AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 6.2.4.2

Energy transfers in everyday appliances

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**8**
Available paper years	**2018–2024**

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.

6.2.4.2 Energy transfers in everyday appliances

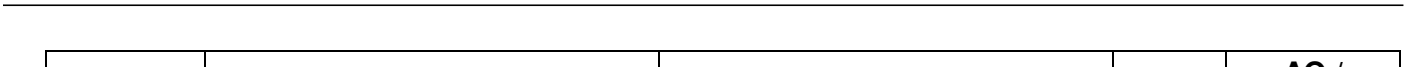
Answer 01 · Mark scheme June 2018 | 8464/P/1F | Original Q2

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 $= \frac{5}{200}$ (1)	allow mass / charge ratio $= \frac{200}{5}$		
	= 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**	

6.2.4.2 Energy transfers in everyday appliances

Answer 01 · Mark scheme

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



6.2.4.2 Energy transfers in everyday appliances

Answer 02 · 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

6.2.4.2 Energy transfers in everyday appliances

Answer 02 · Mark scheme

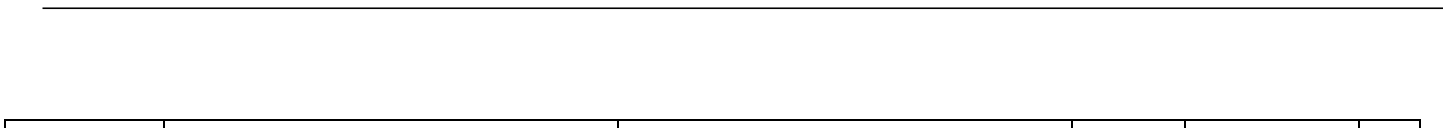
June 2019 | 8464/P/1F | Original Q2

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

6.2.4.2 Energy transfers in everyday appliances

Answer 02 · Mark scheme

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



6.2.4.2 Energy transfers in everyday appliances

Answer 03 · Mark scheme June 2019 | 8464/P/1F | Original Q5

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

6.2.4.2 Energy transfers in everyday appliances

Answer 03 · Mark scheme

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

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

6.2.4.2 Energy transfers in everyday appliances

Answer 04 · Mark scheme November 2020 | 8464/P/1F | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	it can be replenished as it is used		1	AO1 6.1.3
03.2	biomass – renewable nuclear – Non-renewable natural gas – Non-renewable Energy resource / Renewable / Non-renewable Biomass / ✓ / Nuclear / / ✓ Natural gas / / ✓	all 3 correct allow 1 mark for two correct answers	2	AO1 6.1.3
03.3	kinetic chemical	answers must be in the correct order	1 1	AO2 6.1.1.1
03.4	less energy is needed to heat the house the roof is a better insulator		1 1	AO3 6.1.2.1
03.5	E = 26 000 × 30 780 000 (J)		1 1	AO2 6.1.1.4 6.2.4.2
03.6	efficiency = $\frac{\text{useful power output}}{\text{total power input}}$		1	AO1 6.1.2.2

6.2.4.2 Energy transfers in everyday appliances

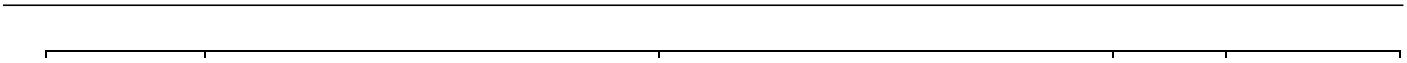
Answer 04 · Mark scheme

03.7	$0.15 = \frac{\text{useful power output}}{26000}$ useful power output = 26000 × 0.15 useful power output = 3900 (W)		1 1 1	AO2 6.1.2.2
03.8	sometimes it is not sunny/windy so there's more chance of electricity being generated at any time **OR** more electricity is generated (1) which reduces the running costs (of the eco-home) (1)	if no other mark scored, allow a reference to reduced greenhouse gas emissions or reduced global warming for 1 mark	1 1	AO3 6.1.3
Total			**15**	

6.2.4.2 Energy transfers in everyday appliances

Answer 04 · Mark scheme

November 2020 | 8464/P/1F | Original Q3



6.2.4.2 Energy transfers in everyday appliances

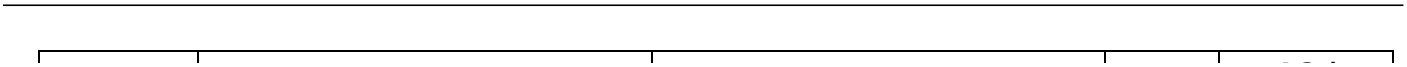
Answer 05 · Mark scheme November 2021 | 8464/P/1F | Original Q5

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**	

6.2.4.2 Energy transfers in everyday appliances

Answer 05 · Mark scheme

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



6.2.4.2 Energy transfers in everyday appliances

Answer 06 · 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

6.2.4.2 Energy transfers in everyday appliances

Answer 06 · 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

6.2.4.2 Energy transfers in everyday appliances

Answer 06 · 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**

6.2.4.2 Energy transfers in everyday appliances

Answer 07 · 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 × 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 × 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

6.2.4.2 Energy transfers in everyday appliances

Answer 07 · Mark scheme

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

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

6.2.4.2 Energy transfers in everyday appliances

Answer 08 · 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

6.2.4.2 Energy transfers in everyday appliances

Answer 08 · 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**

6.2.4.2 Energy transfers in everyday appliances

Answer 02 · 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 03 · Examiner comments June 2019 | 8464/P/1F | Original Q5

Question 5

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

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

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

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

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

6.2.4.2 Energy transfers in everyday appliances

Answer 03 · Examiner comments June 2019 | 8464/P/1F | Original Q5

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

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

Answer 05 · 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.

6.2.4.2 Energy transfers in everyday appliances

Answer 06 · 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 $P = E / t$.

6.2.4.2 Energy transfers in everyday appliances

Answer 06 · 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.

Mark Ranges and Award of Grades

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

6.2.4.2 Energy transfers in everyday appliances

Answer 07 · 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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6.2.4.2 Energy transfers in everyday appliances

Answer 07 · 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 08 · Examiner comments

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

Question 6 (standard demand)

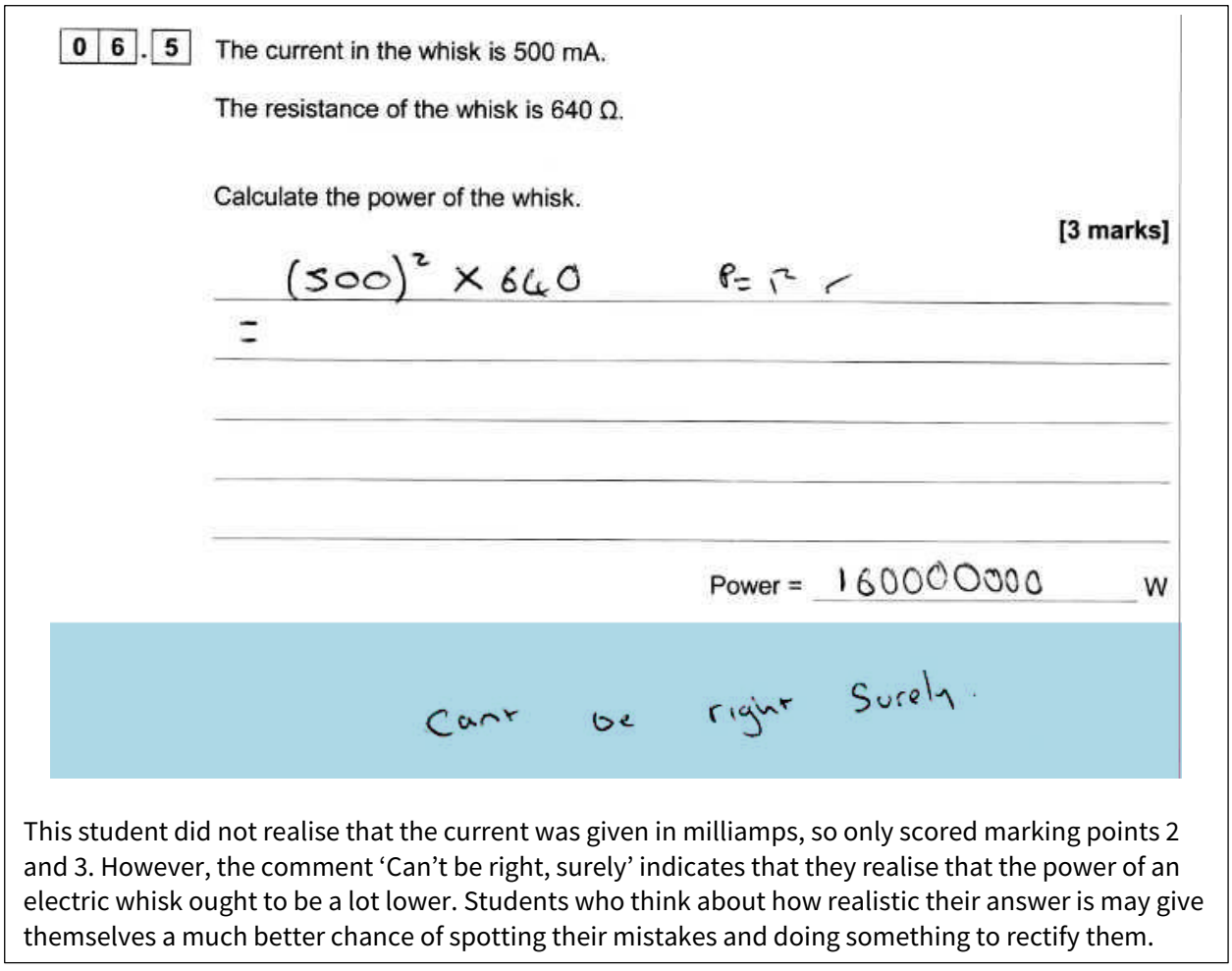
06.1 Roughly two-thirds of students gained at least 1 mark on this question, with about half of these gaining both marks. The most common incorrect answers were an increase in electrical energy and an increase in chemical energy.

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.



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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