the condition of the brakes and tyres, and the speed of the vehicle. It is a good attempt to answer the question and scored 4 marks.

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6.5.4.1.2 Speed

Answer 33 · Examiner comments

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0 7 . 2 As a safety measure, the speed limit on the road was reduced.

Explain how the safety of road users is affected by:

- the condition of the brakes and tyres
- reduced speed.

You should refer to thinking distance and braking distance.

[6 marks]

The conditions of the brakes and Tyres needs to be good, ~~to~~ because if your brakes don't work properly, it will take longer to stop the car. this could be affected by if the person driving is drunk. they aren't thinking properly and endanger other people. If the Tyres aren't fit. if they are driving on icy, wet conditions. will take longer for the car to stop. With the reduced speed. it means that cars aren't driving on the road as fast.

Extra space Which means it endangers less people. As a result. making it ~~safer~~ safe to drive on the road

This student did not refer to braking distance, instead referring to time with the phrase 'taking longer to stop the car'. The answer also demonstrates a relatively common approach to give factors (driving while drunk, in this case) that affect thinking distance but not answering the question. The response gained no credit.

07.3 About a third were able to score some credit on this question. Many had the idea of braking causing heating, but this was given in the question, so students needed to give more detail. The answer needed to be comparative, with a faster car having greater kinetic energy, or needing more friction. Only a small proportion referred to the increased risk at a greater speed, with students far more likely to just state that braking from a greater speed will cause the brakes to overheat, which was not enough to gain the third marking point.

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6.5.4.1.2 Speed

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Contact us

Our friendly team will be happy to support you between 8am and 5pm, Monday to Friday.

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