AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 6.1.1.1

Energy stores and systems

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**25**
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.

6.1.1.1 Energy stores and systems

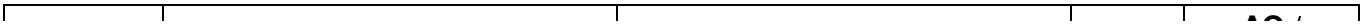
Answer 01 · Mark scheme June 2018 | 8464/P/1F | Original Q3

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**	

6.1.1.1 Energy stores and systems

Answer 01 · Mark scheme

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



6.1.1.1 Energy stores and systems

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

6.1.1.1 Energy stores and systems

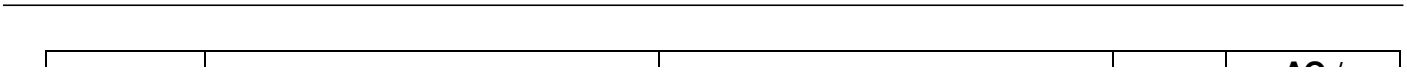
Answer 02 · Mark scheme June 2018 | 8464/P/2F | Original Q5

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**	

6.1.1.1 Energy stores and systems

Answer 02 · Mark scheme

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



6.1.1.1 Energy stores and systems

Answer 03 · Mark scheme

June 2019 | 8464/P/1F | Original Q2

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
02.1	the brightness of the lamp		1	AO3/3a 6.1.3c WS 2.2	A
02.2	zero error		1	AO3/3b 6.1.3c WS 3.7	A
02.3	C		1	AO3/1b 6.1.3c WS 3.7	A
02.4	10.0	allow 10	1	AO3/1a 6.1.3c WS 3.5	G
02.5	$\frac{0.96}{8.0}$ = 0.12	an answer of 0.12 or 12% scores **2** marks allow 12%	1 1	AO2.1 6.1.2.2	E
02.6	replenished		1	AO1.1 in isolation 6.1.3b	G
02.7	E = 490 × 31 E = 15 190 E = 15 000 (J)	an answer of 15 000 (J) scores **3** marks allow 15 200 if correct substitution is seen allow an answer to 2 s.f. consistent with their calculated value of E using E=QV	1 1 1	AO2.1 6.2.4.2	E

6.1.1.1 Energy stores and systems

Answer 03 · Mark scheme

02.8	less fossil fuel is burned		1	AO3.2a 6.1.3e	A
Total			**11**		

6.1.1.1 Energy stores and systems

Answer 03 · Mark scheme

June 2019 | 8464/P/1F | Original Q2



6.1.1.1 Energy stores and systems

Answer 04 · 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**		

6.1.1.1 Energy stores and systems

Answer 04 · Mark scheme

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

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

6.1.1.1 Energy stores and systems

Answer 05 · Mark scheme

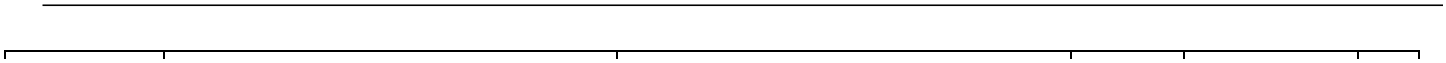
June 2019 | 8464/P/2F | Original Q2

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**		

6.1.1.1 Energy stores and systems

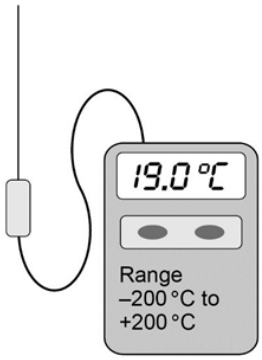
Answer 05 · Mark scheme

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



6.1.1.1 Energy stores and systems

Answer 06 · 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

6.1.1.1 Energy stores and systems

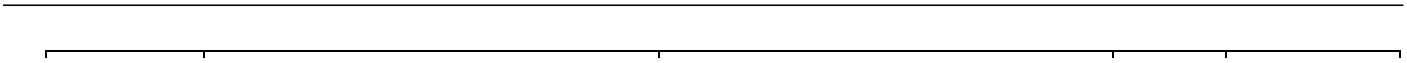
Answer 06 · Mark scheme

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**	

6.1.1.1 Energy stores and systems

Answer 06 · Mark scheme

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



6.1.1.1 Energy stores and systems

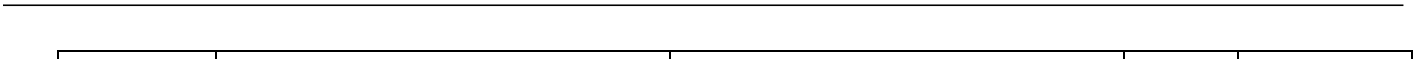
Answer 07 · Mark scheme November 2020 | 8464/P/2F | Original Q1

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**	

6.1.1.1 Energy stores and systems

Answer 07 · Mark scheme

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



6.1.1.1 Energy stores and systems

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

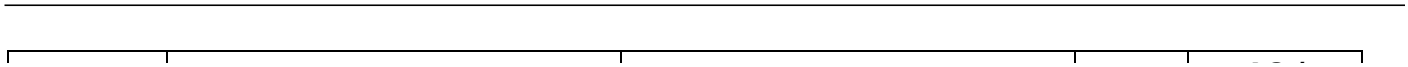
6.1.1.1 Energy stores and systems

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

6.1.1.1 Energy stores and systems

Answer 08 · Mark scheme

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



6.1.1.1 Energy stores and systems

Answer 09 · Mark scheme

November 2021 | 8464/P/1F | Original Q4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	300 (W/m^2)		1	AO2 6.1.3
04.2	(cities closer to the equator) receive a greater solar intensity	allow (cities closer to the equator) receive more radiation/energy ignore they get more sunshine ignore they are hotter	1	AO2 6.1.3
04.3	carbon dioxide		1	AO1 6.1.3
04.4	0.61 × 1100 671 (W)	 allow 670 (W)	1 1	AO2 6.1.2.2
04.5	larger heating panels have a greater input power	allow larger heating panels have a greater input energy (per second)	1	AO3 6.1.3
04.6	the energy required to increase the temperature of 1kg of water by 1 °C		1	AO1 6.1.1.3 6.3.2.2
04.7	8 400 000 = 80 × 4200 × Δθ $\Delta\theta = \frac{8400000}{80 \times 4200}$ Δθ = 25 (°C)		1 1 1	AO2 6.1.1.3 6.3.2.2

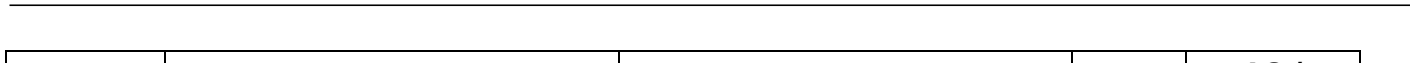
6.1.1.1 Energy stores and systems

04.8	thermal insulation decreases the rate of energy transfer		1	AO1 6.1.2.1
04.9	B		1	AO2 6.1.2.1
Total			**12**	

6.1.1.1 Energy stores and systems

Answer 09 · Mark scheme

November 2021 | 8464/P/1F | Original Q4



6.1.1.1 Energy stores and systems

Answer 10 · Mark scheme

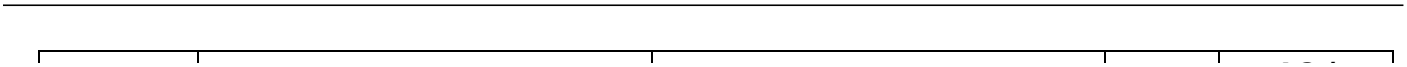
November 2021 | 8464/P/1F | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	$V = I\ R$		1	AO1 6.2.1.3
05.2	3.9 = 0.12 × R $R = \frac{3.9}{0.12}$ R = 32.5 (Ω)	 allow R = 33 (Ω)	1 1 1	AO2 6.2.1.3
05.3	energy = power × time **or** E = P t		1	AO1 6.2.4.2
05.4	time = 150 000s energy = 0.46 × 150 000 energy = 69 000 (J)	 allow a substitution using an incorrectly/not converted value of time allow a correct calculation using an incorrectly/not converted value of time	1 1 1	AO2 6.2.4.2
05.5	thermistor		1	AO1 6.2.1.1
05.6	the current will increase (because) the resistance decreases		1 1	AO1 6.2.1.4
Total			**11**	

6.1.1.1 Energy stores and systems

Answer 10 · Mark scheme

November 2021 | 8464/P/1F | Original Q5



6.1.1.1 Energy stores and systems

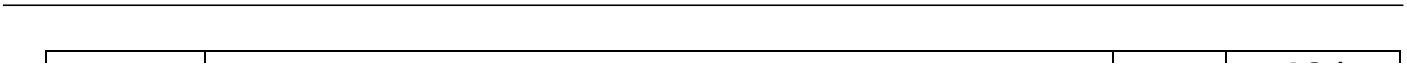
Answer 11 · Mark scheme November 2021 | 8464/P/2F | Original Q3

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**	

6.1.1.1 Energy stores and systems

Answer 11 · Mark scheme

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



6.1.1.1 Energy stores and systems

Answer 12 · Mark scheme

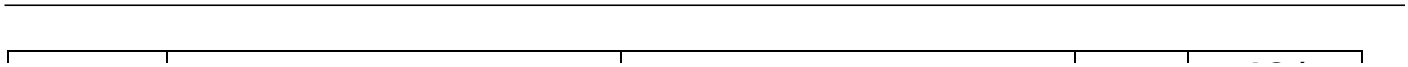
November 2021 | 8464/P/2F | Original Q6

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**	

6.1.1.1 Energy stores and systems

Answer 12 · Mark scheme

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



Answer 13 · 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

6.1.1.1 Energy stores and systems

Answer 13 · 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 14 · Mark scheme

June 2022 | 8464/P/1F | Original Q6

Question 6

Question	Answers	Mark	AO / Spec. Ref.
06.1	**Level 3:** The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	5–6	AO1 6.1.1.3 6.3.2.2 RPA14
	Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the plan is not fully logically sequenced.	3–4	
	Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2	
	No relevant content.	0	
	Indicative content • measure mass of oil using the top pan balance • measure start temperature of oil using the thermometer • place beaker of oil on heater • switch on heater to heat oil • measure final temperature of oil using the thermometer • measure energy transferred using joulemeter • calculate increase in temperature ($\Delta\theta$) • use the equation $E = mc\Delta\theta$ to determine c		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	burns / scalds	allow cuts from broken glass ignore the heater / oil is hot	1	AO1 6.1.1.3 RPA14

6.1.1.1 Energy stores and systems

Answer 14 · Mark scheme

June 2022 | 8464/P/1F | Original Q6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	$\text{power} = \frac{\text{energy transferred}}{\text{time}}$ **or** $P = \frac{E}{t}$		1	AO1 6.1.1.4 6.2.4.2 RPA14

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	$50 = \frac{4750}{t}$ **or** $4750 = 50 \times t$ $t = \frac{4750}{50}$ $t = 95$ (s)		1 1 1	AO2 6.1.1.4 6.2.4.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.5	thermistor		1	AO1 6.2.1.4

6.1.1.1 Energy stores and systems

Answer 14 · Mark scheme

June 2022 | 8464/P/1F | Original Q6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.6	250 (Ω)	allow an answer in the range 240 (Ω) to 260 (Ω) allow **1** mark for temperature = 160 (°C)	2	AO3 6.2.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.7	the water will recover its original properties if the steam is cooled		1	AO1 6.3.1.2

Total Question 6		**15**

Answer 15 · 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

6.1.1.1 Energy stores and systems

Answer 15 · Mark scheme

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**

6.1.1.1 Energy stores and systems

Answer 16 · Mark scheme June 2023 | 8464/P/1F | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	geothermal		1	AO1 6.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	36×10^9 J		1	AO2 6.1.3

Answer 16 · Mark scheme

June 2023 | 8464/P/1F | Original Q5

Question	Answers	Mark	AO / Spec. Ref.
05.3	**Level 3:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	5–6	AO3
	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	AO2
	No relevant content	0	
	Indicative content **Figure 6** • the power output from wind increased • because more wind turbines were built • the power output from solar increased • because more solar panels were built • power output from wind and solar may have increased due to climate change For 2015 and 2016 • wind power was lower in 2016 than in 2015 • because 2016 was less windy than 2015 **Figure 7** • for most of the year the electricity generated from wind is greater than from solar. • the electricity generated from wind is greater in winter than in summer • because winter is windier than summer • the electricity generated from solar is greater in summer than in winter • because hours of sunlight are longer in summer • and because the intensity of sunlight is greater in summer to access Level 3, the answer should describe trends in both graphs, and in solar power and wind power, and give some explanation for changes.		6.1.3

Total Question 5	8

6.1.1.1 Energy stores and systems

Answer 17 · 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

6.1.1.1 Energy stores and systems

Answer 17 · 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 18 · 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

6.1.1.1 Energy stores and systems

Answer 18 · 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**

Answer 19 · 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

6.1.1.1 Energy stores and systems

Answer 19 · 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

6.1.1.1 Energy stores and systems

Answer 20 · 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

6.1.1.1 Energy stores and systems

Answer 20 · 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**

6.1.1.1 Energy stores and systems

Answer 21 · 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 21 · 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

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

6.1.1.1 Energy stores and systems

Answer 22 · 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	

6.1.1.1 Energy stores and systems

Answer 22 · 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**

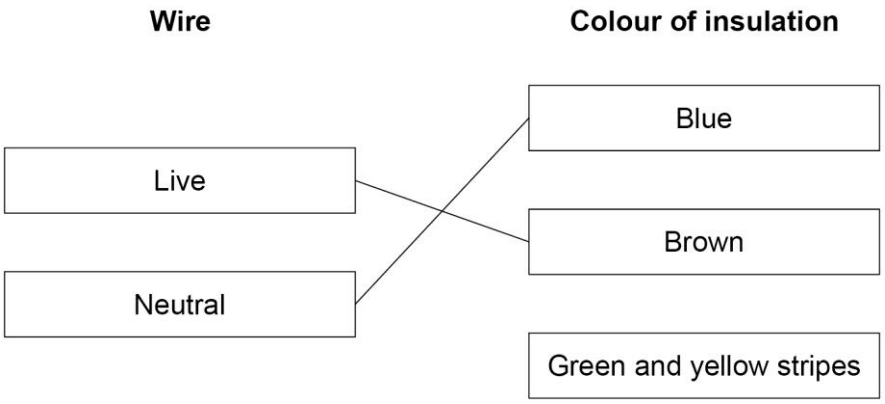
6.1.1.1 Energy stores and systems

Answer 23 · Mark scheme

June 2025 | 8464/P/1F | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	50 Hz		1	AO1 6.2.3.1

Question	Answers	Mark	AO / Spec. Ref.
04.2	 do **not** accept more than one line from a box on the left	1 1	AO1 6.2.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	power = potential difference × current **or** $P = VI$		1	AO1 6.2.4.1

6.1.1.1 Energy stores and systems

Answer 23 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	$2100 = 230 \times I$		1	AO2 6.2.4.1
	$I = \frac{2100}{230}$		1	
	$I = 9.13\ldots$		1	
	$I = 9.1$ (A)	allow an answer calculated using the numbers from the question given to two significant figures	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	$18\,000 = 0.0080 \times L$		1	AO2 6.3.2.3
	$L = \frac{18\,000}{0.0080}$		1	
	$L = 2\,250\,000$ (J/kg)	allow 2 300 000	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.6	efficiency $= \frac{75\,600}{84\,000}$		1	AO2 6.1.2.2
	efficiency = 0.9		1	
	OR			
	efficiency $= \frac{75\,600}{84\,000} \times 100$ (1)			
	efficiency = 90% (1)			

6.1.1.1 Energy stores and systems

Answer 23 · Mark scheme

June 2025 | 8464/P/1F | Original Q4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.7	less energy is wasted	allow power for energy throughout	1	AO1
	(so) costs less to run **or** (so) uses less electricity / energy	allow so the appliance is used for less time	1	AO2 6.1.2.1 6.1.2.2 6.2.4.2

Total Question 4	**15**

6.1.1.1 Energy stores and systems

Answer 24 · Mark scheme

June 2025 | 8464/P/1F | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	any **two** from • chemical store (of the fuel) decreases • thermal store (of engine / gases / surroundings) increases • kinetic energy (of the engine / car) increases		2	AO2 6.1.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	biofuel	allow a named biofuel allow biogas allow wood ignore fossil fuels	1	AO1 6.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	(by a) battery **or** (by) electricity	allow (by an) electric motor	1	AO3 6.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	the amount of fossil fuel that is burned to generate electricity each year has decreased		1	AO3 6.1.3

6.1.1.1 Energy stores and systems

Answer 24 · Mark scheme

June 2025 | 8464/P/1F | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	many generators are required **or** lots of resources are required	allow named device such as wind turbines for generators ignore unreliable	1	AO3 6.1.3
	so it is expensive	if no other mark awarded allow **1** mark for lack of political will	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.6	*hydro-electric power* loss of habitat *wind power* negative visual impact	 allow dangerous for birds allow noise pollution	 1 1	AO1 6.1.3

Total Question 5	9

6.1.1.1 Energy stores and systems

Answer 25 · Mark scheme

June 2025 | 8464/P/1F | Original Q6

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	13 800 = 0.75 × *c* × 20		1	AO2 6.1.1.3 RPA14
	$c = \frac{13\,800}{0.75 \times 20}$		1	
	c = 920 (J/kg °C)		1	

6.1.1.1 Energy stores and systems

Answer 25 · Mark scheme

June 2025 | 8464/P/1F | Original Q6

Question	Answers	Mark	AO / Spec. Ref.
06.2	**Level 3:** The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.	5–6	AO1 6.1.1.3 RPA14
	Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced.	3–4	
	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 **Mass** • use a top pan balance to measure mass of block **Energy transfer** • use a joulemeter to measure energy transferred to block • connect heater to a joulemeter • measure initial energy and switch on • switch off and measure final energy • calculate the difference between initial and final energy • use an ammeter, voltmeter and stopwatch • calculate energy transferred **Temperature change** • use a thermometer to measure temperature of block • measure the initial temperature • measure the final temperature • calculate the difference between initial and final temperature for **Level 3** answers must describe all three measurements		

6.1.1.1 Energy stores and systems

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	the amount of wasted energy is less the temperature increase of the aluminium block is greater		1 1	AO3 6.1.1.3 6.1.2.1 RPA14

Total Question 6	**11**

6.1.1.1 Energy stores and systems

Answer 03 · Examiner comments — June 2019 | 8464/P/1F | Original Q2

Question 2

02.1 Nearly 70% of students correctly chose the brightness of the lamp as the control variable.

02.2 This question was correctly answered by just over 30% of students.

02.3 The anomalous result was recognised by about 70% of students.

02.4 Slightly less than half of the students identified the pattern in the data, and used this to predict the most likely value using the information in the table. Many students who didn't score a mark tried to calculate a mean using some data from the table.

02.5 This calculation was answered well, with around four fifths of students dividing the two values correctly and expressing their answer as either a decimal or a percentage.

02.6 Understanding that renewable resources are replenished was shown by three quarters of students.

02.7 Just over 5% of students gained only 1 mark on this question, for correctly substituting the numbers into an equation. Another 80% or so of students completed the calculation, but the ability to express it to two significant figures was shown by only approximately 30% of students. Some students did not try, some rounded incorrectly, but many reduced 15190 to just 15.

02.8 Just over 70% of students knew that using solar panels would reduce the need to burn fossil fuels.

Answer 04 · 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

6.1.1.1 Energy stores and systems

Answer 04 · 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.

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.

6.1.1.1 Energy stores and systems

Answer 09 · Examiner comments — November 2021 | 8464/P/1F | Original Q4

Question 4 (Low/standard demand)

04.1 The graph was read correctly by slightly more than 50% of the students.

04.2 Many students did not use the information provided in the question. It was not uncommon to see answers such as the equator being closer to the Sun, which gained no credit. Around one in eight students scored a mark.

04.3 The majority of students recalled that carbon dioxide contributes to global warming and is released when fossil fuels are burned.

04.4 Over 90% of students gained both marks.

04.5 Answers such as “bigger panels will heat more water” or “water can be heated up quicker if the panels have a larger surface area” did not answer the question. There were misconceptions which also arose when answering this question, such as the idea that bigger panels hold more water and therefore would take longer to heat up.

If students are asked how the size of the heating panels affects the input power, then their answers need to be in terms of the size of the heating panels and the input power.

Only about a third of students gained this mark, with nearly 10% of students not attempting to answer the question.

Answer 09 · Examiner comments — November 2021 | 8464/P/1F | Original Q4

04.6 Fewer than half of the students chose the correct definition of specific heat capacity.

04.7 Despite being directed to the Physics Equations Sheet, and being given the specific heat capacity value in the question, more than 5% of students did not make any attempt to answer this question. Nearly a third of students gained full marks, but over half of the students gained no marks.

04.8 Just under a third of students answered correctly, with nearly half thinking that thermal insulation increases the rate of energy transfer.

04.9 Only about one in ten students selected the correct answer, with more than 80% choosing option C. Questions 04.8 and 04.9 together suggest that many of the students were confused about the relationship between thermal conduction and thermal insulation.

6.1.1.1 Energy stores and systems

Answer 10 · Examiner comments November 2021 | 8464/P/1F | Original Q5

Question 05 (Standard demand)

05.1 Slightly over a third of students selected the correct equation.

05.2 Full marks were gained by approximately a third of the students, with more than 50% failing to gain any credit.

05.3 This equation was correctly recalled by slightly less than half of students.

05.4 Most students did not attempt to convert 2500 minutes into seconds. Very few students gained all 3 marks, although over 60 % gained at least 2 marks.

05.5 Only a very small proportion of foundation tier students were able to correctly identify the symbol for a thermistor.

05.6 Most students failed to recognise that the resistance of the thermistor would decrease as temperature increased, with many students stating that because the potential different across the thermistor was constant, the current in the thermistor must also be constant. Another misconception demonstrated in a number of responses was that the current would increase because the increased temperature gives the current more energy. Nearly one in five students did not attempt the question.

Answer 11 · 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

6.1.1.1 Energy stores and systems

Answer 11 · 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 12 · 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.

Answer 13 · 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.

Answer 14 · Examiner comments

June 2022 | 8464/P/1F | Original Q6

Question 06 (Standard demand)

06.1 Nearly 70% of students gained some marks on this question, with about a third of students accessing level 2 of the mark scheme and gaining 3 or 4 marks. Only about 5% of students gave answers which scored in level 3.

It was clear that a lot of students were not aware of what a top pan balance is, with many thinking that it is a device to help prevent things from falling over, or that the pan of the top pan balance was to be used for heating the oil. As a consequence of this misunderstanding, a very large number of students placed the top pan balance on the heater. Many students, who did know what a top pan balance is, thought that it would be used to find the weight of oil, rather than the mass of oil.

While most students realised that the thermometer should be used to measure temperature, some students measured the heat with the thermometer, which was not worth any credit.

The joulemeter was often confused with a voltmeter, or students did not appreciate the function of a joulemeter. Common suggestions included setting the joulemeter to 10 and leaving it for a fixed time, for example.

A lot of students did not mention the measuring equipment at all, and simply stated that they would weigh the oil and measure its temperature. Students who did this could gain some credit but were unable to access level 3 on the mark scheme.

Many students described the wrong experiment, instead of finding the boiling point of the oil, carrying out a cooling-curve experiment, or describing how to use an immersion heater to find the specific heat capacity of a block of metal. These responses could still gain some credit, for example by correctly stating how to use the thermometer.

06.2 Approximately half the students could identify the risk when using the given equipment.

It was clear that many students were unable to distinguish between risks, hazards, and precautions. Some students did not talk about safety at all, instead suggesting that a risk might be inaccurate results, for example.

06.3 Nearly 90% of students chose a correct equation from the equation sheet.

Some students omitted important parts of the equation, such as the equals sign, and therefore did not gain the mark.

06.4 Over 60% of students gained full marks on this question, with just over a quarter of all students who attempted the question gaining 0 marks.

Students who started the question by using the equation $E = P\,t$ tended to make fewer mistakes when rearranging than those who used the equation $P = E / t$.

6.1.1.1 Energy stores and systems

Answer 14 · Examiner comments June 2022 | 8464/P/1F | Original Q6

06.5 Fewer than 5% of students recognised that the electrical component whose resistance decreases as temperature increases is a thermistor.

06.6 Just over 10% of students gained both marks, with a further 20% gaining one mark on this question. About 1 in 5 students did not attempt this question.

Some students misread the temperature scale, deciding that the maximum temperature reached was 152 °C or 170 °C, for example. Some students thought that the relevant temperature was the change in temperature of 140 °C. Of those students who correctly read 160 °C from figure 12, but did not then use figure 11, many decided to divide the temperature by a time read from the graph. Some students used their temperature with the maximum resistance of 1000 Ω shown on figure 11.

Students who read 160 °C on figure 12, but decided that this was the resistance of the resistor by writing 160 on the answer line, gained no marks.

06.7 About 20% of students chose the correct answer to why this was a physical change.

Answer 14 · Examiner comments

June 2022 | 8464/P/1F | Original Q6

Mark Ranges and Award of Grades

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

6.1.1.1 Energy stores and systems

Answer 15 · 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 16 · Examiner comments — June 2023 | 8464/P/1F | Original Q5

Question 05 (Standard demand)

05.1 Approximately 60% of students identified geothermal as the renewable energy resource.

05.2 Only about a fifth of students knew that giga means 10^9.

05.3 Many students found this question to be quite accessible, and wrote a fair amount in their answers, although about 1 in 10 students did not attempt this question. About a third of all students' responses were in level 1, giving answers which tended to describe trends in the graphs but not give any attempt to explain the trends or begin to suggest any reasons for the trends. About a third of students gained marks in level 2, giving answers which were better than simple descriptions of the graphs, but tended not to give full explanations for any trends. Just over 10% scored marks in level 3, for giving explanations of trends shown in the graphs.

Many students were not clear in their use of English, and it was common to see statements such as "It is windier than it is sunny," which were ignored. It was also relatively common for students to think that the *y*-axes represented the number of people using wind power or solar power, rather than the power output.

Statements that solar power output increases in the hotter months were ignored. However, an answer that referred to solar output increasing in sunnier months was heading towards an explanation and could lift an answer to a higher level.

6.1.1.1 Energy stores and systems

Answer 17 · 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.

6.1.1.1 Energy stores and systems

Answer 18 · 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 19 · 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.

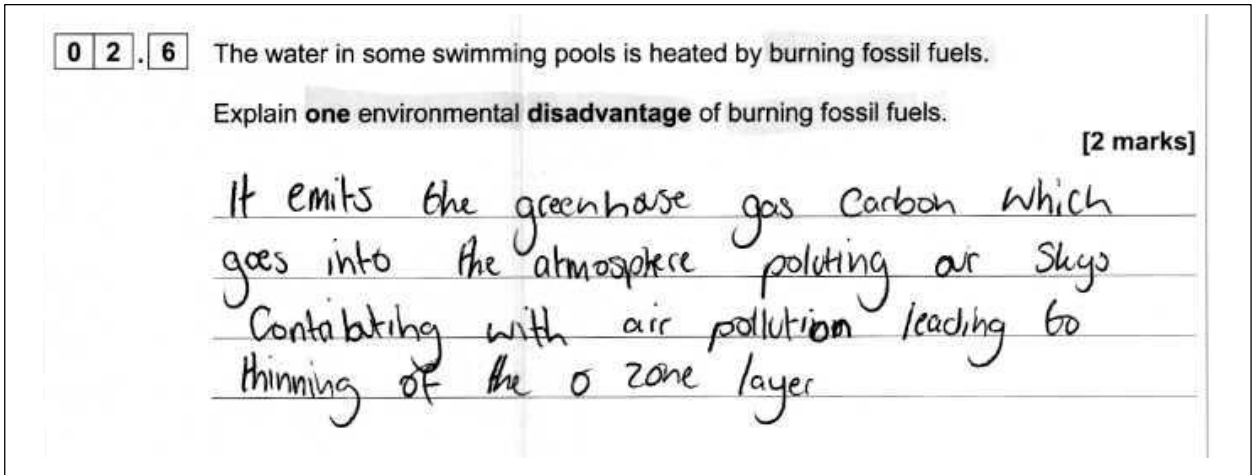
02.4 Around 55% of students correctly identified that 1 J/s is equivalent to 1 W.

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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Answer 20 · Examiner comments

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

Question 6 (standard demand)

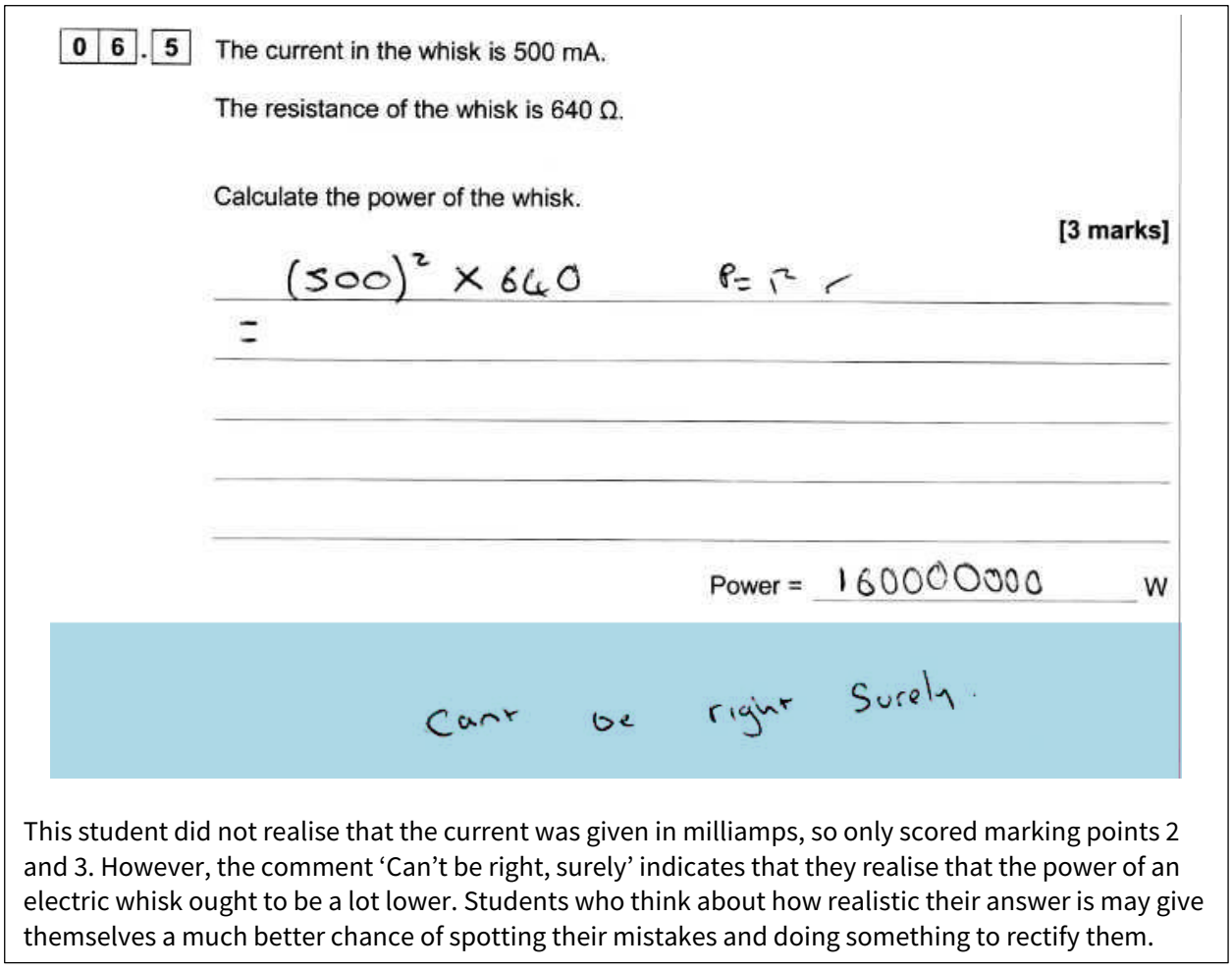
06.1 Roughly two-thirds of students gained at least 1 mark on this question, with about half of these gaining both marks. The most common incorrect answers were an increase in electrical energy and an increase in chemical energy.

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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Answer 21 · Examiner comments

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

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.

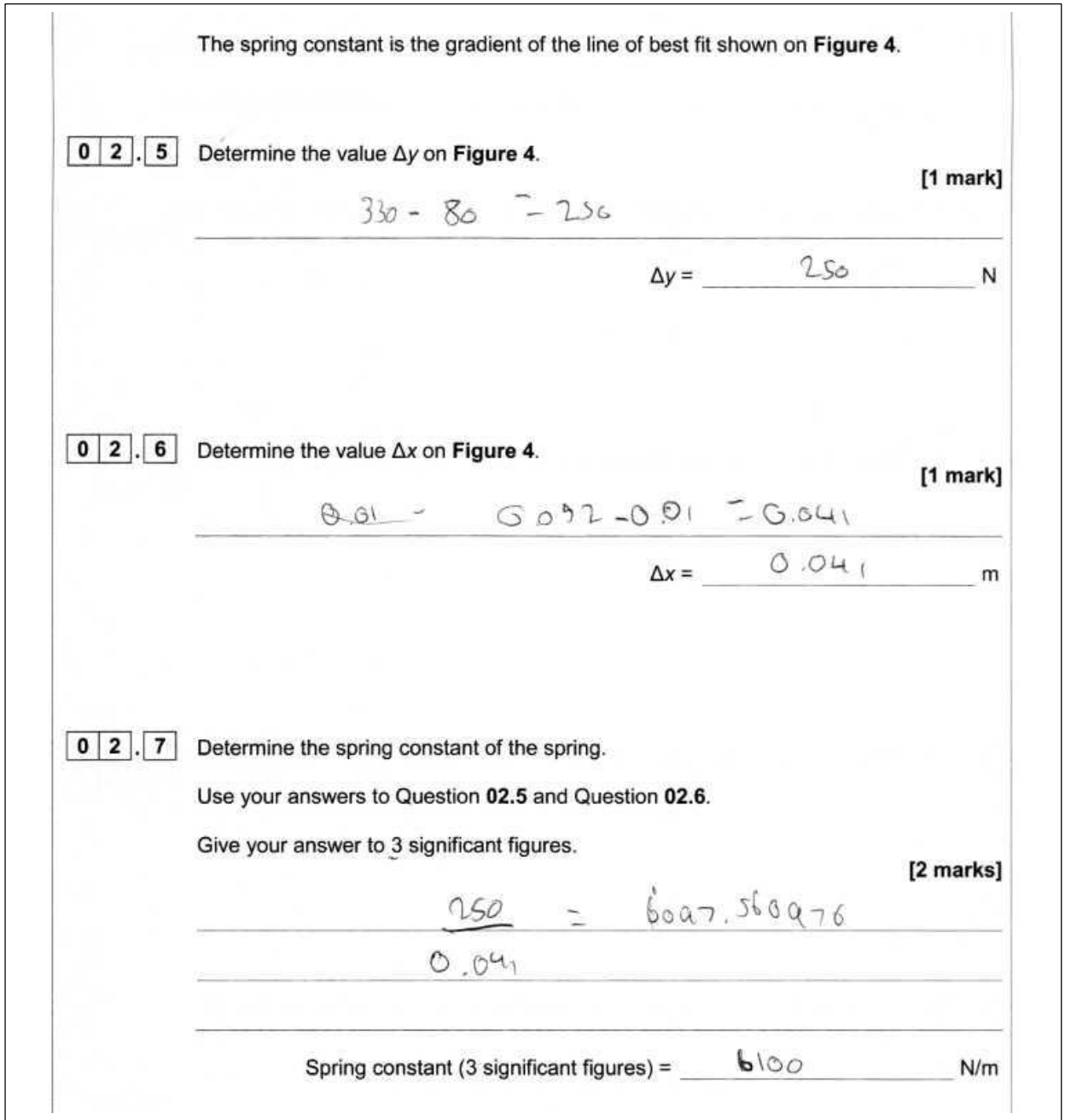
07.6 About a quarter of students correctly determined Δx. The most common incorrect answer was 0.52.

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6.1.1.1 Energy stores and systems

Answer 21 · 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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6.1.1.1 Energy stores and systems

Answer 21 · Examiner comments

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

Contact us

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Answer 22 · Examiner comments

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

Question 3 (Low demand)

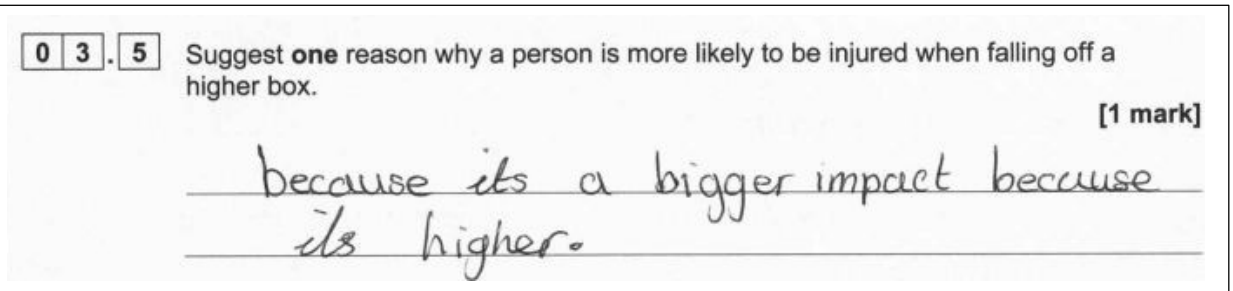
03.1 Only approximately 10% of students gained 2 marks on this question. 50% did get 1 mark for either identifying the stage with least gravitational potential energy, or the stage with the greatest kinetic energy.

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.

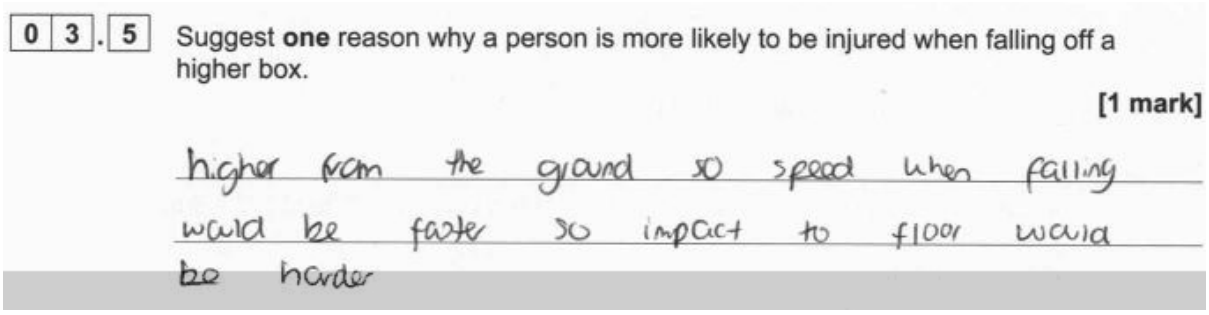
03.3 The calculation was slightly less demanding with a little over 90% of students gaining 2 marks.

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.

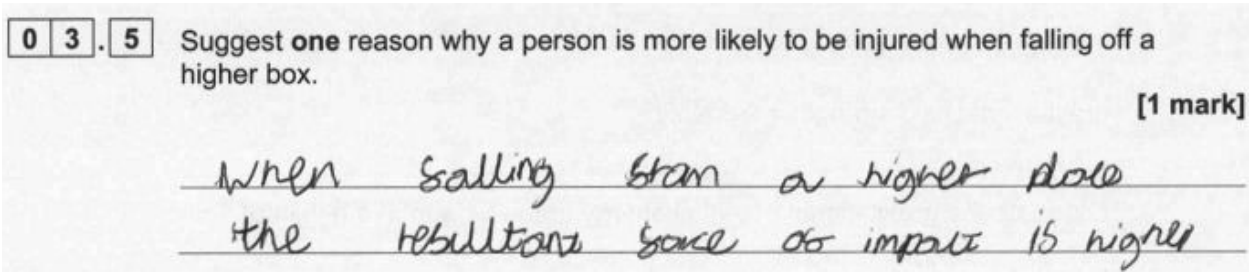
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6.1.1.1 Energy stores and systems

Answer 22 · 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.

Answer 23 · Examiner comments

June 2025 | 8464/P/1F | Original Q4

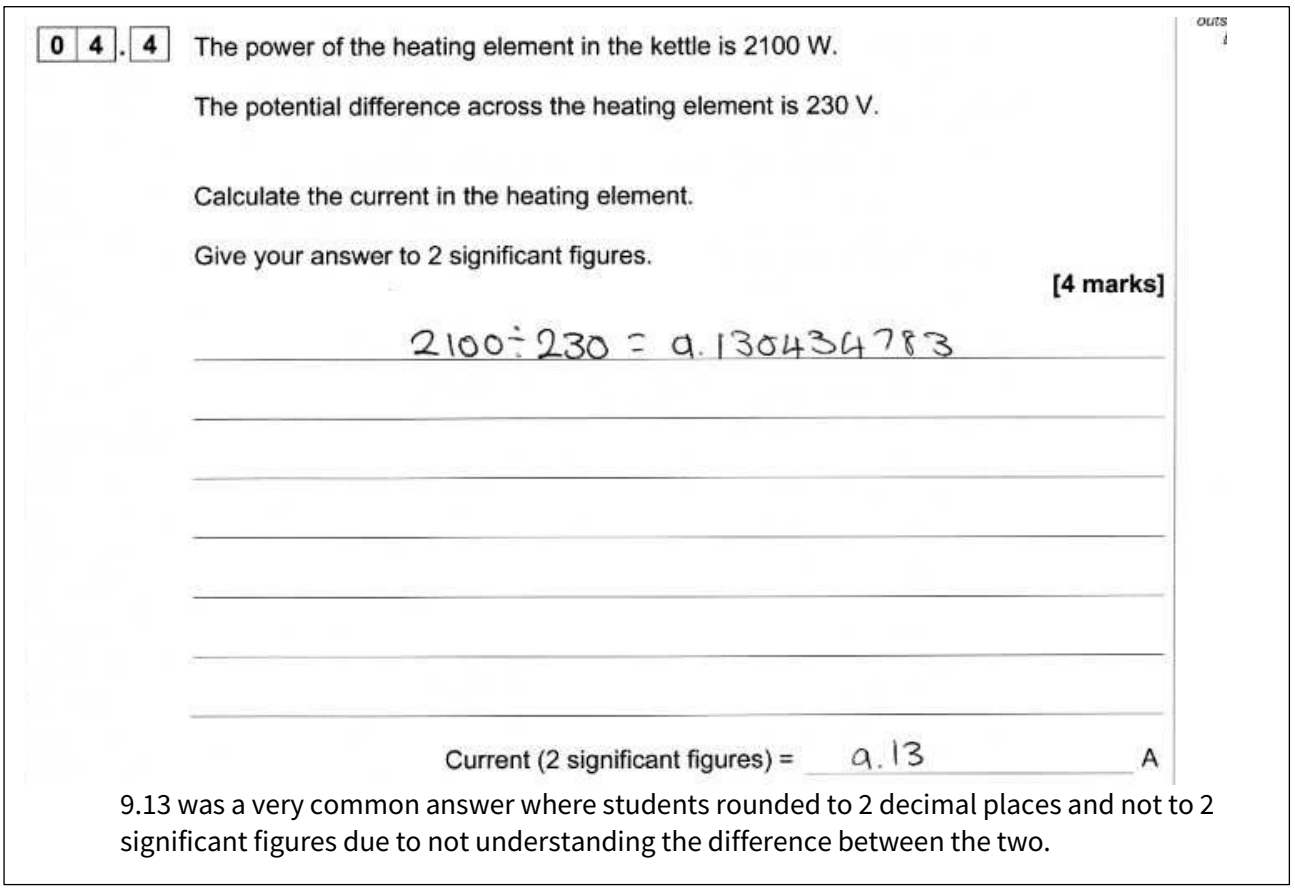
Question 4 (Low and standard demand)

04.1 45% of students selected the correct answer for the frequency of the UK mains electricity supply.

04.2 Just over 20% of students gained 1 mark for correctly identifying the colour of the insulation on one of the wires. 35% of students were able to identify both the colours of the insulation.

04.3 Students now have the equation sheet to select the equation from, so 90% of students gained the mark on this question. Approximately 5% of students selected the incorrect equation.

04.4 The vast majority of students who correctly substituted into the equation scored the 3 calculation marks. Approximately 75% of students gained 3 marks, but only 35% of students gained the mark for the significant figures. Many students gave their answer to 2 decimal places and not to two significant figures.



0 4 . 4 The power of the heating element in the kettle is 2100 W.

The potential difference across the heating element is 230 V.

Calculate the current in the heating element.

Give your answer to 2 significant figures.

[4 marks]

2100 ÷ 230 = 9.130434783

Current (2 significant figures) = 9.13 A

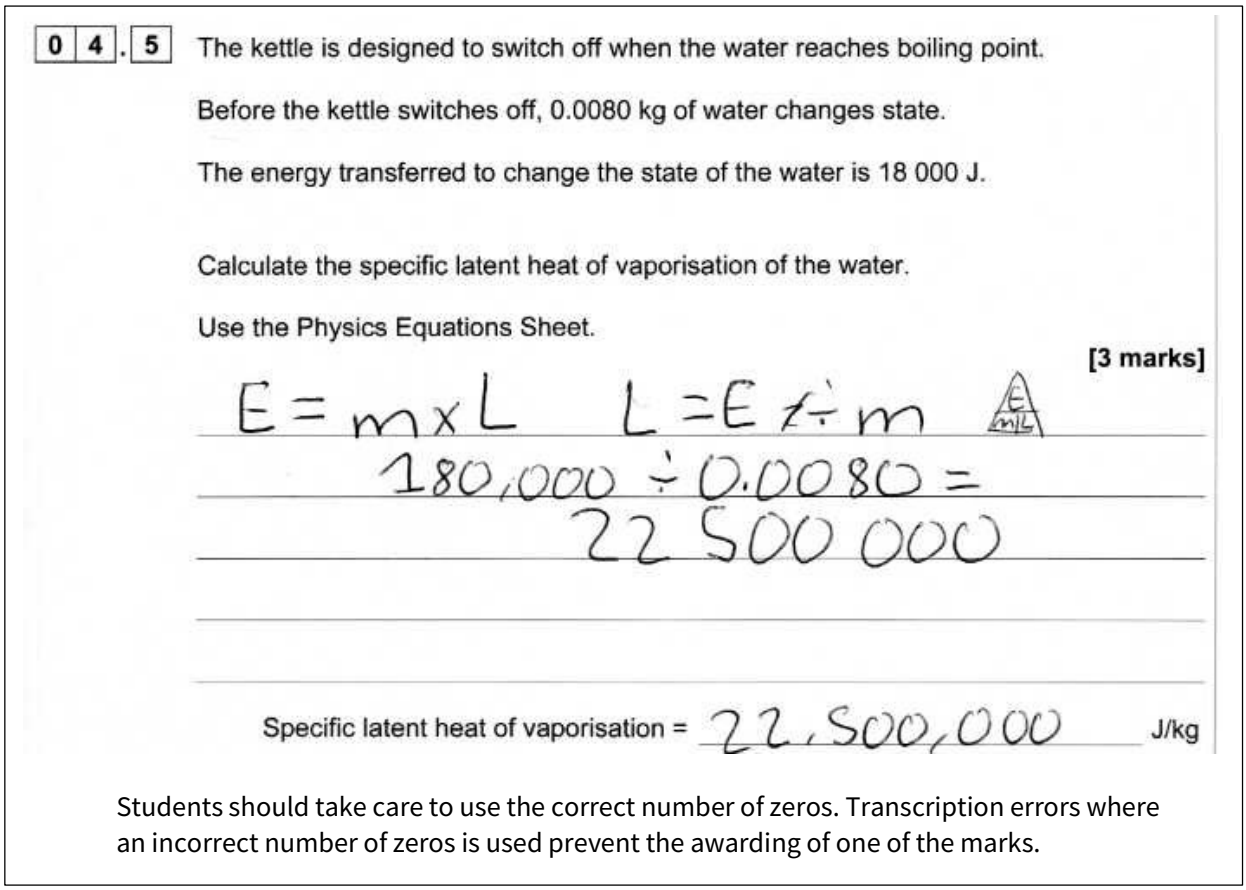
9.13 was a very common answer where students rounded to 2 decimal places and not to 2 significant figures due to not understanding the difference between the two.

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6.1.1.1 Energy stores and systems

Answer 23 · Examiner comments June 2025 | 8464/P/1F | Original Q4

04.5 This calculation proved to be more challenging with approximately 50% of students gaining 3 marks. The vast majority of students who substituted correctly were able to rearrange the equation correctly and then arrive at the correct answer. Most students who did not gain any marks either did not select the correct equation from the equation sheet or did an incorrect initial substitution.



0 4 . 5 The kettle is designed to switch off when the water reaches boiling point.

Before the kettle switches off, 0.0080 kg of water changes state.

The energy transferred to change the state of the water is 18 000 J.

Calculate the specific latent heat of vaporisation of the water.

Use the Physics Equations Sheet.

[3 marks]

$E = m \times L$ $L = E \div m$

$180,000 \div 0.0080 =$

$22\,500\,000$

Specific latent heat of vaporisation = 22,500,000 J/kg

Students should take care to use the correct number of zeros. Transcription errors where an incorrect number of zeros is used prevent the awarding of one of the marks.

04.6 This calculation was well answered with approximately 90% of students gaining 2 marks.

04.7 40% of students gained a mark on this question, but only 3% gained both marks. Very few explained that higher efficiency means less energy is wasted. Many students answered in terms of a kettle due to the previous question and explained that the appliance would complete its task in less time. This was awarded a mark due to the context of the question.

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Answer 24 · Examiner comments

Question 5 (Standard demand)

05.1 25% of students gained marks on this question. 15% of students gained one mark, mostly for either stating that a thermal store of energy increased or that a kinetic store of energy increased. 10% of students gained 2 marks for making both statements, only a small number of students identified that a chemical store of energy was decreasing.

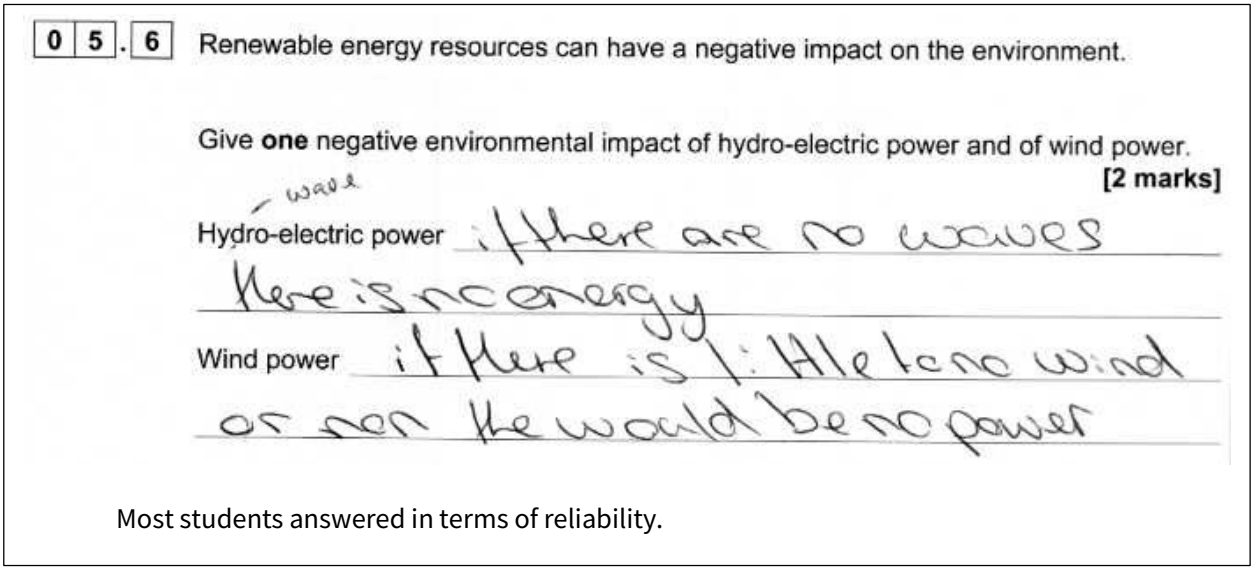
05.2 This question was not well answered, with only approximately 20% of students answering correctly.

05.3 This question was well answered with 85% of students answering correctly by stating that the cars are powered by a battery or by electricity.

05.4 65% of students could correctly analyse the bar chart to conclude that the amount of fossil fuel that is burned to generate electricity each year has decreased.

05.5 Only a very small number of students gained 2 marks on this question. 22% of students gained one mark for identifying that it is expensive, but the vast majority of those students did not state that *many* generators or resources are required

05.6 Most students did not give a negative impact on the environment in their answer and described both types of resource as being unreliable. 30% of students were able to gain 1 mark mostly for giving a negative impact on the environment for wind power. Many students suggested that hydro-electric power has a damaging impact on habitats in the sea. Very few students gained 2 marks.



0 5 . 6 Renewable energy resources can have a negative impact on the environment.

Give **one** negative environmental impact of hydro-electric power and of wind power.

[2 marks]

Hydro-electric power if there are no waves there is no energy

Wind power if there is no wind or sea there would be no power

Most students answered in terms of reliability.

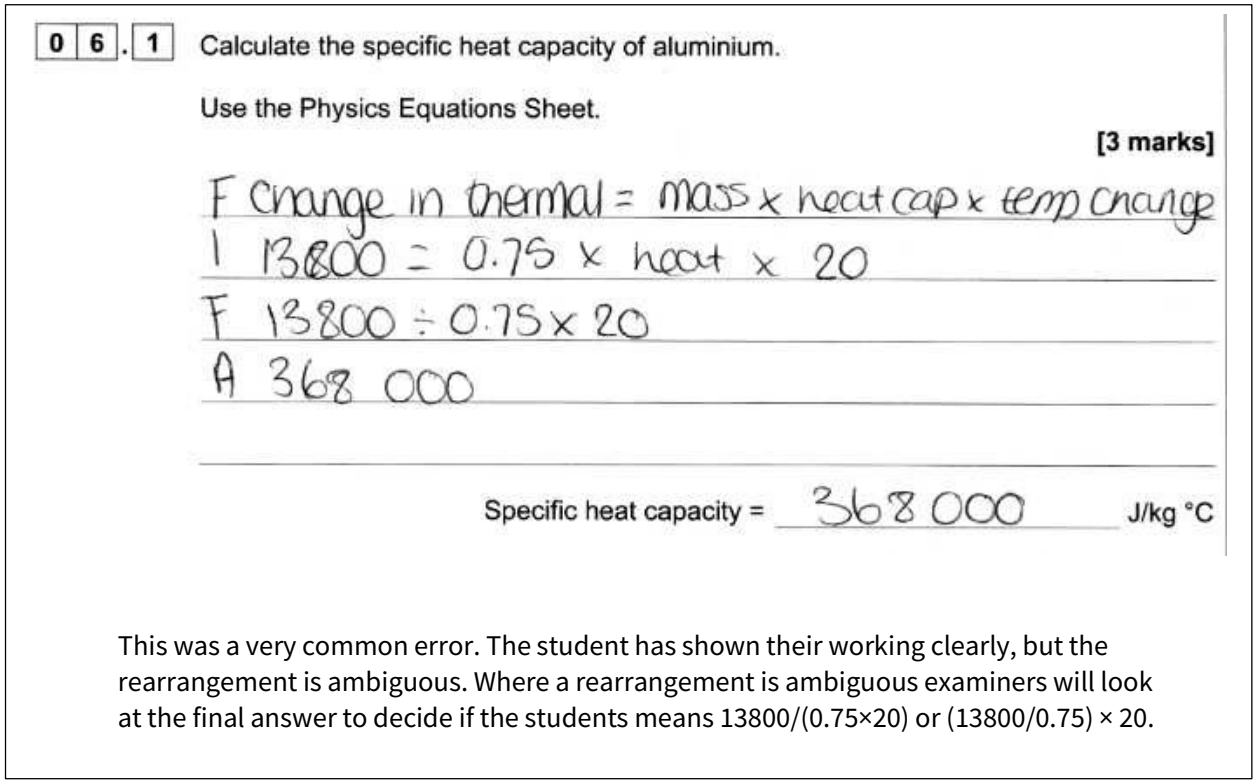
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Answer 25 · Examiner comments

June 2025 | 8464/P/1F | Original Q6

Question 6 (Standard demand)

06.1 This standard demand calculation performed as expected with 40% of students gaining at least one mark. Many students that did a correct substitution found the rearrangement difficult or could not use their calculator correctly



0 6 . 1 Calculate the specific heat capacity of aluminium.

Use the Physics Equations Sheet.

[3 marks]

F change in thermal = mass x heat cap x temp change
I 13800 = 0.75 x heat x 20
F 13800 ÷ 0.75 x 20
A 368 000

Specific heat capacity = 368 000 J/kg °C

This was a very common error. The student has shown their working clearly, but the rearrangement is ambiguous. Where a rearrangement is ambiguous examiners will look at the final answer to decide if the students means 13800/(0.75×20) or (13800/0.75) × 20.

06.2 Students found this question very demanding. Over 20% of students did not attempt the question. 40% of students were able to write something creditworthy. The majority of Level 1 answers gained some credit for suggesting that the temperature could be measured with a thermometer. The 10% of students that wrote Level 2 or 3 answers went on to describe measuring the energy transferred with either a joulemeter or other method and/or measuring mass using a top pan balance.

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6.1.1.1 Energy stores and systems

Answer 25 · Examiner comments June 2025 | 8464/P/1F | Original Q6

0 6 . 2 Describe a method the student could have used to obtain the results in **Table 2**.
[6 marks]

outside the box

1. Calculate the mass in kg of our aluminium block.
2. Set up our electric heater facing the aluminium block and turn it on.
3. Calculate the energy transferred in joules from the heater from what it was before the experiment until after.
4. Measure the temperature change in °C from before the experiment until after.
5. Use these results to calculate our specific heat capacity which is $c = \Delta E \div m \times \Delta\theta$.
6. See the outcome and compare our results on a table.

All of the quantaties to be measured were given in the question, so no credit is given for simply stating that they need to be measured.

0 6 . 2 Describe a method the student could have used to obtain the results in **Table 2**.
[6 marks]

outside box

- Place aluminium on top pan balance to find its mass
- place a thermometer in the aluminium to find its starting temperature
- Connect a power supply and a joulemeter to the aluminium
- leave to aluminium to heat for 5 minutes
- Use thermometer to find its new temperature and joulemeter to find how much energy was needed to increase the temperature.

In this response the students has given the equipment needed and stated what it is measuring.

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6.1.1.1 Energy stores and systems

Answer 25 · Examiner comments June 2025 | 8464/P/1F | Original Q6

Contact us

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