AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 6.1.1.2

Changes in energy

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**16**
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.

6.1.1.2 Changes in energy

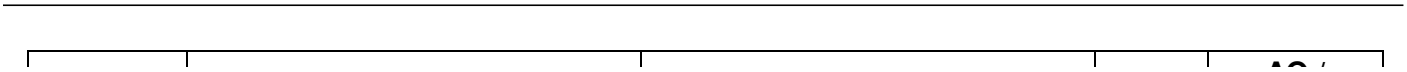
Answer 01 · Mark scheme June 2018 | 8464/P/1F | Original Q3

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**	

6.1.1.2 Changes in energy

Answer 01 · Mark scheme

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



6.1.1.2 Changes in energy

Answer 02 · Mark scheme June 2018 | 8464/P/2F | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	increases		1	AO1 6.5.3
05.2	the band returns to its original shape because there is an elastic force	allow band gets shorter allow because the stretching force has been removed if no other mark has been scored, allow for **1** mark the elastic potential energy decreases	1 1	AO1 6.5.3
05.3	any **two** from: • initially the band does not stretch when a force is applied • (when extending) as force increases the extension increases • the relationship is non-linear	allow a certain force is needed before the band extends allow the increase is not proportional do **not** accept directly proportional	2	AO3 6.5.3
05.4	straight diagonal line from bottom left to top right straight line through the origin	allow the line to curve upwards beyond the elastic limit	1 1	AO1 6.5.3
05.5	force = spring constant × extension	allow $F = k\,e$	1	AO1 6.5.3

6.1.1.2 Changes in energy

Answer 02 · Mark scheme

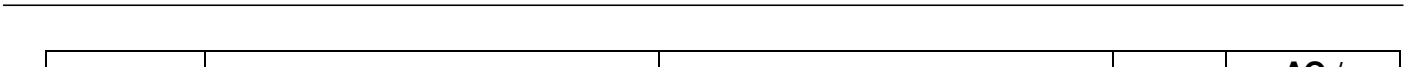
June 2018 | 8464/P/2F | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.6		an answer of 120 (N) scores **3** marks an answer of 12 000 (N) scores **2** marks		AO2 6.5.3
	7.5 cm = 0.075 m		1	
	$F = 1\,600 \times 0.075$	this mark may be awarded if e is incorrectly / not converted	1	
	$F = 120$ (N)	allow an answer that is consistent with their value of e	1	
Total			**11**	

6.1.1.2 Changes in energy

Answer 02 · Mark scheme

June 2018 | 8464/P/2F | Original Q5



6.1.1.2 Changes in energy

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**		

6.1.1.2 Changes in energy

Answer 03 · Mark scheme

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

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

6.1.1.2 Changes in energy

Answer 04 · Mark scheme

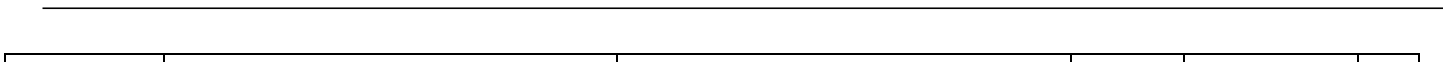
June 2019 | 8464/P/2F | Original Q2

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**		

6.1.1.2 Changes in energy

Answer 04 · Mark scheme

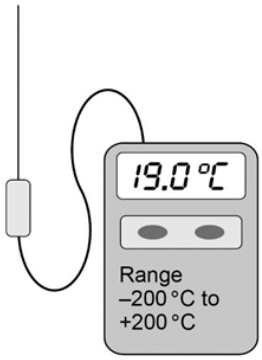
June 2019 | 8464/P/2F | Original Q2



6.1.1.2 Changes in energy

Answer 05 · 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

6.1.1.2 Changes in energy

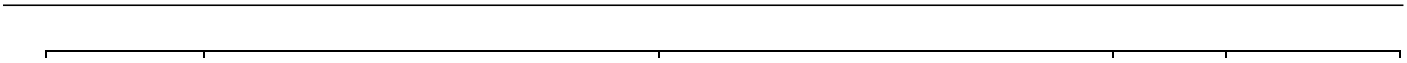
Answer 05 · Mark scheme

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**	

6.1.1.2 Changes in energy

Answer 05 · Mark scheme

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



6.1.1.2 Changes in energy

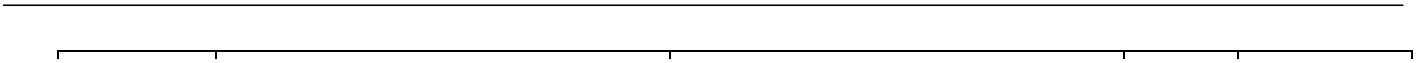
Answer 06 · Mark scheme November 2020 | 8464/P/2F | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	vectors have magnitude and direction		1	AO1 6.5.4.1.3
01.2	there is a resultant force acting on the ball		1	AO1 6.5.4.2.1
01.3	length of lane = 4.5 × 4.0 length of lane = 18 (m)		1 1	AO2 6.5.4.1.3
01.4	arrow in opposite direction arrow same length drawn from the ball		1 1	AO1 6.5.4.2.3
01.5	$a = \frac{12 - 0}{0.15}$ $a = 80\ (m/s^2)$		1 1	AO2 6.5.4.1.3
01.6	increases stays the same increases		1 1 1	AO2 6.1.1.2 6.5.4.1.3
Total			**11**	

6.1.1.2 Changes in energy

Answer 06 · Mark scheme

November 2020 | 8464/P/2F | Original Q1



6.1.1.2 Changes in energy

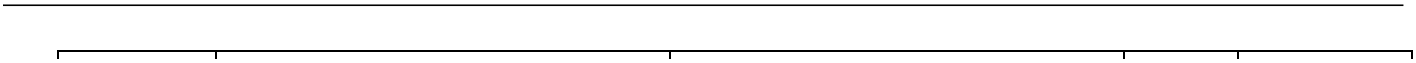
Answer 07 · Mark scheme November 2020 | 8464/P/2F | Original Q4

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**	

6.1.1.2 Changes in energy

Answer 07 · Mark scheme

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



6.1.1.2 Changes in energy

Answer 08 · 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

6.1.1.2 Changes in energy

Answer 08 · Mark scheme

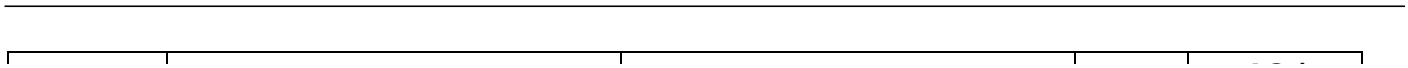
November 2021 | 8464/P/1F | Original Q2

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

6.1.1.2 Changes in energy

Answer 08 · Mark scheme

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



6.1.1.2 Changes in energy

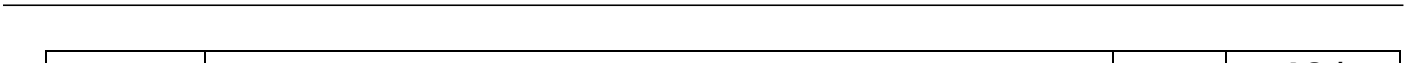
Answer 09 · Mark scheme November 2021 | 8464/P/2F | Original Q3

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**	

6.1.1.2 Changes in energy

Answer 09 · Mark scheme

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



6.1.1.2 Changes in energy

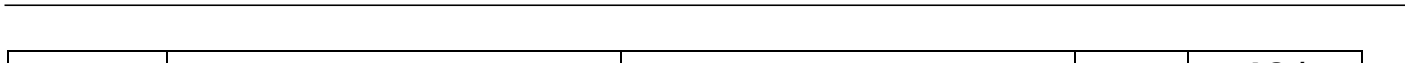
Answer 10 · Mark scheme November 2021 | 8464/P/2F | Original Q6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	the spring will return to its original length when the force is removed		1	6.5.3 AO1
06.2	measure the original length of the spring **and** the extended length of the spring (with the metre rule) extension = extended length – original length		1 1	6.5.3 AO1
06.3	e = 0.080 m $E_e = 0.5 \times 40 \times (0.080)^2$ $E_e = 0.128$ (J)	 allow a correct substitution using an incorrectly / not converted value of e allow a correct calculation using an incorrectly / not converted value of e	1 1 1	6.5.3 AO2
06.4	force = spring constant × extension **or** F = k e		1	6.5.3 AO1
06.5	300 = k × 0.40 $k = \frac{300}{0.40}$ k = 750 (N/m)		1 1 1	6.5.3 AO2
Total			**10**	

6.1.1.2 Changes in energy

Answer 10 · Mark scheme

November 2021 | 8464/P/2F | Original Q6



Answer 11 · 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

6.1.1.2 Changes in energy

Answer 11 · 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**

Answer 12 · 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

6.1.1.2 Changes in energy

Answer 12 · 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**

6.1.1.2 Changes in energy

Answer 13 · 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

6.1.1.2 Changes in energy

Answer 13 · Mark scheme

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**

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

6.1.1.2 Changes in energy

Answer 14 · Mark scheme

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

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	**EITHER** releases carbon dioxide	ignore references to pollution	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

6.1.1.2 Changes in energy

Answer 15 · Mark scheme

June 2024 | 8464/P/2F | Original Q7

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	(as a spring decompresses) the elastic potential energy of the spring decreases (as the gymnast leaves the floor) the kinetic energy of the gymnast increases **or** the gravitational potential energy of the gymnast increases **OR** (as a spring decompresses) the spring exerts a force on the gymnast (1) (so) work is done on the gymnast (1)		1 1	AO1 6.5.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2	e = 0.012 m		1	AO2
	E_e= 0.5 × 8500 × 0.012^2	allow a correct substitution using an incorrectly / not converted value of e	1	AO2
	E_e = 0.612	allow 0.61 allow a correct calculation using an incorrectly / not converted value of e	1	AO2
	J **or** joule		1	AO1 6.5.3

Answer 15 · Mark scheme

June 2024 | 8464/P/2F | Original Q7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.3	measure the original length of the spring **and** the compressed length of the spring (using a metre rule) compression = original length − compressed length **OR** calculate / measure the weight of the mass on the spring (1) use the equation $e = \frac{F}{k}$ (1)		1 1	AO3 6.5.3 RPA18

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4	masses could fall (off the spring) (so) less likely to cause injury / damage (if done on the floor)	 allow less hazardous allow lower risk (of injury) allow specific cause of injury eg landing on foot	1 1	AO1 6.5.3 RPA18

Answer 15 · Mark scheme

June 2024 | 8464/P/2F | Original Q7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.5	Δy = (330 – 80 =) 250 (N)		1	AO3 6.5.3 RPA18

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.6	Δx = (0.052 – 0.010 =) 0.042 (m)		1	AO3 6.5.3 RPA18

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.7		allow ecf from question **07.5 and** question **07.6**		AO3 6.5.3 RPA18
	$k = \frac{250}{0.042}$	allow k = 5952.38	1	
	5950 (N/m)	allow their calculated gradient to 3 significant figures	1	

Total Question 7	14

6.1.1.2 Changes in energy

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	

6.1.1.2 Changes in energy

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**

6.1.1.2 Changes in energy

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.

6.1.1.2 Changes in energy

Answer 08 · 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 09 · 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

6.1.1.2 Changes in energy

Answer 09 · 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 10 · Examiner comments November 2021 | 8464/P/2F | Original Q6

Question 6 (standard demand)

06.1 30% of students correctly selected the meaning of elastically deformed.

06.2 10% of students scored marks on this question. Most of the answers that did not score marks did not refer to any practical procedure or equipment. Some answers did mention measuring the spring, but did not identify which property should be measured, nor which piece of equipment should be used to take the measurement.

06.3 80% of students were able to select the correct equation from the physics equations sheet, and substitute the values into the equation. Nearly all these students correctly evaluated the answer and were awarded 2 marks. Only 2 students converted 80 mm to metres and scored full marks.

06.4 Approximately 25% of students correctly recalled the equation.

06.5 Approximately 25% of students were able to substitute the numbers into the correctly rearranged equation and evaluate the answer to score full marks.

6.1.1.2 Changes in energy

Answer 11 · 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.

6.1.1.2 Changes in energy

Answer 12 · 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.

6.1.1.2 Changes in energy

Answer 13 · 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.

Answer 14 · Examiner comments

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.

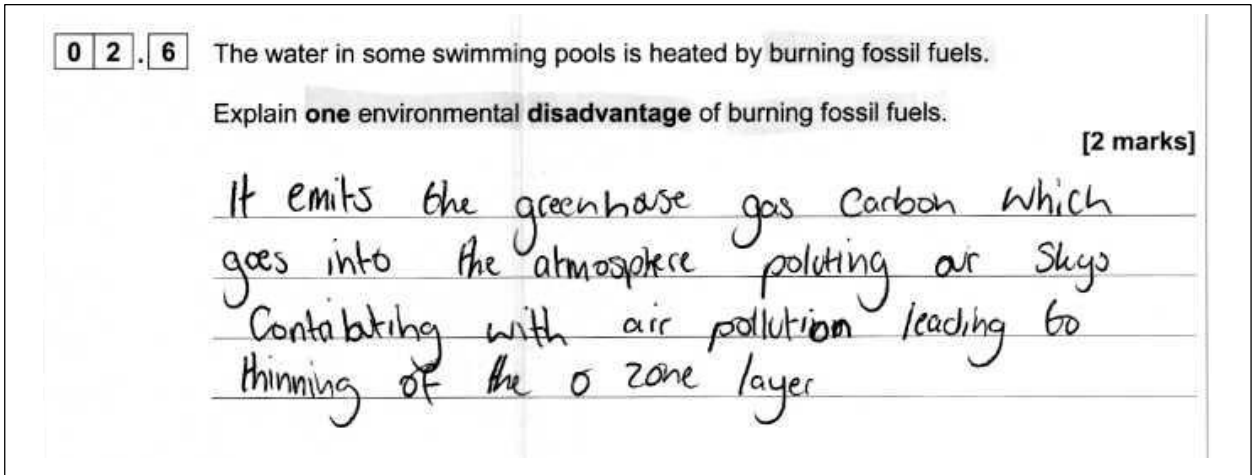
02.4 Around 55% of students correctly identified that 1 J/s is equivalent to 1 W.

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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Answer 15 · Examiner comments

Question 7 (standard demand)

07.1 This question was not well answered with nearly 90% of students gaining no marks and 1% gaining full marks. Students find the idea of energy stores very confusing. As in previous series, the mark scheme allows students to be awarded marks for answering in term of transfers or transformations: this is the only way students were able to score marks on this question.

07.2 Two-thirds of students scored 2 or 3 marks for this calculation. Very few students converted the centimetres into metres, so less than 1% of students scored full marks.

07.3 15% of students described measuring the length of the spring and were awarded marks; 5% of students gained 2 marks. Most students did not describe measuring anything and wrote vague answers about energy.

07.4 Approximately 20% of students identified that the large masses meant that the experiment should be done on the laboratory floor rather than on the table for safety reasons. However, most students gained no marks as they wrote that the table would not be level or that as it was higher that would affect the readings.

07.5 Just under 30% of students correctly used the values from the graph to determine the value for Δy. Most incorrect answers gave it as either 300 or 330.

07.6 About a quarter of students correctly determined Δx. The most common incorrect answer was 0.52.

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6.1.1.2 Changes in energy

Answer 15 · Examiner comments June 2024 | 8464/P/2F | Original Q7

07.7 This question was reasonably well answered with 35% of students gaining at least 1 mark. The error carried forward (ecf) meant that students could use their answers from questions 07.5 and 07.6 and many students were able to gain 2 marks for doing so, even if their previous answers were wrong.

The spring constant is the gradient of the line of best fit shown on **Figure 4**.

0 2 . 5 Determine the value Δy on **Figure 4**. **[1 mark]**

330 - 80 = 250

Δy = 250 N

0 2 . 6 Determine the value Δx on **Figure 4**. **[1 mark]**

0.01 - 0.092 - 0.01 = 0.041

Δx = 0.041 m

0 2 . 7 Determine the spring constant of the spring.

Use your answers to Question **02.5** and Question **02.6**.

Give your answer to 3 significant figures. **[2 marks]**

250 = 6097.560976

0.041

Spring constant (3 significant figures) = 6100 N/m

When ecf is allowed, students who give one value incorrectly can still gain subsequent marks in the next part of the question.

In this example from a Higher tier paper, the student gained the mark for question 02.5 but not for question 02.6. In their answer to question 02.7 they were awarded the first mark for dividing their answer to question 02.5 by their answer to question 02.6 and the second mark for giving the correct answer to this calculation to the correct number of significant figures.

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6.1.1.2 Changes in energy

Answer 15 · Examiner comments

June 2024 | 8464/P/2F | Original Q7

Contact us

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

Tel: 01483 477756
Email: gcsescience@aqa.org.uk

aqa.org.uk

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Answer 16 · Examiner comments

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

Question 3 (Low demand)

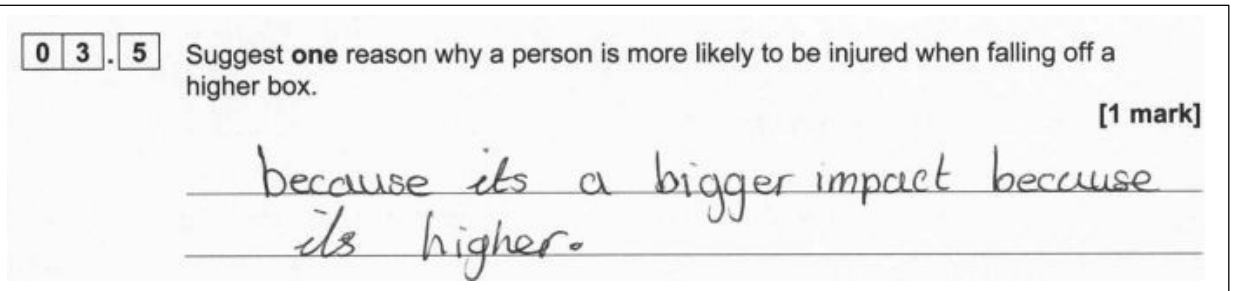
03.1 Only approximately 10% of students gained 2 marks on this question. 50% did get 1 mark for either identifying the stage with least gravitational potential energy, or the stage with the greatest kinetic energy.

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.

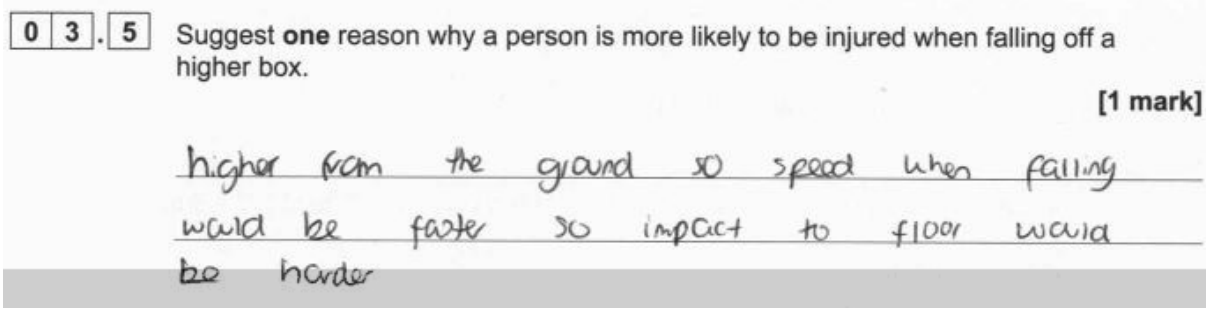
03.3 The calculation was slightly less demanding with a little over 90% of students gaining 2 marks.

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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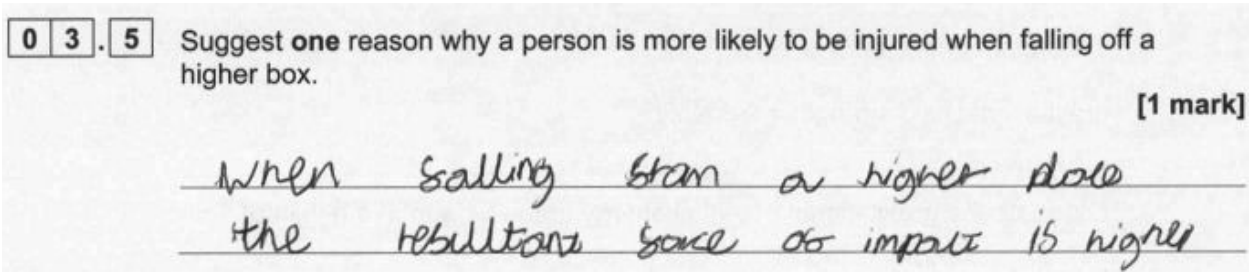
6.1.1.2 Changes in energy

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.