AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 6.1.1.4

Power

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**23**
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.

6.1.1.4 Power

Answer 01 · Mark scheme

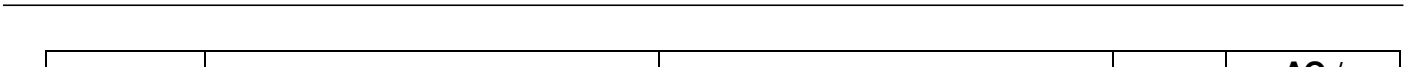
June 2018 | 8464/P/1F | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	biofuel geothermal		1 1	AO1 6.1.3
01.2	it is predictable		1	AO1 6.1.3
01.3	2.8 MW		1	AO2 6.1.3
01.4	any **two** from: • visual pollution • noise pollution • dangerous to birds • may lower house prices		2	AO1 6.1.3
01.5	**Level 2:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.		3–4	AO3 6.1.3
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.		1–2	
	No relevant content		0	
	Indicative content • less fossil fuel burnt • more nuclear fuel used • more renewables used • gas remained the same • less carbon dioxide released • less greenhouse gases • less global warming • less acid rain • less environmental pollution • more hazardous waste produced (nuclear) • the percentage generated by coal has decreased 8% • the percentage generated by renewables has increased by 6% • the percentage generated by nuclear has increased by 2%			
Total			**10**	

6.1.1.4 Power

Answer 01 · Mark scheme

June 2018 | 8464/P/1F | Original Q1



6.1.1.4 Power

Answer 02 · Mark scheme

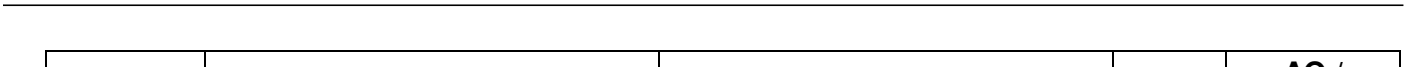
June 2018 | 8464/P/1F | Original Q2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	the store of chemical energy in the battery has reduced		1	AO1 6.2.4.2
02.2		an answer of 7.254 scores **2** marks		
	P = 3.90 × 1.86		1	AO2 6.2.4.1
	P = 7.254	allow 7.25 or 7.3	1	AO2 6.2.4.1
	W		1	AO1 6.2.4.1
02.3	**comparison with compact power source**			AO3 6.2.4.2
	5 times as many charges		1	
	(only) twice the mass	allow (only) twice as heavy as the compact	1	
	comparison with the high capacity power source			
	although half the number of charges		1	
	(only) one third the mass	allow (only) a third as heavy as the high capacity	1	
	or			
	calculation of charge / mass ratio for large power source	allow mass / charge ratio		
	$= \frac{5}{200}$ (1)	$= \frac{200}{5}$		
	= 0.025 (1)	allow 40		
	calculation of charge / mass ratio for high capacity and compact power sources (1)	allow mass / charge ratio		
	charge / mass ratio greatest for large source (1)	allow lowest mass / charge ratio		
Total			**8**	

6.1.1.4 Power

Answer 02 · Mark scheme

June 2018 | 8464/P/1F | Original Q2



6.1.1.4 Power

Answer 03 · Mark scheme

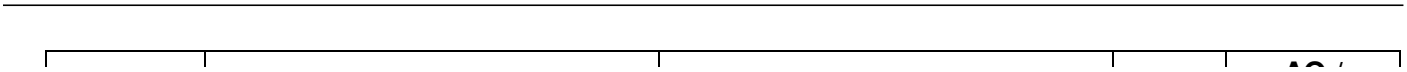
June 2018 | 8464/P/1F | Original Q5

<table>
<tr><th>Question</th><th>Answers</th><th>Extra information</th><th>Mark</th><th>AO / Spec. Ref.</th></tr>
<tr><td>05.1</td><td>gamma</td><td></td><td>1</td><td>AO1
6.4.2.1</td></tr>
<tr><td>05.2</td><td>alpha</td><td></td><td>1</td><td>AO1
6.4.2.1</td></tr>
<tr><td>05.3</td><td>gamma</td><td></td><td>1</td><td>AO1
6.4.2.1</td></tr>
<tr><td>05.4</td><td><table><tr><th>isotope</th><th>number of neutrons</th><th>number of protons</th></tr><tr><td>uranium-238</td><td>146</td><td>92</td></tr><tr><td>thorium-234</td><td>144</td><td>90</td></tr></table></td><td></td><td>1
1</td><td>AO2
6.4.1.2</td></tr>
<tr><td>05.5</td><td>Δθ = 80 °C
E = 150 × 4200 × 80
E = 50 400 000 (J)</td><td>an answer of 50 400 000 scores 3 marks
allow 50 000 000 (J)
allow max 2 marks for correct calculation using incorrect value of Δθ
allow 1 mark for correct calculation using θ = 20 or θ = 100</td><td>1
1
1</td><td>AO2
6.3.2.2</td></tr>
<tr><td>Total</td><td></td><td></td><td>8</td><td></td></tr>
</table>

6.1.1.4 Power

Answer 03 · Mark scheme

June 2018 | 8464/P/1F | Original Q5



6.1.1.4 Power

Answer 04 · Mark scheme

June 2019 | 8464/P/1F | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
01.1	LED		1	AO1.1 AO1 in isolation 6.2.1.1	A
01.2	the same as		1	AO1.1 6.2.1.2	G
01.3	 1500 – 900 600 (thousand)	an answer of 600 (thousand) or 600 000 scores **2** marks two correct readings from the graph scores **1** mark allow a range of 1480 to 1520 and a range of 880 to 920 allow an answer in the range of 560 (thousand) to 640 (thousand) consistent with their allowed readings	 1 1	AO2.2 6.2.1.2 WS 3.2	G
01.4	repeat the experiment using exactly the same method		1	AO3.3a 6.2.1.2	A
01.5	 power = 0.80 × 0.020 power = 0.016 (W)	an answer of 0.016 (W) scores **2** marks	 1 1	AO2.1 6.2.4.1 WS 3.3	E
01.6	power = (current)^2 × resistance		1	AO1.1 AO1 in isolation 6.2.4.1	A
01.7	temperature increases		1	AO1.1 6.1.1.1	E

6.1.1.4 Power

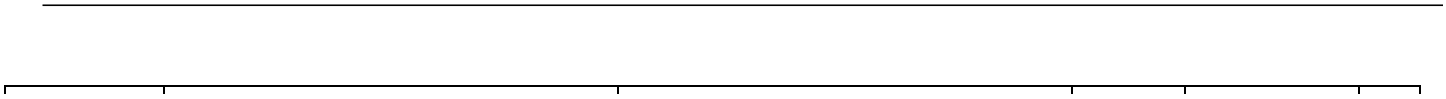
Answer 04 · Mark scheme

01.8	Q = 0.020 × 180 Q = 3.6 (C)	an answer of 3.6 (C) scores **2** marks	1 1	AO2.1 6.2.1.2 WS 3.3	E
Total			**11**		

6.1.1.4 Power

Answer 04 · Mark scheme

June 2019 | 8464/P/1F | Original Q1



6.1.1.4 Power

Answer 05 · 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

6.1.1.4 Power

Answer 05 · Mark scheme

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

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

6.1.1.4 Power

Answer 05 · Mark scheme

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



6.1.1.4 Power

Answer 06 · 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**		

6.1.1.4 Power

Answer 06 · Mark scheme

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

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

6.1.1.4 Power

Answer 07 · Mark scheme

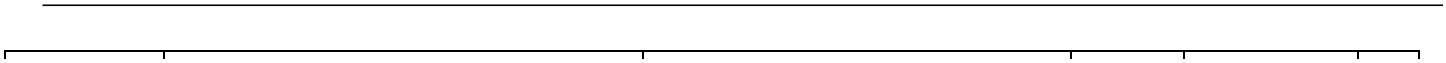
June 2019 | 8464/P/2F | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
05.1	velocity frequency wavelength		1 1 1	AO1 6.6.2.3	G
05.2	so people are not exposed to (as much) gamma radiation because gamma radiation can damage human tissue	allow less gamma radiation reaches the Earth's surface allow increases the risk of cancer or (cell) mutation allow gamma rays are ionising ignore any reference to temperature / heating of the atmosphere	1 1	AO1 6.6.2.3	E
05.3	(microwaves) are used in (satellite) communications	ignore any reference to temperature / heating of the atmosphere	1	AO2 6.6.2.4	E
05.4	can cause skin cancer / premature ageing	allow sunburn allow eye / skin damage cancer on its own is insufficient	1	AO1 6.6.2.3	E
05.5	risk from UV radiation is highest in July / summer two correct readings from the bar chart which support their comparison	allow any sensible comparison of named months / seasons if no other mark scored, two correct readings from the graph scores **1** mark	1 1	AO3 6.6.2.3	E
Total			**9**		

6.1.1.4 Power

Answer 07 · Mark scheme

June 2019 | 8464/P/2F | Original Q5



6.1.1.4 Power

Answer 08 · Mark scheme

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

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

6.1.1.4 Power

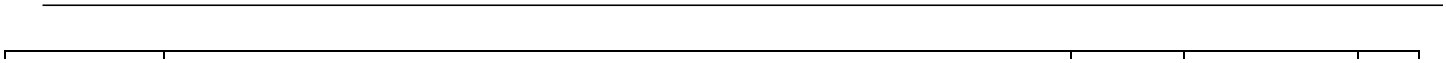
Answer 08 · Mark scheme

Total			**11**		

6.1.1.4 Power

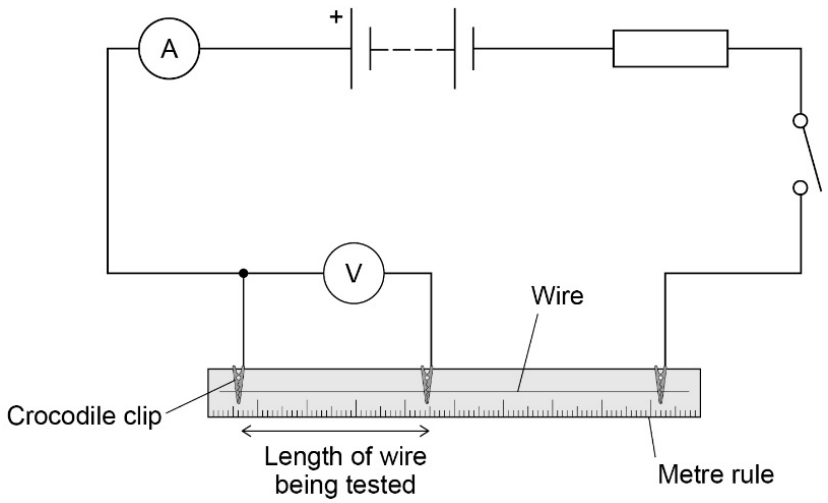
Answer 08 · Mark scheme

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



6.1.1.4 Power

Answer 09 · Mark scheme November 2020 | 8464/P/1F | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	both symbols correct and in the correct position  		1	AO1 6.2.1.3 6.2.1.4 RPA 15
01.2	the length of the wire being tested		1	AO1 6.2.1.3 RPA 15
01.3	the resistance of the wire		1	AO1 6.2.1.3 RPA 15
01.4	mean p.d. = $\frac{0.16 + 0.17 + 0.15}{3}$ mean p.d. = 0.16 (V)		1 1	AO2 6.2.1.3 RPA 15
01.5	R = 0.32/0.50 R = 0.64 (Ω)		1 1	AO2/1 6.2.1.3 6.2.1.3 RPA 15

6.1.1.4 Power

Answer 09 · Mark scheme

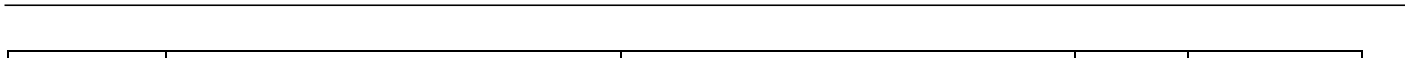
November 2020 | 8464/P/1F | Original Q1

01.6	power = 0.32 × 0.50 power = 0.16 (W)		1 1	AO2 6.2.4.1
01.7	charge flow = 0.50 × 17 8.5 (C)		1 1	AO2 6.2.1.2
01.8	a straight line through the origin with a lower gradient		1	AO1/2 6.2.1.3 RPA 15
Total			**12**	

6.1.1.4 Power

Answer 09 · Mark scheme

November 2020 | 8464/P/1F | Original Q1



6.1.1.4 Power

Answer 10 · 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

6.1.1.4 Power

Answer 10 · Mark scheme

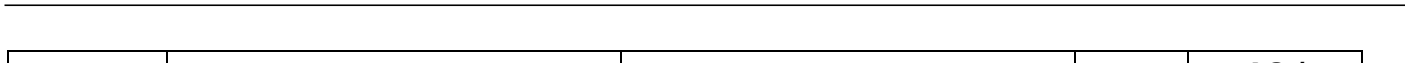
November 2021 | 8464/P/1F | Original Q2

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

6.1.1.4 Power

Answer 10 · Mark scheme

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



6.1.1.4 Power

Answer 11 · Mark scheme November 2021 | 8464/P/1F | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1			1	AO1 6.2.1.1
03.2	the flow of electrical charge		1	AO1 6.2.1.2
03.3	all 4 components connected in a series circuit	allow a cell instead of a battery allow an LED or LDR symbol instead of a lamp ignore the + sign on the battery symbol	1	AO3 6.2.1.1 6.2.2
03.4	decrease the resistance of the variable resistor		1	AO1 6.2.1.3
03.5	P = 0.75 × 0.16 P = 0.12 (W)		1 1	AO2 6.2.4.1
03.6	charge flow = current × time Q = It		1	AO1 6.2.1.2

6.1.1.4 Power

Answer 11 · Mark scheme

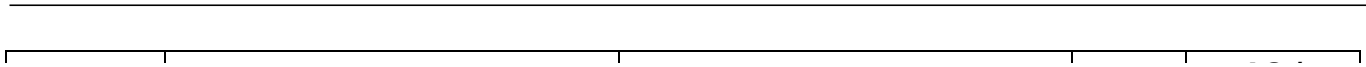
November 2021 | 8464/P/1F | Original Q3

03.7	200 mA = 0.2 A charge flow = 0.2 × 15 charge flow = 3.0 (C)	 allow a correct substitution using an incorrectly/not converted value for current allow a correct calculation using an incorrectly/not converted value for current	1 1 1	AO2 6.2.1.2
03.8	1.6		1	AO3 6.2.1.2
03.9	260 mA to 380 mA		1	AO2 6.2.1.2
Total			**12**	

6.1.1.4 Power

Answer 11 · Mark scheme

November 2021 | 8464/P/1F | Original Q3



6.1.1.4 Power

Answer 12 · 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

6.1.1.4 Power

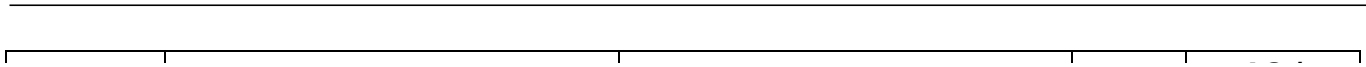
Answer 12 · Mark scheme

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**	

6.1.1.4 Power

Answer 12 · Mark scheme

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



6.1.1.4 Power

Answer 13 · Mark scheme

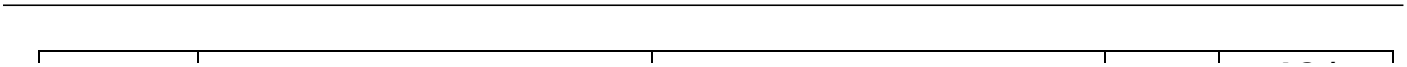
November 2021 | 8464/P/1F | Original Q5

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**	

6.1.1.4 Power

Answer 13 · Mark scheme

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



6.1.1.4 Power

Answer 14 · Mark scheme

June 2022 | 8464/P/1F | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	16 500(GW) **and** 30 000 (GW) read from graph		1	AO3 6.1.3
	percentage = $\frac{16500}{30000}$ (×100%)	allow a correct substitution using a value of 15300 or 18000 for gas	1	
	percentage = 55 (%)	allow an answer consistent with a value of 15300 or 18000 for gas	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	coal and gas		1	AO1.1 6.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	the national grid		1	AO1 6.2.4.3

6.1.1.4 Power

Answer 14 · Mark scheme

June 2022 | 8464/P/1F | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	potential difference increases current is reduced so there is less / low energy loss (to the surroundings)	allow large potential difference allow small current allow less / low heating in the transmission cables ignore resistance do **not** allow no energy loss	1 1 1	AO1 6.2.4.3

Total Question 5		**8**

Answer 15 · 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

6.1.1.4 Power

Answer 15 · Mark scheme

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

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	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

6.1.1.4 Power

Answer 15 · 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**

6.1.1.4 Power

Answer 16 · Mark scheme

June 2022 | 8464/P/2F | Original Q2

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	any **one** from: • stand up • use a funnel • pour water slowly • pour at arms-length • wear heat-proof gloves	gloves on its own is insufficient allow do not touch hot objects (with bare hands)	1	AO3 6.6.2

Question	Answers	Mark	AO / Spec. Ref.
02.2	**Level 2:** The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	3–4	AO1 6.6.2.2
	Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2	
	No relevant content	0	
	Indicative content • use the kettle to heat the water • use measuring cylinder to measure volume of water • same volume of water in each flask • use the thermometer to measure temperature of the water • ensure temperature is the same in each flask • infrared detector the same distance from each flask • use the infrared detector to measure the power of infrared radiation from each flask and compare results		

6.1.1.4 Power

Answer 16 · Mark scheme

June 2022 | 8464/P/2F | Original Q2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	as time increases the power decreases the change (in power) each 60s decreases as the time increases	 allow rate of decrease of power decreases	1 1	AO3 6.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	4.4 W		1	AO3 6.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	any **one** from: • all surfaces will be at the same temperature • temperature of the water does not need to be measured • more surfaces can be tested • the procedure only needs to be done once • volume of water does not need to be measured	allow different surfaces can be tested at the same time	1	AO3 6.2.2

6.1.1.4 Power

Answer 16 · Mark scheme

June 2022 | 8464/P/2F | Original Q2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	measurements can be taken at the same time results will be more accurate	allow no need to move the detectors / cube	1 1	AO3 6.2.2

Total Question 2		11

6.1.1.4 Power

Answer 17 · Mark scheme

June 2023 | 8464/P/1F | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1			1	AO1 6.2.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	charge		1	AO1 6.2.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	place the component / thermistor in the water / beaker		1	AO3 6.2.1.4
	record the temperature (of the water) using the thermometer	allow place the thermometer in the water / beaker and record the temperature	1	
	record / measure the resistance (using the resistance meter)		1	
	change the temperature of the water (using the kettle) and repeat the measurements (of temperature and resistance)		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	non-linear		1	AO1 6.2.1.4

6.1.1.4 Power

Answer 17 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	(resistance changes from) 200 (Ω) to 80 (Ω) change in resistance = 120 (Ω)		1 1	AO2 6.2.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.6	power = potential difference × current or $P = V I$		1	AO1 6.2.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.7	$2900 = 230 \times I$ $I = \frac{2900}{230}$ I = 12.6… (A)	 allow 13 (A)	1 1 1	AO2 6.2.4.1

Total Question 4	**13**

6.1.1.4 Power

Answer 18 · 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 18 · 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**

6.1.1.4 Power

Answer 19 · Mark scheme

June 2024 | 8464/P/1F | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	the current in both lamps is the same		1	AO1 6.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	(4.5 – 1.5 =) 3 (V)	allow (4.5 – 1.5 =) 3.0 (V)	1	AO2 6.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	$P = 1.5 \times 1.2$ 1.8 (W)		1 1	AO2 6.2.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	$R = \frac{1.5}{1.2}$ 1.25 (Ω)	allow 1.3 (Ω)	1 1	AO2 6.2.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	$Q = 1.2 \times 40$ 48 (C)		1 1	AO2 6.2.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.6	the temperature of each lamp increases		1	AO1 6.2.1.4

6.1.1.4 Power

Answer 19 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.7	lamp **X** no longer emits light because the circuit is no longer complete	 dependent on MP1 allow because there is no current	1 1	AO3 6.2.2

Total Question 1	**11**

6.1.1.4 Power

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

6.1.1.4 Power

Answer 20 · Mark scheme

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

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

6.1.1.4 Power

Answer 21 · Mark scheme

June 2025 | 8464/P/1F | Original Q2

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	symbols for filament lamp, ammeter and cell used a simple complete series circuit	allow **1** mark for 2 correct circuit symbols MP3 dependent on scoring at least **1** other mark	2 1	AO1 6.2.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	cell		1	AO1 6.2.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	$Q = 1.5 \times 30$ $Q = 45$ (C)		1 1	AO2 6.2.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	$R = \frac{12}{1.5}$ $R = 8$ Ω	 allow 8.0 allow ohms	1 1 1	AO2 AO2 AO1 6.2.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	as potential difference increases, the current increases non-linear relationship	 allow at a decreasing rate	1 1	AO3 6.2.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	(resistance) increases		1	AO1 6.2.1.4

Question	Answers	Mark	AO / Spec. Ref.
02.7	**Level 2:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	3–4	AO3
	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 6.2.4.2
	No relevant content	0	
	Indicative content • both types of bulb have equal brightness • the same number of bulbs are needed • LED bulbs do not need to be replaced as often **power comparison** • the input power of filament lamp is greater • the input power of the filament lamp is 32 W greater • the input power of filament lamp is 5 times greater • the brightness per watt for the LED bulb is 100 arbitrary units • the brightness per watt for the filament lamp is 20 arbitrary units **consequence** • LED bulb transfers less energy • (number of units of) electricity used is lower for LED bulb • LED bulb wastes less energy • LED bulb running costs are lower • the LED bulb is more efficient • the LED bulb is 5 times more efficient for **Level 2** answers must include a valid calculation		

Total Question 2	**16**

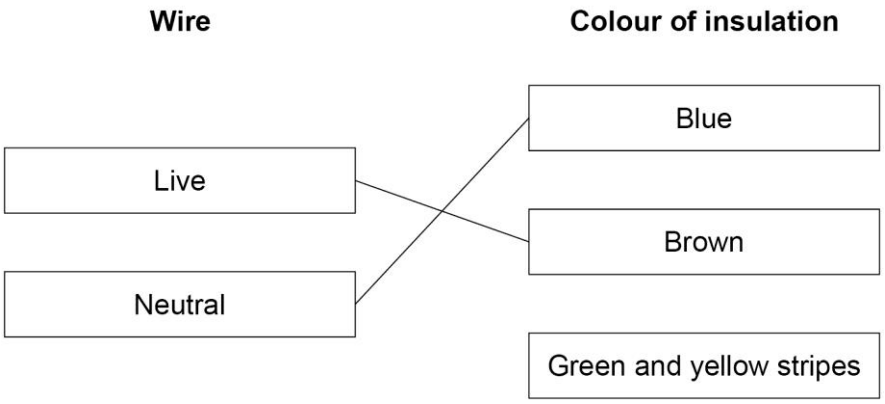
6.1.1.4 Power

Answer 22 · 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

6.1.1.4 Power

Answer 22 · Mark scheme

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

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	2100 = 230 × *I*		1	AO2 6.2.4.1
	$I = \frac{2100}{230}$		1	
	I = 9.13…		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 × *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 = $\frac{75\,600}{84\,000}$ × 100 (1)			
	efficiency = 90% (1)			

6.1.1.4 Power

Answer 22 · Mark scheme

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

6.1.1.4 Power

Answer 23 · 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

6.1.1.4 Power

Answer 23 · 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

6.1.1.4 Power

Answer 04 · Examiner comments

June 2019 | 8464/P/1F | Original Q1

Question 1 (Low demand)

01.1 Slightly below 60% of students recognised the LED in this question.

01.2 Around 33% of students knew that the circuit in the diagram is series circuit, so the current is the same through both components.

01.3 More than half of all students gained both marks. Many who did not score appeared to have read the scale of the graph incorrectly, for example reading 850 thousand and 1450 thousand steps when they should have read 900 thousand and 1500 thousand steps.

01.4 Almost 70% of students knew that checking repeatability requires repeating with the same method.

01.5 A simple calculation using a given formula was well answered with slightly less than 90% of students showing clear working and gaining both marks.

01.6 Fewer than 30% of students knew the formula relating power, current and resistance.

01.7 Almost 90% of students knew that a current would increase the temperature of the resistor.

01.8 This straightforward calculation using a given equation was done well, with clear working shown. Over 90% scored both marks. Some students, however, converted 180 seconds to minutes before calculating the answer.

6.1.1.4 Power

Answer 05 · 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 06 · 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

6.1.1.4 Power

Answer 06 · 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 10 · 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.

6.1.1.4 Power

Answer 11 · Examiner comments — November 2021 | 8464/P/1F | Original Q3

Question 3 (Low/standard demand)

03.1 Slightly over half the students knew the symbol for a filament lamp.

03.2 Nearly three quarters of all students answered this correctly.

Answer 11 · Examiner comments — November 2021 | 8464/P/1F | Original Q3

03.3 This question was testing whether students were able to draw four components in series. A complete circuit was needed, with no gaps around the components. Many students drew the components at right angles to the wires, and therefore not connected into the circuit. Students were given the symbols in the question, and were expected to draw them correctly, so those who drew a line through the middle of the ammeter, for example, did not gain the mark. Roughly 45% of students gained this mark, with almost 10% not attempting the question at all.

03.4 Just over 40% of students answered correctly, with more than a third opting to place an additional ammeter in the circuit.

03.5 Over 90% gained both marks.

03.6 Just under half the students correctly recalled the equation, but almost 1 student in 8 did not attempt to answer.

03.7 A fair proportion of students attempted to convert 15 seconds into minutes, and then multiplied this by 200, gaining no marks. It was uncommon for students to attempt to convert milliamps into amps. Just over half of all students gained at least 2 marks.

03.8 Many students struggled to answer this question, and less than a quarter of students answered correctly.

03.9 Around than one in ten students selected the correct answer. Roughly a third of students selected the third option, suggesting that the vast majority of these students were not familiar with the ± symbol.

6.1.1.4 Power

Answer 12 · 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 12 · 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.

6.1.1.4 Power

Answer 13 · 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.

6.1.1.4 Power

Answer 14 · Examiner comments

Question 05 (Standard demand)

05.1 About 15% of students gained all three marks on this question, with around 80% failing to score any marks. Nearly a fifth of students did not attempt this question.

Errors were made reading the graph, with a fair number of students misreading the scale to obtain an incorrect peak value for gas, leading to a maximum mark of 2 on this question. It was common for students to think that the peak value of demand was the maximum value on the y-axis, which prevented any marks from being scored. Some students tried to determine the total supply and demand at 6 pm, which resulted in no marks being awarded.

05.2 Over half the students chose the correct energy resources.

05.3 Just over one in ten students recalled the name of the national grid. Nearly a quarter of students did not attempt this question.

Many students thought that the question was referring to a wifi signal, a mobile phone signal, or the internet. In many cases this led them to try to answer question **05.4** by also writing about mobile phone networks or wifi signals, which they were unable to do successfully. Some students gave answers such as national power grid, or national electricity grid, which did gain the mark.

05.4 Only slightly over 5% of students gained any marks at all on this question. Over a quarter of students did not attempt the question.

There was a clear misconception among many students that greater efficiency referred to increased rate of delivery of electricity. It was not uncommon for students to suggest that a step-up transformer increases the speed of the current so that electricity can get to consumers more quickly. Some students thought that a step up transformer physically lifted the cables up above the ground. It was reasonably common for students to suggest that step up transformers were positioned high above the ground to ensure better network coverage, or that they give a better signal with fewer connection issues, which seemed to correspond with responses to question **05.3** about mobile phone networks or Wi-Fi networks.

Answer 15 · 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 $P = E / t$.

6.1.1.4 Power

Answer 15 · Examiner comments

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.

6.1.1.4 Power

Answer 15 · Examiner comments

Mark Ranges and Award of Grades

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

6.1.1.4 Power

Answer 16 · Examiner comments

June 2022 | 8464/P/2F | Original Q2

Question 2 (Low demand)

02.1 Approximately 40% of students were able to suggest a way to reduce the risk of burning. Many incorrect answers suggested wearing gloves – unqualified, this is insufficient, as some gloves would not offer any protection. Other incorrect answers were impractical, such as full insulation suits.

02.2 This question on describing a practical was reasonably well answered. Over two thirds of students wrote answers that contained relevant content and scored marks. The answers that failed to make it into level two did not describe the use of all the equipment, or were vague, suggesting using measuring the temperature, but not stating that this is done using the thermometer. Many answers failed to include the use of the measuring cylinder. 25% of students' answers were judged to be in level two, so their methods would have led to a valid outcome

02.3 Over 75% of students were able to describe the power decreasing as the time increased. Very few students were able to describe the amount power decreased each minute getting less, as only approximately 5% of students were awarded 2 marks.

02.4 Approximately 50% of students were able to interpret the data and identify the most likely value for the power.

02.5 Only 20% of students were able to give an advantage of the Leslie Cube. Most answers were very vague with simple statements like 'it's easier'.

02.6 Approximately 45% of students scored at least one mark on this question. The most common correct answer was 'more accurate'. 5% of students scored two marks on this question.

6.1.1.4 Power

Answer 17 · Examiner comments

June 2023 | 8464/P/1F | Original Q4

Question 04 (Low demand and standard demand)

04.1 Slightly more than half the students correctly chose the thermistor, with the variable resistor being the most common incorrect answer.

04.2 Just under 40% of students recognised that current is a flow of charge. The most common answer was that current is a flow of energy, which did not gain any credit.

04.3 About 60% of students scored at least 1 mark on this question, but less than one in ten students gained full marks. Many students just put the thermistor near to the beaker of water or near to the kettle, so that recording the resistance would not give a relevant measurement. Some measured the resistance of the water rather than the resistance of the thermistor. It was not uncommon for students to pour the iced water or boiling water on the ground and then put the thermistor in the ground. Few students organised their answer into a logical sequence.

04.4 Over 40% of students correctly identified the trend as non-linear.

04.5 About half of the students gained both marks for this calculation, with the majority of the remaining students gaining no credit. Many of those who did not score calculated the change in temperature rather than referring to Figure 5 and determining the change in resistance.

04.6 Only about 85% of students correctly wrote down the equation, despite the equation being given on the Equation Sheet this year. Over 5% of students did not attempt this question.

04.7 Nearly 70% of students scored at least one mark, with about 65% gained full marks for this calculation.

6.1.1.4 Power

Answer 18 · 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.

6.1.1.4 Power

Answer 19 · Examiner comments

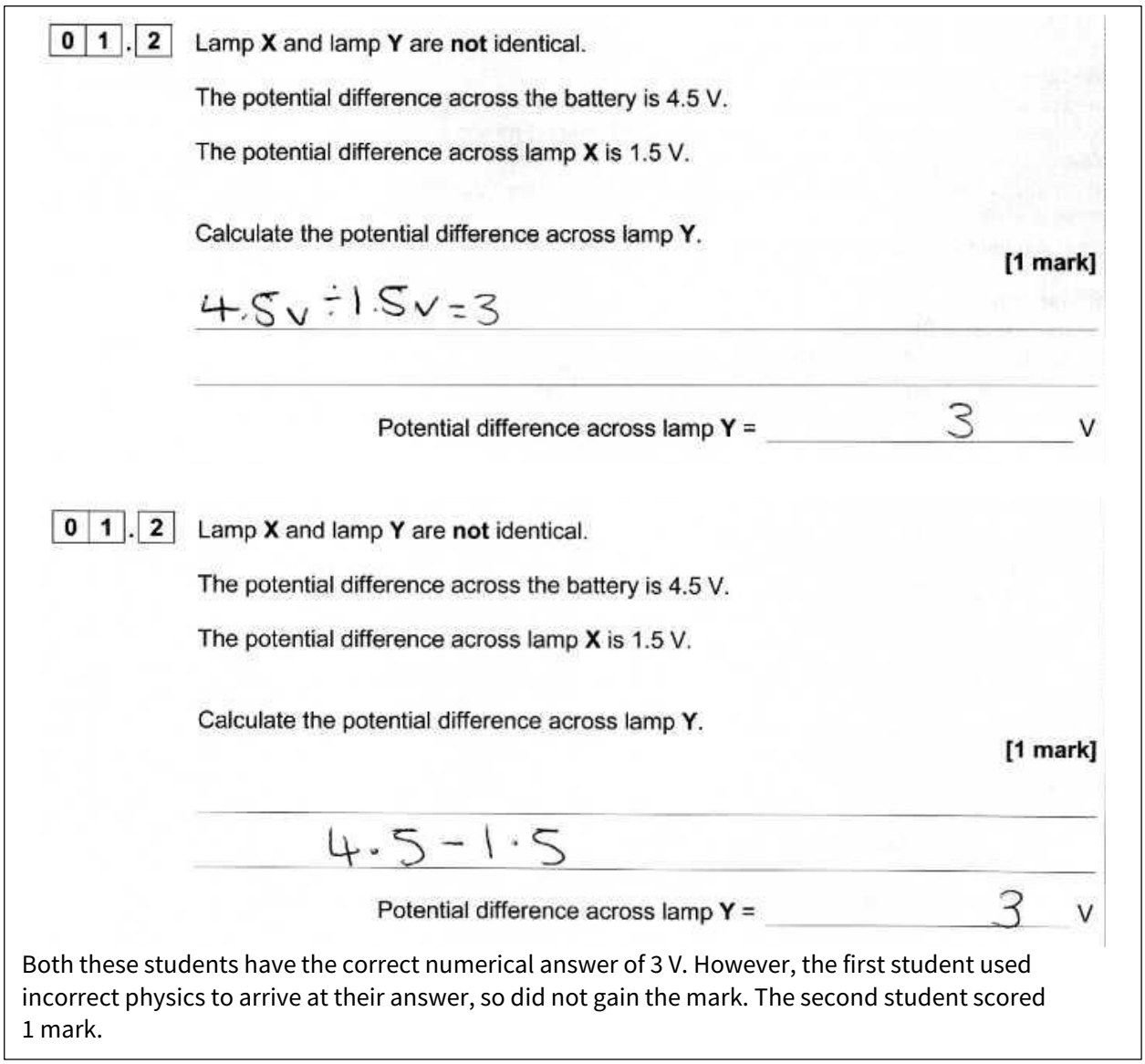
June 2024 | 8464/P/1F | Original Q1

Question 1 (low demand)

01.1 Roughly half of all students recognised that the current in two lamps connected in series is the same.

01.2 Approximately 1 in 2 students answered this question correctly.

Students who demonstrated that they had arrived at the answer of 3.0 V by using incorrect physics did not score this mark. This included those who divided 4.5 V by 1.5 V, and, less commonly, those who calculated a mean of 4.5 V and 1.5 V. If a student gave the correct answer without showing their reasoning, it was assumed that they had used correct physics and the mark was awarded.



0 1 . 2 Lamp **X** and lamp **Y** are **not** identical.

The potential difference across the battery is 4.5 V.

The potential difference across lamp **X** is 1.5 V.

Calculate the potential difference across lamp **Y**.

[1 mark]

4.5v ÷ 1.5v = 3

Potential difference across lamp **Y** = 3 V

0 1 . 2 Lamp **X** and lamp **Y** are **not** identical.

The potential difference across the battery is 4.5 V.

The potential difference across lamp **X** is 1.5 V.

Calculate the potential difference across lamp **Y**.

[1 mark]

4.5 - 1.5

Potential difference across lamp **Y** = 3 V

Both these students have the correct numerical answer of 3 V. However, the first student used incorrect physics to arrive at their answer, so did not gain the mark. The second student scored 1 mark.

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6.1.1.4 Power

Answer 19 · Examiner comments June 2024 | 8464/P/1F | Original Q1

01.3 This question was generally very well answered, with around 90% of students able to substitute into the equation and calculate the correct answer.

01.4 Nearly 85% of all students calculated the correct resistance and gained both marks.

01.5 The majority of students gained full marks on this question.

A common mistake was to divide the 40 seconds by 100, before using the time in the equation given. Students who made this error arrived at an incorrect answer but could still gain a mark if their answer was consistent with the current multiplied by their time.

01.6 Slightly less than a third of students recognised that the resistance of a filament lamp increases because the temperature increases. The most common incorrect answer was from students who stated that the power of the battery increases to cause the resistance of the lamp to increase.

01.7 Approximately 35% of students identified that lamp X would no longer emit light if lamp Y breaks, with a high proportion of students selecting that lamp X would get brighter. Approximately 2 in 5 of those students who selected the correct answer were able to articulate a valid reason for this.

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Answer 20 · Examiner comments

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

Question 6 (standard demand)

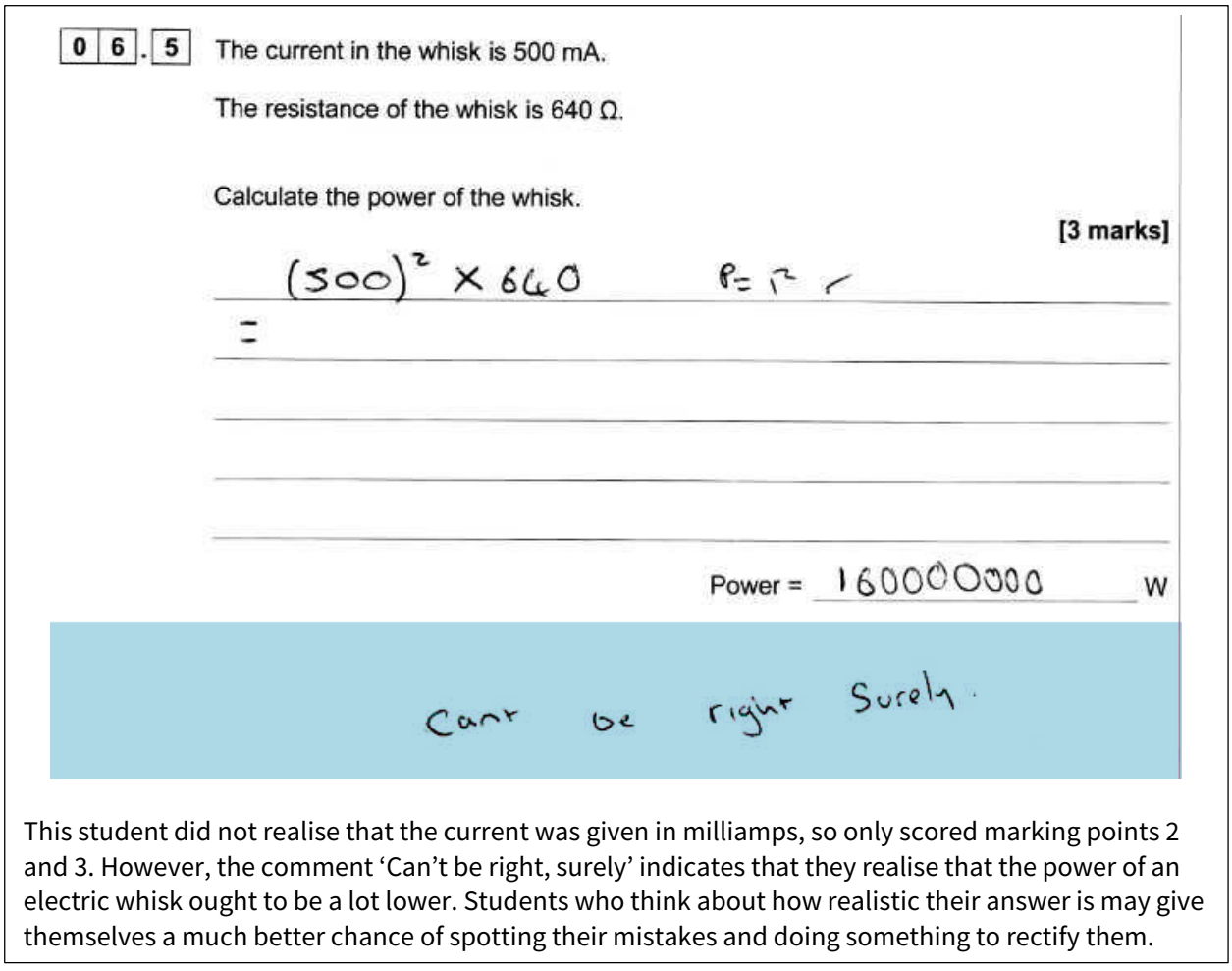
06.1 Roughly two-thirds of students gained at least 1 mark on this question, with about half of these gaining both marks. The most common incorrect answers were an increase in electrical energy and an increase in chemical energy.

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

Cant be right Surely.

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

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

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

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6.1.1.4 Power

Answer 21 · Examiner comments

Question 2 (Low demand)

02.1 This question discriminated well and produced a good spread of marks. 35% of students gained 3 marks for selecting the correct circuit symbols and drawing a simple complete series circuit. 70% of students made one error and were awarded 2 marks. Most of the students that scored 2 marks selected an incorrect circuit symbol, but some did select them correctly but could not draw a simple complete series circuit. 10% of students gained 1 mark for 2 correct circuit symbols.

02.2 65% of students correctly identified the cell as the source of energy for the circuit.

02.3 This low demand calculation was well answered with 90% of students gaining both marks. Some students did an unusual conversion of time, dividing 30 by 100.

02.4 85% of students correctly calculated the resistance of the filament lamp and gained both calculation marks. The unit mark was awarded independently, and 60% of students selected the correct unit.

02.5 65% of students gained a mark for describing the current increasing as the potential difference increases. Only a small number of students described the relationship as being non-linear.

02.6 Only 30% of students described the resistance of the filament lamp increasing as the temperature increases.

02.7 This question discriminated well and produced a good spread of marks. Approximately 50% of students wrote Level 2 responses and gained either 3 or 4 marks. 40% of students wrote Level 1 responses because they did not include a calculation. Only a very small number of students did not write anything creditworthy, and a very small number did not attempt the question.

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Answer 22 · Examiner comments

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

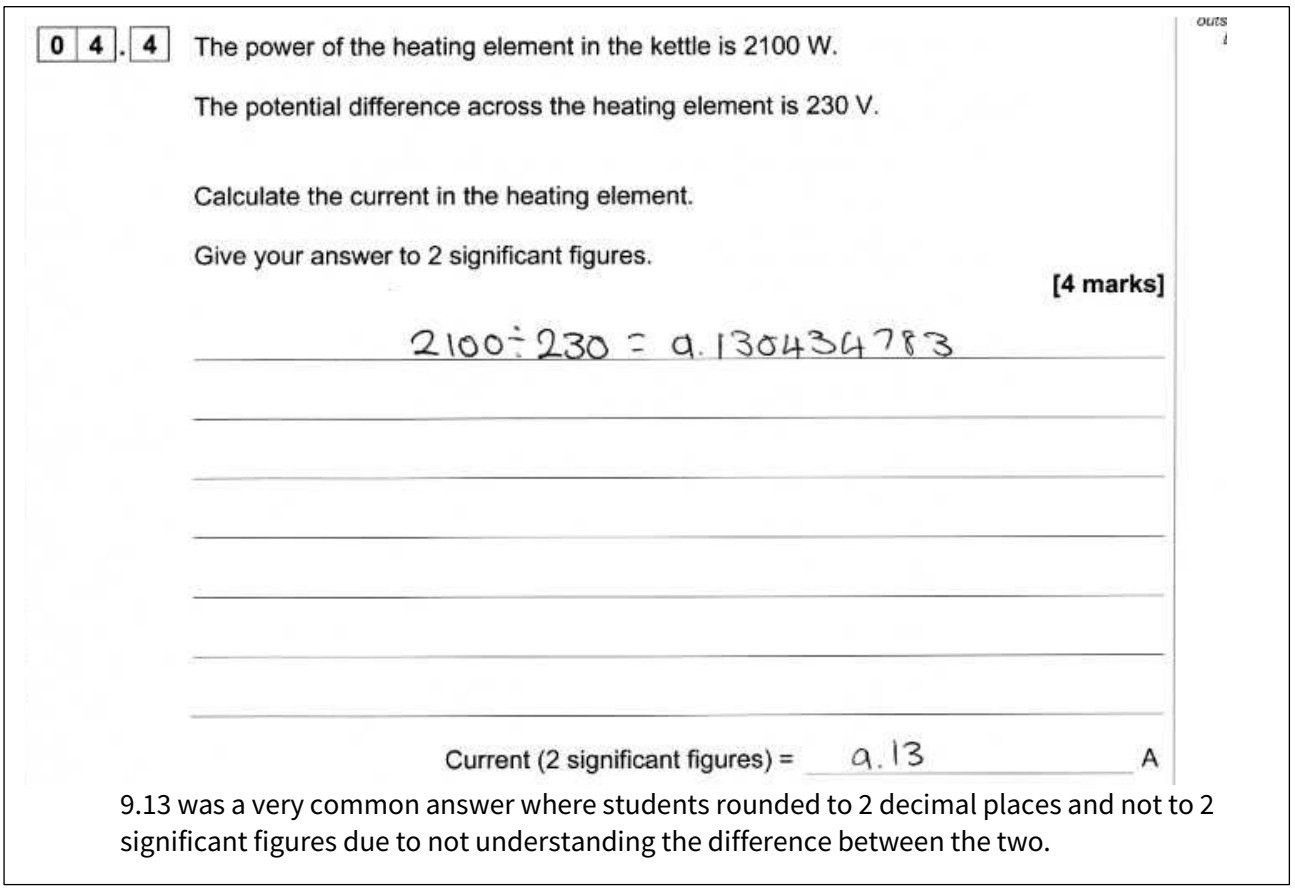
Question 4 (Low and standard demand)

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

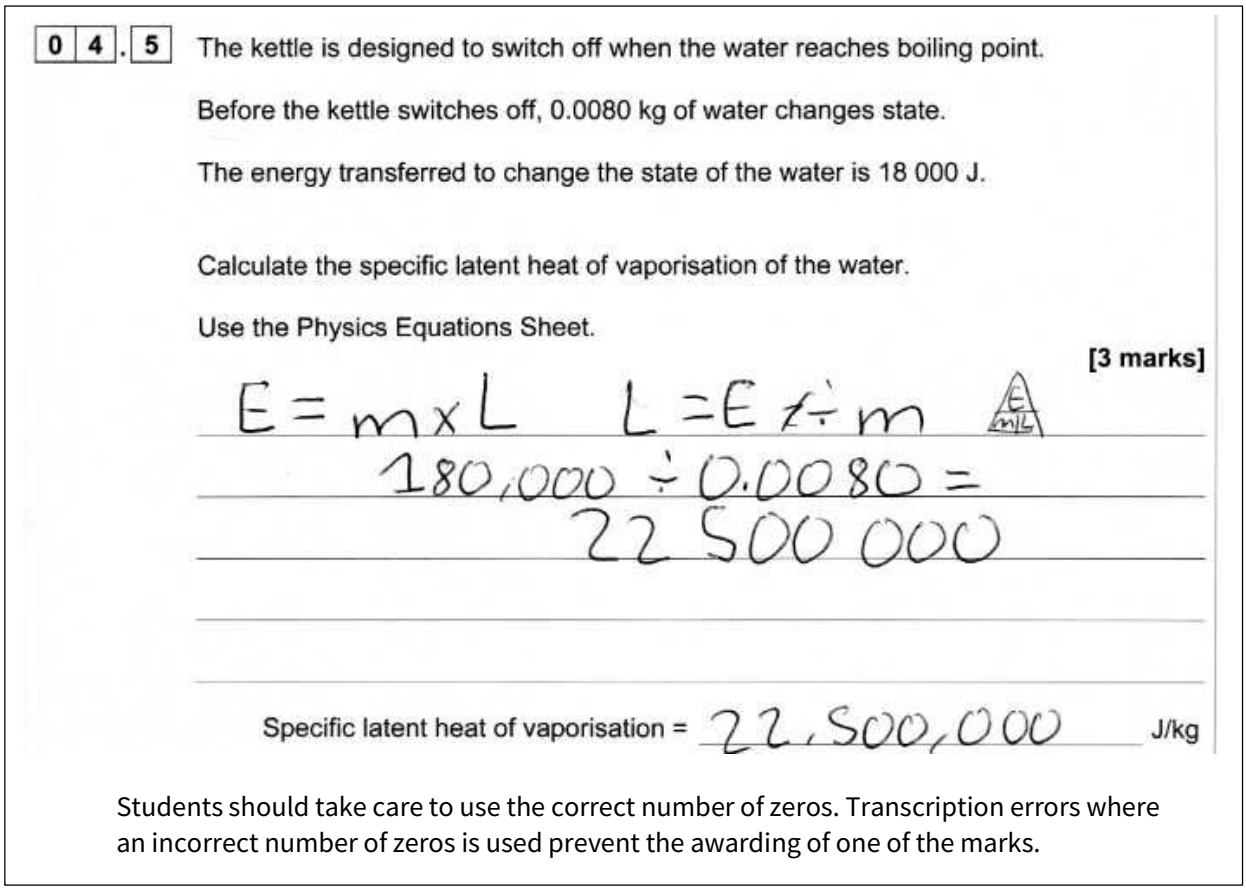
9.13 was a very common answer where students rounded to 2 decimal places and not to 2 significant figures due to not understanding the difference between the two.

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6.1.1.4 Power

Answer 22 · 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 23 · 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.

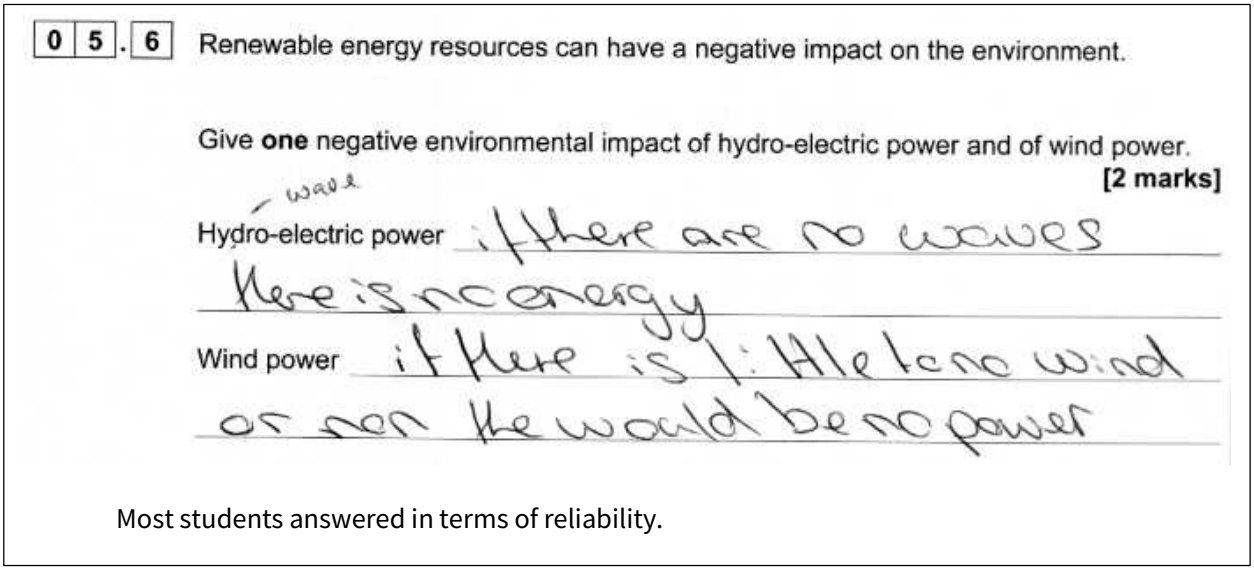
05.2 This question was not well answered, with only approximately 20% of students answering correctly.

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 (wave) there is no energy

Wind power if there is little no wind or non the would be no power

Most students answered in terms of reliability.

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