AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 6.2.4.1

Power

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**10**
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.

6.2.4.1 Power

Answer 01 · Mark scheme

June 2018 | 8464/P/1H | Original Q6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	a curve in the first and third quadrants only, passing through origin		1	AO1 6.2.1.4
	decreasing gradient		1	
06.2	any **two** from: • $I_1 = I_2 + I_3$ • $I_2 = I_3$ • $I_1 = 2I_2$ • $I_1 = 2I_3$	allow **1** mark for each correct description given in words	2	AO2 6.2.2
06.3		an answer of 60 scores **5** calculation marks		
	$3 = I^2 \times 12$		1	AO2 6.2.4.1
	$I = \sqrt{\left(\frac{3}{12}\right)}$		1	6.2.4.2
	$I = 0.5$ (A)		1	
	$Q = 0.5 \times 60 = 30$	allow Q = their calculated I × 60	1	
	$Q_{total} = 60$	allow an answer that is consistent with their calculated value of I	1	
	or			
	$3 = I^2 \times 12$ (1)			
	$I = \sqrt{\left(\frac{3}{12}\right)}$ (1)			
	$I = 0.5$ (A) (1)			
	$I_{total} = 1.0$ (A) (1)	allow I_{total} = their I × 2		
	$Q = 1.0 \times 60 = 60$ (1)	allow an answer that is consistent with their calculated value of I		
	coulombs **or** C		1	AO1

6.2.4.1 Power

Answer 01 · Mark scheme

June 2018 | 8464/P/1H | Original Q6

Question	Answers	Mark	AO / Spec. Ref.
06.4	**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 logically linking. The resulting account is not fully clear.	3–4	AO2
	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 • resistance of LDR changes when light intensity changes • when light intensity increase resistance of LDR decreases • overall resistance of circuit decreases • potential difference across total resistance remains unchanged • current in ammeter increases • potential difference across fixed resistor increases • potential difference across LDR decreases • reading on the voltmeter decreases • potential difference is shared between the components in series • the lower the resistance of the LDR the smaller the share of the potential difference • reading on the voltmeter decreases		6.2.1.1 6.2.1.4
Total		**16**	

6.2.4.1 Power

Answer 02 · Mark scheme

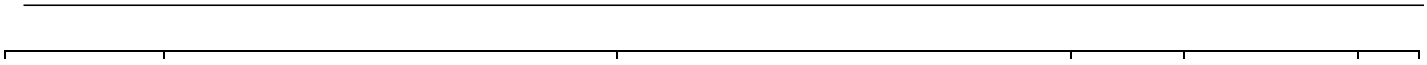
June 2019 | 8464/P/1H | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
03.1	an energy resource that cannot be replenished as it is used	allow an energy resource that will run out ignore cannot be re-used	1	AO1.1 AO1 in isolation 6.1.3	E
03.2		an answer of 30 (A) scores **4** marks		AO2.1 6.2.4.1	E
	6.9 k(W) = 6900 (W)		1		
	6900 = 230 × I	allow correct substitution of an incorrectly/not converted value for power	1		
	$I = \frac{6900}{230}$	allow a correct transformation using an incorrectly/not converted value for power	1		
	I = 30 (A)	allow a correct calculation using an incorrectly/not converted value for power	1		
03.3	direct potential difference is always in the same direction	allow direct current is always in the same direction	1	AO1.1 6.2.3.1	E
	alternating potential difference changes direction	allow alternating current changes direction	1		
03.4	lower potential difference across the cable	allow lower power/energy dissipation	1	AO1.1 6.1.2.2	E
	it is more efficient **OR** (lower resistance gives) a greater current (for the same potential difference) (1) so the car battery can charge faster (1)	allow it won't get as hot	1	6.2.4.1	
Total			**9**		

6.2.4.1 Power

Answer 02 · Mark scheme

June 2019 | 8464/P/1H | Original Q3



6.2.4.1 Power

Answer 03 · Mark scheme

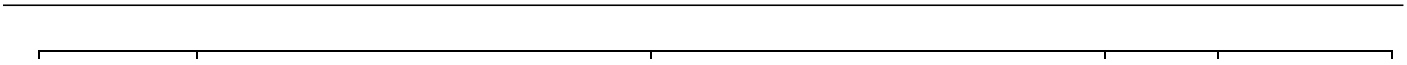
November 2021 | 8464/P/1H | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	$V = I R$		1	AO1 6.2.1.3
01.2	$3.9 = 0.12 \times R$ $R = \frac{3.9}{0.12}$ $R = 32.5\ (\Omega)$	 allow R = 33 (Ω)	1 1 1	AO2 6.2.1.3
01.3	energy = power × time **or** E = P t		1	AO1 6.2.4.2
01.4	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
01.5	thermistor		1	AO1 6.2.1.1
01.6	the current will increase (because) the resistance decreases		1 1	AO1 6.2.1.4
Total			11	

6.2.4.1 Power

Answer 03 · Mark scheme

November 2021 | 8464/P/1H | Original Q1



6.2.4.1 Power

Answer 04 · Mark scheme

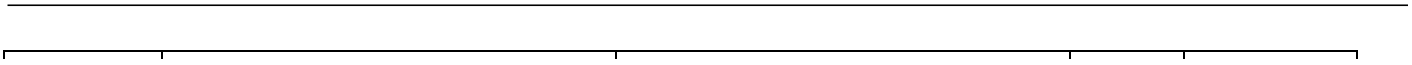
November 2021 | 8464/P/1H | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	240 mW = 0.24 W		1	AO2 6.2.4.1
	$0.24 = 2.5 \times I$	allow a correct substitution using an incorrectly/not converted value of power	1	
	$I = \frac{0.24}{2.5}$	allow a correct re-arrangement using an incorrectly/not converted value of power	1	
	$I = 0.096$ (A)	allow a correct calculation using an incorrectly/not converted value of power	1	
05.2	because the potential difference is always positive	allow because potential difference does not change direction	1	AO1 6.2.3.1
05.3	potential difference is (directly) proportional to current		1	AO2 6.2.1.4
05.4	voltmeter: the reading is the same in both circuits		1	AO2 6.2.2
	ammeter: the reading in circuit **B** is twice the reading of circuit **A**	allow **1** mark for the reading in circuit **B** is bigger than circuit **A**	2	
Total			**9**	

6.2.4.1 Power

Answer 04 · Mark scheme

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



Answer 05 · Mark scheme

Question 2

Question	Answers	Mark	AO / Spec. Ref.
02.1	**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.
02.2	burns / scalds	allow cuts from broken glass ignore the heater / oil is hot	1	AO1 6.1.1.3 RPA14

6.2.4.1 Power

Answer 05 · Mark scheme

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

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	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.
02.4	$50 = \frac{4750}{t}$ **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.
02.5	thermistor		1	AO1 6.2.1.4

6.2.4.1 Power

Answer 05 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	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.
02.7	the water will recover its original properties if the steam is cooled		1	AO1 6.3.1.2

Total Question 2		**15**

6.2.4.1 Power

Answer 06 · Mark scheme

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

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	reverse the connections to the LED / battery	allow reverse the potential difference across the LED / diode	1	AO3 6.2.1.4
	because an LED / diode only allows current through in one direction	allow because an LED / diode has a large resistance in the reverse direction	1	

6.2.4.1 Power

Answer 06 · Mark scheme

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

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	290 mA = 0.29 A		1	AO2 6.2.4.1
	$0.98 = V \times 0.29$ **or** $R = \frac{0.98}{0.29^2}$	allow a correct substitution of an incorrectly / not converted current allow R = 11.652… ignore $0.98 = (0.29)^2 \times R$	1	
	$V = \frac{0.98}{0.29}$	allow $V = 11.65 \times 0.29$ allow a correct substitution of an incorrectly / not converted current	1	
	V = 3.379…	allow a correct rearrangement using an incorrectly / not converted current	1	
	V = 3.4 (V)	allow a correct calculation using an incorrectly / not converted current allow a correctly rounded answer to 2 sig figs consistent with their calculated value of V using numbers from the question	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	electrons in the atom fall to a lower energy level		1	AO1 6.4.1.1

6.2.4.1 Power

Answer 06 · Mark scheme

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

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	$1.4 = Q \times 200$		1	AO2 6.2.4.2 6.2.1.2
	$Q = \frac{1.4}{200}$		1	
	$Q = 0.0070$ (C)		1	
	$0.0070 = I \times 2.8 \times 10^{-4}$	allow a correct substitution of their calculated value of Q	1	
	$I = \frac{0.0070}{2.8\times10^{-4}}$	allow a correct re-arrangement using their value of Q	1	
	$I = 25$ (A)	allow an answer consistent with their value of Q	1	
	OR			
	$1.4 = P \times 2.8 \times 10^{-4}$ (1)			
	$P = \frac{1.4}{2.8\times10^{-4}}$ (1)			
	$P = 5000$ (W) (1)			
	$5000 = 200 \times I$ (1)	allow a correct substitution of their calculated value of P		
	$I = \frac{5000}{200}$ (1)	allow a correct re-arrangement using their value of P		
	$I = 25$ (A) (1)	allow an answer consistent with their value of P		

Total Question 5		14

6.2.4.1 Power

Answer 07 · Mark scheme

June 2023 | 8464/P/1H | Original Q3

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	potential difference is increased (and) current decreases (so) energy/power losses in the transmission cables decrease	allow transformer **X** is a step up transformer allow (so) there is less heating in the transmission cables	1 1 1	AO1 6.2.4.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	$11\,000 \times I_s = 400\,000 \times 660$ $I_s = \frac{400\,000 \times 660}{11\,000}$ $I_s = 24\,000$ (A)		1 1 1	AO2 6.2.4.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	the street lamps are connected in parallel		1	AO3 6.2.2

Answer 07 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	resistance (of the LDR) increases	allow resistance (of the circuit) increases	1	AO1
	(so) the current decreases	allow so the LDR has a greater (share of the) potential difference	1	AO3
	(so) the potential difference across R decreases	dependent on MP1	1	AO3 6.2.1.4 6.2.1.3 6.2.2 6.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	20 mA = 0.020 A		1	AO2 6.2.4.1
	$6.0 = 0.020^2 \times R$	allow a correct substitution using an incorrectly / not converted value of current.	1	
	$R = \frac{6.0}{0.020^2}$	allow a correct re-arrangement using their incorrectly / not converted value of current.	1	
	R = 15000 (Ω) **OR** 20 mA = 0.020 A (1) $V = \frac{6.0}{0.020} = 300$ (1) $R = \frac{300}{0.020}$ (1) R = 15000 (Ω) (1)	allow an answer consistent with their incorrectly / not converted value of current	1	

Total Question 3	**14**

6.2.4.1 Power

Answer 08 · Mark scheme

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

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	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.
01.2	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.
01.3	$92 = \frac{23\,000}{\text{time}}$ $\text{time} = \frac{23\,000}{92}$ 250 (s)		1 1 1	AO2 6.1.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	$P = I^2 R$		1	AO1 6.2.4.1

6.2.4.1 Power

Answer 08 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	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.
01.6	230 (V)		1	AO1 6.2.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.7	decreases		1	AO1 6.2.4.1

Total Question 1	12

6.2.4.1 Power

Answer 09 · Mark scheme

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

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	circuit with a cell, (switch) and resistor in series	allow battery for cell	1	AO2
	ammeter in series (with the resistor and the cell)		1	AO1
	voltmeter in parallel with resistor		1	AO1 6.2.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	I = 0.45 (A)	subsequent marks may be awarded if an incorrectly / not converted value of I is used	1	AO2 6.2.1.3
	$2.7 = 0.45 \times R$		1	
	$R = \frac{2.7}{0.45}$		1	
	R = 6 (Ω)	allow 6.0 (Ω)	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	straight line through the origin in **both** 1st and 3rd quadrant		1	AO1 6.2.1.4

6.2.4.1 Power

Answer 09 · Mark scheme

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

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	R = 2200 (Ω)	subsequent marks may be awarded if an incorrectly / not converted value of R is used	1	AO2
	$P = 0.012^2 \times 2200$		1	AO2
	P = 0.3168 (W)	allow P = 0.32 allow P = 0.317	1	AO2
	resistors **A**, **B** and **C**	dependent on MP1 **and** MP3	1	AO3
	OR			6.2.4.1
		the first three marks may be awarded for calculating I_{max} for any of the resistors		
	R = 2200 (Ω) (1)	subsequent marks may be awarded if an incorrectly / not converted value of R is used		
	$2.0 = I^2 \times 2200$ (1)			
	I = 0.030…(1)			
	resistors **A**, **B** and **C** (1)	dependent on MP1 **and** MP3		

Total Question 3	12

6.2.4.1 Power

Answer 10 · Mark scheme

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

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	230 (V) 50 (Hz)	allow about 230 (V)	1 1	AO1 6.2.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	live – brown neutral – blue		1 1	AO1 6.2.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	alternating (potential difference) continuously changes direction direct (potential difference) is always in the same direction		1 1	AO1 6.2.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	energy / power is transferred by the laptop (when being used) (so) the power delivered to the battery is reduced	 allow (so) the rate at which energy is transferred to the battery is lower	1 1	AO2 AO3 6.1.1.4 6.1.2.1

6.2.4.1 Power

Answer 10 · Mark scheme

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

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	$P = 15 \times 4.8$		1	AO2 6.2.4.1 6.2.4.2 6.1.1.4
	$P = 72$ (W)		1	
	$\Delta P = 97 - 72 = 25$ (W)		1	
	$25 = \frac{225\,000}{t}$	subsequent marks may be awarded if an incorrect / not converted value of E is used.	1	
	$t = 9000$ (s)		1	
	$t = 2.5$ (hours)		1	

Total Question 5	14

6.2.4.1 Power

Answer 01 · Examiner comments

June 2018 | 8464/P/1H | Original Q6

Question 6 (Standard/high and High demand)

06.1 33% of students drew a curve in the correct quadrants which passed through the origin with decreasing gradient to score two marks. 25% of students then curved their lines back towards the *x*-axis at the ends and so did not score the gradient mark. The most common mistake was to draw a straight line in the correct quadrants through the origin as for a fixed resistor. A few drew the graph for a diode. Some students drew a curve or straight line through the second and fourth quadrants, and some drew a line or curve which was in one quadrant only, or intersected more than two quadrants.

06.2 Responses to this question were very mixed. 24% of students scored two marks and 24% of students scored one mark. Many students talked about the current being strongest close to the battery, and weaker further away. Voltage was also discussed in some responses.

Many students just stated that the current split which was not sufficient. However, there were some excellent concise answers that demonstrated a very good understanding of current in parallel circuits.

06.3 Half of the students found this multistep calculation question very challenging and scored no marks. 13 % of students scored five marks for correctly calculating a charge flow of 30 C but did not double this to determine the total.

Those who were unable to calculate the correct current could still have scored three marks for multiplying their incorrectly calculated current by 60, then doubling this number and finally naming the correct unit. Very few of these scored anything other than the unit mark. Those that did multiply a number by 60 often did not gain credit because it was unclear what their number represented.

06.4 Very few students achieved a level 3 response in this question. 38% of students gained at least one mark. A large number of students listed what they could recall about circuits despite this not being relevant to the question – information such as which meter is connected in series, which in parallel and what other components are in the circuit.

The majority of students were unable to recognise the symbol for the LDR with many stating it was a thermistor. Those that did recognise the symbol for the LDR often did not recall the correct link between light intensity and resistance or even the function of the LDR. Many students thought that the LDR was the actual light that was switched on and off by the light intensity. Many students who started the question well, correctly identifying the LDR and linking that correctly to how the resistance of the LDR would change, failed to explain how this change in resistance would affect the readings on the ammeter and voltmeter. Very few students demonstrated an understanding of how resistance affects current.

6.2.4.1 Power

Answer 01 · Examiner comments

June 2018 | 8464/P/1H | Original Q6

Use of statistics

Statistics used in this report may be taken from incomplete processing data. However, this data still gives a true account on how students have performed for each question.

Mark Ranges and Award of Grades

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

6.2.4.1 Power

Answer 02 · Examiner comments — June 2019 | 8464/P/1H | Original Q3

Question 3 (Standard/high demand)

03.1 Just over 70% of students described a non-renewable resource correctly, as either a resource which is not replenished as it is used, or as a resource which is finite and will run out.

03.2 Slightly more than 40% of students gained full marks on this question. Around one in seven students gained 3 marks, mostly for failing to convert 6.9 kW into watts, or for making an incorrect conversion. Around 35% of students gained no marks on this question.

03.3 About a third of students gained 2 marks on this question but over half the students gained 0 marks. Answers describing current or potential difference were accepted, but a proportion of students incorrectly described direct current as what happens in a series circuit, and alternating as what happens in a parallel circuit. Other misconceptions included students who suggested that direct potential difference takes a constant value but alternating potential difference changes value. While this may be true, it does not explain the difference between direct and alternating.

Answer 02 · Examiner comments — June 2019 | 8464/P/1H | Original Q3

03.4 Just under half of students scored 1 mark, with around a further 15% of students gaining both marks. Many students gave answers in terms of the risk of electrocution or safety, which did not gain credit. Many students wrote of more electricity going through a lower resistance cable, which was not sufficient: they needed to either mention a lower potential difference across the cable, or a greater current in the cable for the same potential difference.

Answer 03 · Examiner comments — November 2021 | 8464/P/1H | Original Q1

Question 01 (Standard demand)

01.1 Slightly over two thirds of students selected the correct equation.

01.2 Full marks were gained by over 60% of the students, with about 35% failing to gain any credit.

01.3 This equation was correctly recalled by around 70% of students.

01.4 Most students did not attempt to convert 2500 minutes into seconds. Nearly a quarter of students gained all 3 marks, with just over half of students gaining 2 marks.

01.5 Slightly less than 40% of higher tier students were able to correctly identify the symbol for a thermistor.

6.2.4.1 Power

Answer 03 · Examiner comments November 2021 | 8464/P/1H | Original Q1

01.6 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. Roughly one in ten students gained 2 marks, with just over a third gaining 1 mark.

Answer 04 · Examiner comments November 2021 | 8464/P/1H | Original Q5

Question 5 (High demand)

05.1 Of those students who attempted to convert 240 mW to watts, there was confusion evident about whether mW referred to milliwatts or megawatts. Around 45% of students gained at least 3 marks.

05.2 Many students incorrectly suggested that the changing frequency of the potential difference explained the answer. Only around 15% of students answered correctly.

05.3 Almost 30% of students correctly identified the directly proportional relationship.

05.4 Very few students were able to correctly identify that the potential difference in both circuits would be the same. To gain full marks when discussing the ammeter readings, students had to realise that since the potential difference across each resistor is the same, and all resistors have the same resistance, the current in each resistor is the same. The current in the ammeter in circuit B is therefore double that of circuit A. The question was targeted at the highest ability students, and very few students were able to reason this through and state this relationship.

6.2.4.1 Power

Answer 05 · Examiner comments

Question 02 (Standard demand)

02.1 Almost all students gained some marks on this question, with about half of students accessing level 2 of the mark scheme and gaining 3 or 4 marks. Just over 15% 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, many students placed the top pan balance on the heater. Of the students who did know what a top pan balance is, a sizeable minority thought that it is 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 worth no 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 were unable to access level 3 on the mark scheme, but could gain some credit for these statements.

Some students described the use of a voltmeter, ammeter, and stopclock to determine the energy supplied to the heater. Although a method determining specific heat capacity of oil using this equipment would lead to a valid outcome, this did not use the equipment given in the question, so would not be able to score all 6 marks.

Many students described the wrong experiment, either 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.

02.2 Approximately 60% of 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.

02.3 As students were given an equation sheet for this exam, almost 100% of students gave the correct equation.

02.4 Nearly 90% of students gained full marks on this question, with just over 5% of students scoring 0 marks.

6.2.4.1 Power

Answer 05 · Examiner comments

02.5 Only about a fifth of students recognised that the electrical component whose resistance decreases as temperature increases is a thermistor.

02.6 Just over 40% of students gained both marks, with around a quarter gaining one mark on 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 4, but did not then use figure 3, many decided to divide the temperature by a time read from the graph, or tried to use the equation $R = V / I$ or $P = I^2 R$. Some students used their temperature with the maximum resistance of 1000 Ω shown on figure 3.

Students who read 160 °C on figure 3 and decided that this was the resistance of the resistor by writing 160 on the answer line gained no marks.

02.7 Just under 40% of students chose the correct answer to why this was a physical change.

6.2.4.1 Power

Answer 06 · Examiner comments — June 2022 | 8464/P/1H | Original Q5

Question 05 (Standard/high and high demand)

05.1 Most students were unable to answer this question correctly, with only about 10% of students gaining any marks, and less than 5% gaining both marks.

Common suggestions which would not work included moving the LED closer to the battery, swapping the voltmeter and ammeter, moving the resistor, removing the resistor, reducing the resistance of the resistor, or placing the resistor after the LED.

05.2 Around a fifth of students gained full marks on this question, with a third of students gaining 4 marks.

Although the simplest way to calculate the answer was to use $P = VI$, a significant minority of students decided that a 5-mark calculation needed two equations to arrive at the correct answer. This was possible, by using $P = I^2R$ and then $V = IR$, an approach which could gain full marks. However, most students who attempted this alternative route neglected to convert mA to A.

05.3 Around 15% of students chose the correct description.

05.4 This extended calculation was answered well, with around 45% of students gaining all 6 marks. Just under 10% of students gained 3 marks, and about 35% gaining no marks.

Answer 07 · Examiner comments — June 2023 | 8464/P/1H | Original Q3

Question 03 (Standard/high and high demand)

03.1 Just over half of all students gained at least one mark on this question. Many students seemed to think that greater efficiency means that energy is transferred at a greater rate. It was also common for answers to suggest that the transformer either increases or decreases resistance, which was ignored.

03.2 Slightly less than 60% of students gained full marks on this calculation. Many students who did not score anything attempted to use $V=IR$ for the primary coil and then the secondary coil. Students who used the correct equation but gained or lost a zero in their answer at some point could score a maximum of 2 marks.

03.3 Only about 25% of students answered this multiple-choice question correctly. This was the third most common answer, with more students selecting that current is dissipated to the surroundings, and that the cables have electrical resistance.

03.4 About a quarter of students scored at least one mark, but very few gained more than this. Some thought that the LDR was an LED, suggesting that as it gets darker the LDR needs to emit more light so the current must increase, for example. Some thought that the total resistance of the circuit must remain constant, so as the resistance of the LDR decreased, the resistance of the fixed resistor must increase. Many students struggled to express themselves, finding it difficult to

6.2.4.1 Power

Answer 07 · Examiner comments

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express which potential difference they were writing about – the potential difference across the battery, the fixed resistor or the LDR.

03.5 Approximately a fifth of students gained all 4 marks, with about half of all students scoring 3 marks on this calculation. Many students did not attempt to convert mA to A, and of those who did many conversions were incorrect. Of the students scoring 0 marks, it was reasonably common for them to neglect to square the current when using $P = I^2 R$.

Answer 08 · Examiner comments

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

Question 1 (standard demand)

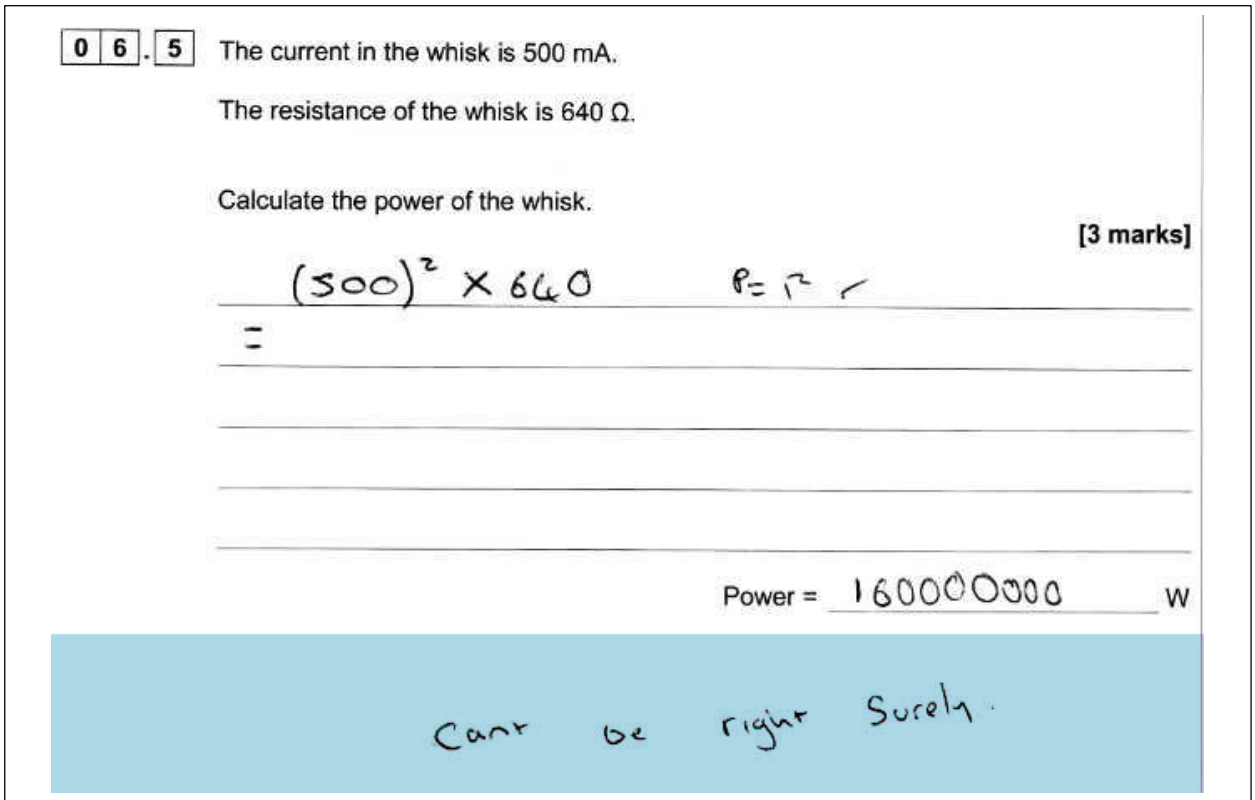
01.1 Almost all students scored at least 1 mark on this question, with nearly two-thirds scoring both marks. The most common incorrect answers were an increase in electrical energy and an increase in chemical energy.

01.2 A very low proportion of students answered this incorrectly.

01.3 Nearly 90% of students arrived at the correct final answer for this calculation, gaining 3 marks.

01.4 Most students selected the correct equation, with about 1% of students not gaining this mark.

01.5 For this calculation, many students did not correctly convert the current 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. About 40% scored all 3 marks, but about 50% gained 2 marks, and over 95% scored at least 1 mark.



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.

01.6 Slightly more than one in two students could recall the potential difference between the live and neutral wires.

01.7 Over 80% of students identified that an increase in current would be caused by a decrease in resistance.

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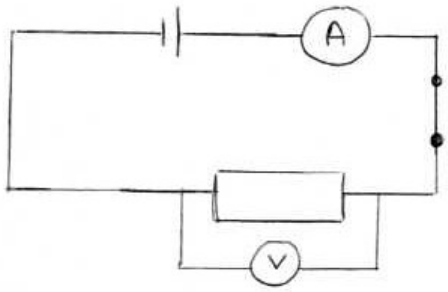
Answer 09 · Examiner comments

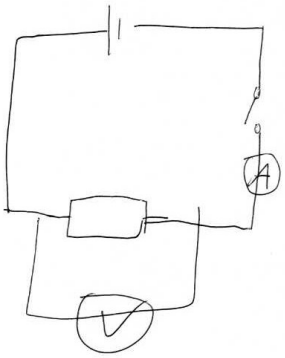
June 2025 | 8464/P/1H | Original Q3

Question 3 (Standard and standard/high demand)

03.1 Nearly 90% of students gained at least 1 mark on this question. 40% gained all three marks for using all the correct circuit symbols and drawing an ammeter in series and voltmeter in parallel with the resistor. 25% of students gained 2 marks due to having one error, which most commonly was having an incorrect circuit symbol or having the voltmeter in series.



It is expected that students draw circuit diagram accurately. This an excellent example, scoring all 3 marks.



There should be no lines through the symbols, this example shows incorrect circuit symbols and there is a significant gap in the circuit next to the cell.

03.2 This calculation was reasonably well answered. Over 70% of students gained at least 3 marks. Nearly all students that did a correct substitution were able to rearrange correctly and calculate the final answer. 45% of students did a correct conversion of the current to amps and did the calculation correctly so gained 4 marks.

03.3 75% of students draw a straight line through the origin in both 1st and 3rd quadrant so gained the mark. A number of students only drew the line in the 1st quadrant, so did not gain the mark. Some students drew the IV curve for a lamp.

03.4 There were two different valid calculations students could do to determine which resistors in figure 3 were suitable to be used. The most common method was to determine the power when a current of 0.012A was in a resistor. 10% of students gained a mark for converting the resistance in ohms but could not get any further. 45% of students completed a valid calculation so gained 3 marks. Only 15% went on to draw the correct conclusion based on their calculation and were awarded 4 marks.

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Answer 10 · Examiner comments

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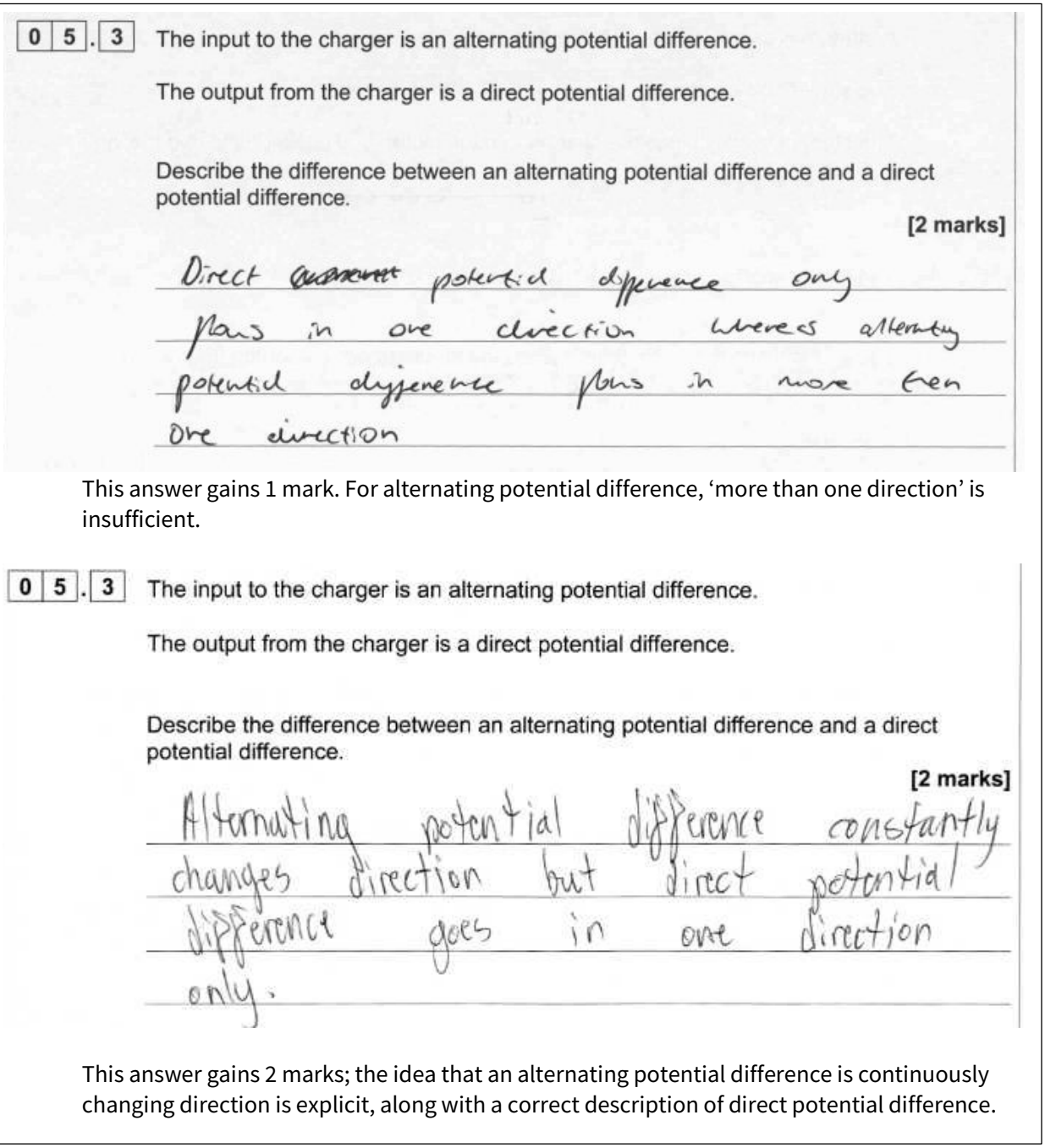
Question 5 (Standard/high and high demand)

05.1 55% of students gave one correct value and 20% gave both correct. Where, only one was correct, the frequency was more commonly known.

05.2 75% of students correctly named both wires and the correct colour of insulation. Where only one mark was awarded, it was most common to see the live wire and colour correct, but the name of the second wire was incorrect. Incorrect responses often gave the colour of the earth wire.

05.3 43% gained 1 mark. The vast majority of these were awarded the mark for direct (potential difference) is always in the same direction. Under 10% of students also gained the mark for the alternating potential difference. For alternating potential difference, the idea that it is continuously changing direction must be explicit.



0 5 . 3 The input to the charger is an alternating potential difference.

The output from the charger is a direct potential difference.

Describe the difference between an alternating potential difference and a direct potential difference.

[2 marks]

Direct potential difference only flows in one direction whereas alternating potential difference flows in more than one direction

This answer gains 1 mark. For alternating potential difference, 'more than one direction' is insufficient.

0 5 . 3 The input to the charger is an alternating potential difference.

The output from the charger is a direct potential difference.

Describe the difference between an alternating potential difference and a direct potential difference.

[2 marks]

Alternating potential difference constantly changes direction but direct potential difference goes in one direction only.

This answer gains 2 marks; the idea that an alternating potential difference is continuously changing direction is explicit, along with a correct description of direct potential difference.

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6.2.4.1 Power

Answer 10 · Examiner comments June 2025 | 8464/P/1H | Original Q5

05.4 60% of students correctly identified that the laptop is using energy as it is still being used. Only a very small number correctly explained that this meant that the rate at which the energy is stored in the battery decreases.

05.5 This multi-step calculation proved to be more challenging than in previous years. Only approximately 15% of students gained full marks. 50% of students calculated the power of the laptop but could not get any further. Some students calculated the time in seconds correctly but could not convert the answer to hours. Students are reminded that they should show their working for multi-step calculations.