AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 6.5.1.3

Gravity

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**17**
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.

6.5.1.3 Gravity

Answer 01 · Mark scheme

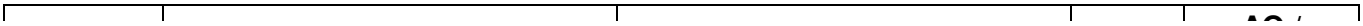
June 2018 | 8464/P/1F | Original Q3

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	

6.5.1.3 Gravity

Answer 01 · Mark scheme

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



6.5.1.3 Gravity

Answer 02 · Mark scheme

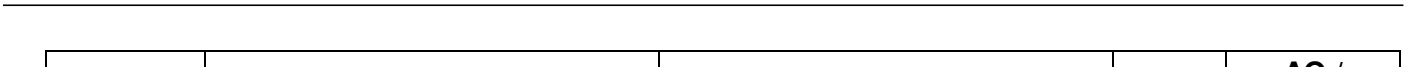
June 2018 | 8464/P/2F | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	equal to		1	AO1 6.5.4.2.3
03.2		an answer of 833 (N) **or** 830 (N) scores **2** marks		AO2 6.5.1.3
	weight = 85 × 9.8		1	
	weight = 833 (N)	allow weight = 830 (N)	1	
03.3		an answer that rounds to 525 (J) scores **2** marks		AO2 6.5.2
	work done = 833 × 0.63	allow their calculated value from question **03.2** × 0.63	1	
	work done = 525 (J)	allow an answer that is consistent with their calculated value from question **03.2**	1	
03.4	work done = 0 (J)		1	AO2 6.5.2
03.5		an answer of 682 (N) **or** 680 (N) scores **2** marks		AO2 6.5.4.2.2
	force = 62 × 11		1	
	force = 682 (N)	allow force = 680 (N)	1	
Total			**8**	

6.5.1.3 Gravity

Answer 02 · Mark scheme

June 2018 | 8464/P/2F | Original Q3



6.5.1.3 Gravity

Answer 03 · 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**		

6.5.1.3 Gravity

Answer 03 · Mark scheme

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

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

6.5.1.3 Gravity

Answer 04 · Mark scheme

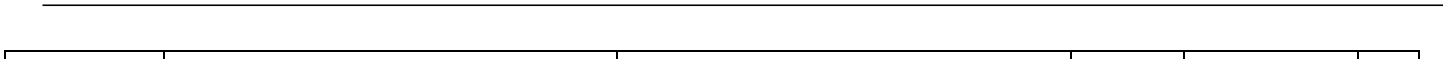
June 2019 | 8464/P/2F | Original Q2

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
02.1	it is the same size as the downward force		1	AO2 6.5.4.3.2	A
02.2	weight is a vector		1	AO1 6.5.1.1	A
02.3	centre of mass		1	AO2 6.5.1.3	A
02.4	W = 45 × 9.8 W = 441 (N)	an answer of 441 (N) scores **2** marks allow 440 (N)	1 1	AO2 6.5.1.3	E
02.5	**Level 2:** Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.		3–4	AO1 6.1.1.1	E
	Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.		1–2		
	No relevant content.		0		
	Indicative content • as height changes gravitational potential energy changes • gravitational potential energy decreases when moving to the lower bar • as speed changes kinetic energy changes • kinetic energy increases when moving to the lower bar • transfer from gravitational potential energy to kinetic energy as height decreases • the sum of the kinetic energy and gravitational potential energy is constant				
02.6	reduces the force exerted the risk of injury to gymnast is reduced	ignore impact allow so the gymnast does not get injured	1 1	AO3 6.5.4.2.2	E
Total			**11**		

6.5.1.3 Gravity

Answer 04 · Mark scheme

June 2019 | 8464/P/2F | Original Q2



6.5.1.3 Gravity

Answer 05 · Mark scheme

November 2020 | 8464/P/2F | Original Q6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	iron and steel will be attracted (to the magnet) aluminium, copper and tin will not be attracted (to the magnet)	 allow **1** mark is one metal is in the incorrect list, but all the other four are correct if no other mark awarded allow iron and steel are magnetic for **1** mark	1 1	AO1 6.7.1.1
06.2	the paperclip would still be attracted to the magnet because of induced magnetism	 allow the paper clip becomes an induced magnet allow because the paper clip is a temporary magnet allow there is a magnetic field at the south pole	1 1	AO1 6.7.1.1
06.3	weight = mass × gravitational field strength or W = mg	do not accept gravity for gravitational field strength	1	AO1 6.5.1.3
06.4	1.0 g = 0.0010 kg weight of 1 paperclip = 0.0010 × 9.8 Force = 0.0098 x 20 = 0.196 (N)	allow 0.001 (kg) allow 0.0098 (N) allow correct substitution using incorrectly/not converted value of mass of paperclip allow correct calculation using incorrectly/not converted value of mass of paperclip	1 1 1	AO2 6.5.1.3

6.5.1.3 Gravity

Answer 05 · Mark scheme

November 2020 | 8464/P/2F | Original Q6

Total			**8**	

6.5.1.3 Gravity

Answer 06 · 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

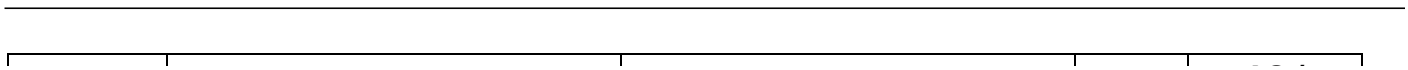
6.5.1.3 Gravity

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

6.5.1.3 Gravity

Answer 06 · Mark scheme

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



6.5.1.3 Gravity

Answer 07 · Mark scheme

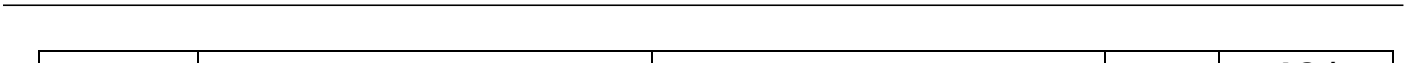
November 2021 | 8464/P/2F | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	electrostatic force		1	AO1 6.5.1.2
01.2	the downward force is the same size as the upward force		1	AO2 6.5.1.2
01.3	normal contact force		1	AO1 6.5.1.2
01.4	W = 55 × 9.8 539 (N)	 allow 540 (N)	1 1	AO2 6.5.1.3
01.5	the weight decreased		1	AO3 6.5.1.3
01.6	centre of mass		1	AO3 6.5.1.3
01.7	300 (N)		1	AO2 6.5.1.4
Total			**8**	

6.5.1.3 Gravity

Answer 07 · Mark scheme

November 2021 | 8464/P/2F | Original Q1



6.5.1.3 Gravity

Answer 08 · Mark scheme

November 2021 | 8464/P/2F | Original Q7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	a quantity with both magnitude and direction		1	AO1 6.5.1.1
07.2	displacement		1	AO1 6.5.4.1.1
07.3	gradient = $\frac{(4-0)}{(1.6-0)}$ acceleration = 2.5 m/s^2	 allow use of a = Δv / t	1 1	AO2 6.5.4.1.5
07.4	constant deceleration	allow large deceleration allow decelerates to a stop	1	AO2 6.5.4.1.5
07.5	resultant force = mass × acceleration **or** F = ma	allow force = mass × acceleration	1	AO1 6.5.4.2.2
07.6	1800 = m × 25 m = $\frac{1800}{25}$ m = 72 (kg)		1 1 1	AO2 6.5.4.2.2
07.7	performance can be monitored during the game	allow do not have to wait until the end of the game to download data	1	AO3 6.6.2.4
Total			**10**	

6.5.1.3 Gravity

Answer 09 · 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

6.5.1.3 Gravity

Answer 09 · Mark scheme

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

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

6.5.1.3 Gravity

Answer 10 · Mark scheme

June 2022 | 8464/P/2F | Original Q3

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	vertical arrow from **X** pointing downwards	ignore any labels	1	AO2 6.5.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	$W = 0.150 \times 9.8$ $W = 1.47$ (N)	 allow 1.5 (N)	1 1	AO2 6.5.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	the resultant force on the apple is zero		1	AO1 6.5.4.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	the resultant force on the apple is downwards		1	AO1 6.5.4.2.2

6.5.1.3 Gravity

Answer 10 · Mark scheme

June 2022 | 8464/P/2F | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	$t = \frac{4.9}{9.8}$ t = 0.5 (s)	 allow 0.50 (s)	1 1	AO2 6.5.4.1.2

Total Question 3		7

Answer 11 · 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

6.5.1.3 Gravity

Answer 11 · 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

6.5.1.3 Gravity

Answer 12 · Mark scheme

June 2023 | 8464/P/2F | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	weight acts downwards		1	AO2 6.5.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	a gravitational		1	AO1 6.5.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	$W = 12\,000 \times 0.070$ $W = 840$ (N)		1 1	AO2 6.5.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	$E_e = 0.5 \times 12\,000 \times (0.070)^2$ $E_e = 29.4$ (J)	 allow 29 (J)	1 1	AO2 6.5.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	the spring will not go back to its original length when the force is removed		1	AO1 6.5.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.6	B		1	AO3 6.5.3 RPA18

6.5.1.3 Gravity

Answer 12 · Mark scheme

June 2023 | 8464/P/2F | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.7	B		1	AO1 6.5.3 RPA18

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.8	any **two** from: • use a greater range of forces • use forces that are similar to the weight of a person • test more (identical) springs • find the limit of proportionality • repeat (discard anomalous results) and calculate a mean	allow test more forces allow elastic limit	2	AO3 6.5.3 RPA18

Total Question 1	11

6.5.1.3 Gravity

Answer 13 · Mark scheme

June 2023 | 8464/P/2F | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	0.30 (m)		1	AO2 6.5.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	$W = 710 \times 0.30$ $W = 213$ Nm	 allow ecf from question **05.1**	1 1	AO2 6.5.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	force / weight is greater		1	AO3 6.5.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	gravitational potential thermal		1 1	AO2 6.5.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	weight = mass × gravitational field strength **or** $W = mg$		1	AO1 6.5.1.3

6.5.1.3 Gravity

Answer 13 · Mark scheme

June 2023 | 8464/P/2F | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.6	710 = m × 9.8		1	AO2 6.5.1.3
	$m = \frac{710}{9.8}$		1	
	m = 72.4…		1	
	m = 72 (kg)	this mark can only be awarded if the correct equation is used and a value of m is calculated	1	

Total Question 5	**11**

6.5.1.3 Gravity

Answer 14 · Mark scheme

June 2024 | 8464/P/1F | Original Q2

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	a renewable energy resource that uses hot rocks underground		1	AO1 6.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	$\Delta E = 15 \times 3800 \times 9.0$ 513 000 (J)		1 1	AO2 6.3.2.2 6.1.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	9600 (J)		1	AO2 6.1.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	1 W		1	AO1 6.1.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	height = $\frac{196}{5.0 \times 9.8}$ 4 (m)	 allow 4.0 (m)	1 1	AO2 6.1.1.2

6.5.1.3 Gravity

Answer 14 · Mark scheme

June 2024 | 8464/P/1F | Original Q2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	ignore references to pollution **EITHER** releases carbon dioxide		1	AO1 6.1.3
	which contributes to global warming	allow climate change for global warming allow which is a greenhouse gas allow which contributes to the greenhouse effect	1	
	OR releases sulfur / nitrogen dioxide (1)	allow other oxides of nitrogen		
	which causes acid rain (1)			
	OR releases soot (1)	allow carbon for soot allow particulates		
	which can cause global dimming (1)	allow reduces air quality allow causes smog		

Total Question 2	9

Answer 15 · Mark scheme

June 2024 | 8464/P/2F | Original Q2

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	the forces are the same size		1	AO1 6.5.4.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	they act in opposite directions		1	AO1 6.5.4.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	196 (N)		1	AO2 6.5.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	$m = \frac{196}{9.8}$ 20 (kg)	allow ecf from question **02.3**	1 1	AO2 6.5.1.3

6.5.1.3 Gravity

Answer 15 · Mark scheme

June 2024 | 8464/P/2F | Original Q2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	the weight will decrease (as the gravitational field strength decreases)		1	AO3 6.5.1.3
	the weight will then become constant		1	
	at 15 mins	dependent on MP1 or MP2 allow a value in the range 14 to 16 mins allow for the last 10 minutes allow at the maximum height	1	

Total Question 2	**8**

6.5.1.3 Gravity

Answer 16 · 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	

6.5.1.3 Gravity

Answer 16 · 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

6.5.1.3 Gravity

Answer 17 · 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

6.5.1.3 Gravity

Answer 17 · Mark scheme

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**

6.5.1.3 Gravity

Answer 03 · 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 03 · 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.

6.5.1.3 Gravity

Answer 06 · 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 07 · Examiner comments November 2021 | 8464/P/2F | Original Q1

Question 1 (Low demand)

01.1 Approximately 60 % of students correctly identified that friction is a non-contact force.

01.2 Approximately one third of students knew that the two forces were the same size. Of those that did not, the majority though that the downwards force was greater.

01.3 Approximately one third of students knew that the force acting upwards on the person was a normal contact force.

01.4 This calculation was very well answered. Over 90% of students scored 2 marks, and a few students scored 1 mark for correctly substituting, but then not correctly evaluating the final answer.

01.5 Just over 50% of students got this question correct by selecting ‘The weight decreased’.

01.6 50% of students knew that the point ‘X’ represented the centre of mass.

01.7 Again, 50% of students were able to determine the resultant force. From those that could not, there was a mix of answers. Some students wrote one of the forces down, and some added the forces together.

6.5.1.3 Gravity

Answer 08 · Examiner comments

November 2021 | 8464/P/2F | Original Q7

Question 7 (standard demand)

07.1 75% of students knew that a vector was a quantity with both magnitude and direction.

07.2 30% of students knew that displacement was the vector.

07.3 Approximately 10% of students were able to determine the acceleration from the graph.

07.4 Nearly 20% of students were able to describe the motion of the player. Of those that were unable to and scored no marks, most gave answers such as ‘the motion decreased’.

07.5 Just under 50% of students correctly recalled the equation.

07.6 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.

07.7 Nearly 20% of students wrote a reasonable suggestion that the data could be analysed during the game. Many of the incorrect answers suggested that the data could be analysed after the game.

6.5.1.3 Gravity

Mark Ranges and Award of Grades

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

6.5.1.3 Gravity

Answer 09 · 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.

6.5.1.3 Gravity

Answer 10 · Examiner comments June 2022 | 8464/P/2F | Original Q3

Question 3 (Low demand)

03.1 The vast majority of students were unaware that the arrow should be drawn from the centre of mass. The majority of students just labelled the apple 'weight'.

03.2 90% of students were able to correctly calculate the weight.

03.3 60% of students knew that the resultant force on the stationary apple was zero.

03.4 80% of students knew that the resultant force on the accelerating apple was downwards.

03.5 A little over 75% of students calculated the time correctly. A significant number of students substituted the numbers incorrectly and arrived at an answer of 2.

Answer 11 · 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.

6.5.1.3 Gravity

Answer 12 · Examiner comments

June 2023 | 8464/P/2F | Original Q1

Question 1 (Low demand)

01.1 Over 95% of students knew that weight acts downwards.

01.2 Approximately 90% of students knew that weight is a gravitational force.

01.3 A little over 90% of students correctly calculated the weight. Nearly all students that substituted correctly also gave the correct final answer.

01.4 Over 80% of students scored 2 marks for this calculation. Again, nearly all students that substituted correctly also gave the correct final answer.

01.5 Approximately 85% of student knew that inelastically deformed meant that the spring will not go back to its original length when the force is removed.

01.6 This question was not as well answered, but over 60% of students were able to identify which length was the extension.

01.7 Nearly 80% of students were able identify which graph shows that the extension of the spring is directly proportional to the force applied to the spring.

01.8 Only 5% of students were able to suggest two improvements to the investigation. Most of the 45% of students that gained one mark suggested using a greater number of forces, or a bigger force. There were lots of vague responses that suggested repeating but not taking a mean.

6.5.1.3 Gravity

Answer 13 · Examiner comments

June 2023 | 8464/P/2F | Original Q5

Question 5 (Low demand and standard demand)

05.1 A little over 70% of students were able to convert cm to m.

05.2 80% of students were able to use their value from question 05.1 correctly and calculate the work done. Very few students correctly substituted in the equation and did not calculate the correct value. Of those that did, it was clear that they did not have a calculator.

05.3 Nearly 70% of students correctly stated that the force / weight would increase.

05.4 Approximately 10% of students scored two marks on this question. Despite the question stating that the engineer was stationary, many incorrectly selected kinetic energy.

05.5 This question was well answered with the vast majority of students getting the mark. Students were given the equation sheet, which will have contributed to the overall performance on this question.

05.6 Nearly 75% of students calculated the correct value, and 35% of students were able to correctly give the answer to 2 significant figures.

Answer 14 · Examiner comments

June 2024 | 8464/P/1F | Original Q2

Question 2 (low demand)

02.1 Just under two-thirds of students correctly identified geothermal energy as a renewable energy resource that uses hot rocks underground.

02.2 This calculation question was answered well, with almost 90% of students gaining both marks. A small minority of students incorrectly converted the mass from kilograms to grams as part of their calculation.

02.3 Some students were confused by the unit of m^2 and decided that the 120 should also be squared. The correct value of energy was given by approximately 65% of students.

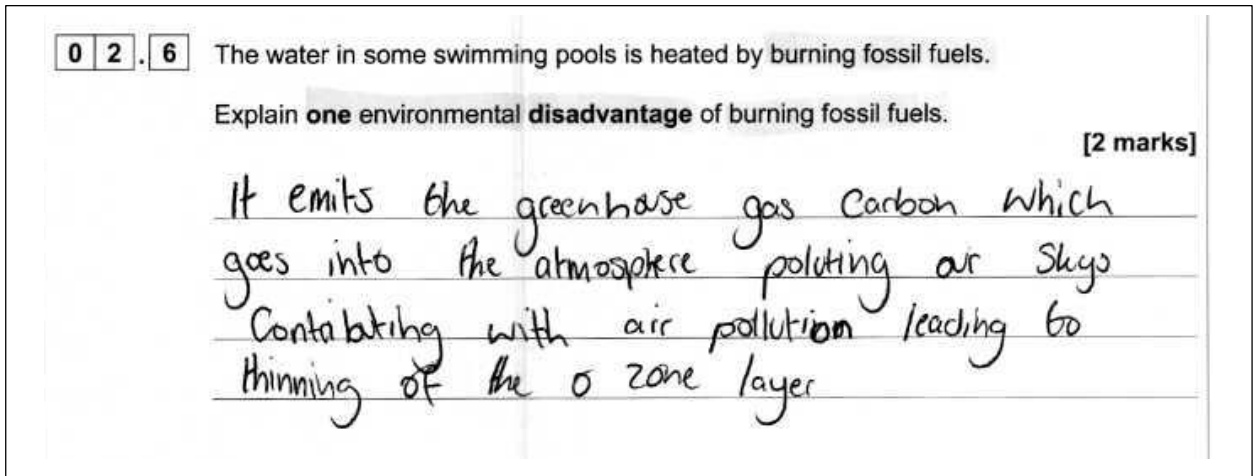
02.4 Around 55% of students correctly identified that 1 J/s is equivalent to 1 W.

02.5 Roughly 70% of students were able to answer this question correctly. Amongst students who did not calculate the correct height, it was relatively common to see substitutions made where brackets should have been used, but were not, eg height = 196 J ÷ 5.0 kg × 9.8 N/kg.

02.6 Almost two-thirds of students gained at least 1 mark on this question, with approximately a fifth of students gaining both marks. Of those who scored both marks, the most common answers referred to a release of carbon dioxide contributing to global warming.

Many students gave vague answers which were not creditworthy, often referring to pollution or toxic chemicals rather than named pollutants. It was also relatively common for students to refer to a 'carbon footprint', which did not prevent marks from being awarded but did not answer the question.

Some students stated that an environmental disadvantage of fossil fuels is that they are non-renewable, which did not score any credit.



0 2 . 6 The water in some swimming pools is heated by burning fossil fuels.

Explain **one** environmental **disadvantage** of burning fossil fuels.

[2 marks]

It emits the greenhouse gas carbon which goes into the atmosphere poluting our Skys Contributing with air pollution leading to thinning of the o zone layer

This student scored marking point 1 for identifying that carbon is released. This scored against the third alternative in the mark scheme, as carbon is equivalent to soot. However, marking point 2 was not awarded, as the environmental disadvantages associated with soot are global dimming, reduced air quality, or smog. There was a small, but noticeable, minority of students who incorrectly linked carbon dioxide with thinning of the ozone layer or holes in the ozone layer.

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6.5.1.3 Gravity

Answer 15 · Examiner comments

June 2024 | 8464/P/2F | Original Q2

Question 2 (low demand)

02.1 This question was assessing Newton's third law. 25% of students knew that the two forces were the same size, the majority selecting the incorrect option that the force on the suitcase was bigger.

02.2 About two-thirds of students correctly selected the answer that the forces act in opposite directions.

02.3 Two-thirds of students read the correct value of the scale on the newtonmeter. There was a range of incorrect answers, but 198 was the most common mistake.

02.4 The calculation of mass was reasonably well answered, with two-thirds of students being awarded 2 marks. There was an error carried forward applied from the previous question so students who read the scale incorrectly could still gain full marks on this question.

02.5 This question asked for a description of how the weight changed; many students described how the gravitational field strength changed, or did not use the graph at all and answered in terms of air resistance or pressure. The majority of the 40% of students that gained marks only scored 1 mark for stating that the weight would decrease. The vast majority of students did not quote any values from the graph.

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Answer 16 · Examiner comments

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

Question 3 (Low demand)

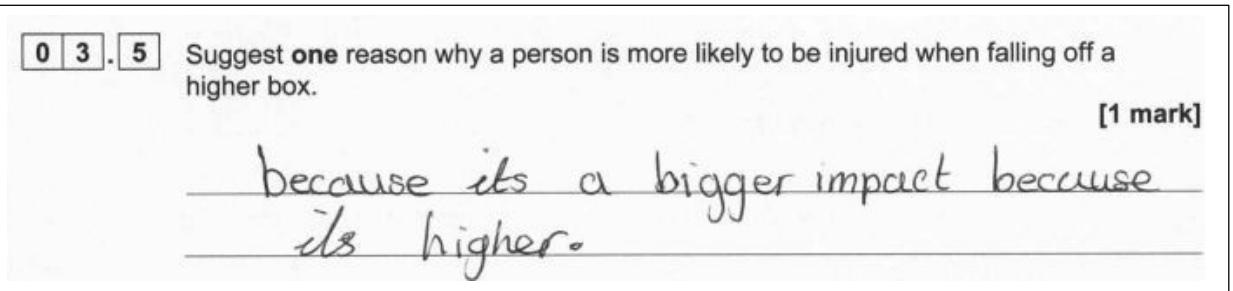
03.1 Only approximately 10% of students gained 2 marks on this question. 50% did get 1 mark for either identifying the stage with least gravitational potential energy, or the stage with the greatest kinetic energy.

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.

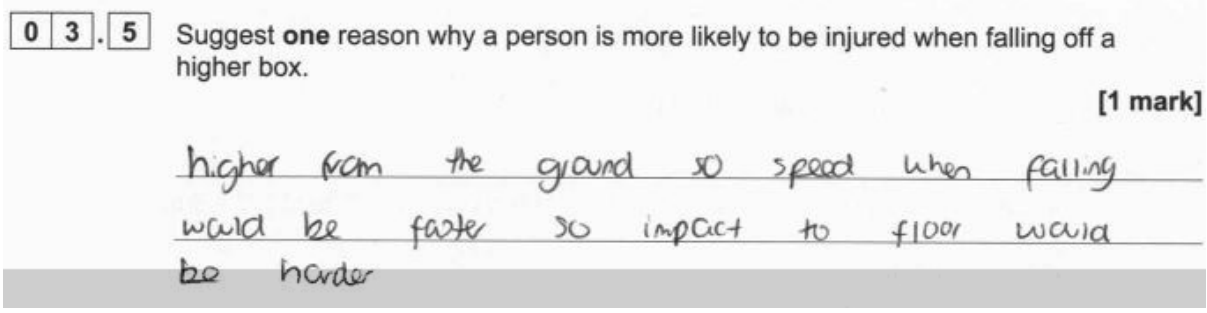
03.3 The calculation was slightly less demanding with a little over 90% of students gaining 2 marks.

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.

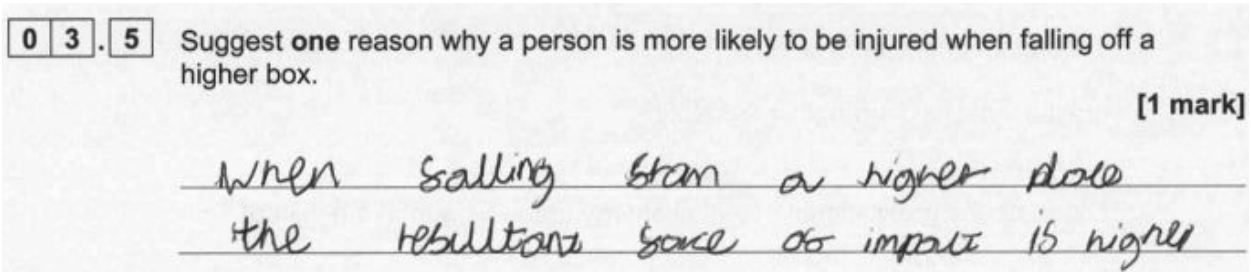
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6.5.1.3 Gravity

Answer 16 · 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.

6.5.1.3 Gravity

Answer 17 · Examiner comments

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

Question 3 (Low demand)

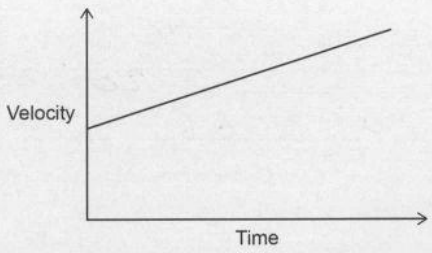
03.1 Almost two thirds of students were able to interpret the scale on the diagram and arrive at a correct answer.
Some students calculated the correct distance but then contradicted this by multiplying their answer by 20, which prevented them from scoring any marks.

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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6.5.1.3 Gravity

Answer 17 · Examiner comments

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

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.