AQA GCSE Physics | 8463

SPECIFICATION POINT 4.2.4.1

Power

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**52**
Available paper years	**2003–2025**

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.

4.2.4.1 Power

Answer 01 · Mark scheme June 2003 | 3451H | Original Q15 | Legacy

The full source mark scheme begins on page 77. Follow original question 15 in that document.

Answer 02 · Mark scheme June 2004 | 3451H | Original Q2 | Legacy

The full source mark scheme begins on page 99. Follow original question 2 in that document.

Answer 03 · Mark scheme June 2004 | 3451H | Original Q13 | Legacy

The full source mark scheme begins on page 99. Follow original question 13 in that document.

Answer 04 · Mark scheme June 2004 | 3462H3 | Original Q2 | Legacy

The full source mark scheme begins on page 120. Follow original question 2 in that document.

Answer 05 · Mark scheme June 2004 | 3462H3 | Original Q11 | Legacy

The full source mark scheme begins on page 120. Follow original question 11 in that document.

Answer 06 · Mark scheme November 2007 | PHY1A | Original Q8 | Legacy

Eight	**3**	**3**	**2**	**1**

4.2.4.1 Power

Answer 07 · Mark scheme

Question 3

question	answers	extra information	mark
(a)(i)	24(V)		1
(ii)	current always flows in the same direction **or** current only flows one way		1
(b)(i)	more power / force needed work done to lift the scooter uphill **or** work done against gravity	accept energy transformed faster accept it moves against gravity accept energy is transformed to gravitational potential energy	1 1
(ii)	reduces it		1
(c)	375	**1** mark for correct substitution **1** mark for an answer = 250 **1** mark for an answer = 125	2
(d)	86400 coulomb	**1** mark for correct substitution **1** mark for an answer = 43200 answer 24 gains **1** mark answer 24 Ah gains **2** marks answer 12 Ah gains **1** mark only accept C	2 1
total			10

4.2.4.1 Power

Answer 07 · Mark scheme

PHY2H

4.2.4.1 Power

Answer 08 · Mark scheme

Question 6

question	answers	extra information	mark
(a)(i)	step-down (transformer) because fewer turns on the output/secondary (coil)	no credit for just 'step-down transformer' accept '…less turns…' do **not** credit '…fewer coils…' **or** 'the p.d. across the input / primary will be greater than the p.d. across the output / secondary'	1
(ii)	to prevent a short (circuit)(through the turns of wire or through the core	do **not** credit references to safety **or** heat (insulation)	1
(iii)	(easily) magnetised (and demagnetised)	accept '(it's) magnetic' do **not** accept 'because it's a conductor'	1
(b)	2250	correct substitution eg $\frac{150}{\text{p.d. across secondary}} = \frac{500}{7500}$ gains **1** mark **or** appropriate transformation eg (p.d. across secondary =) $\frac{\text{number of turns on secondary}}{\text{number of turns on primary}} \times$ p.d. across primary gains **1** mark	2

continued

PHY3H

Question 6 continued

question	answers	extra information	mark
(c)	any **two** from: • to reduce the voltage / p.d. (of the domestic supply) • higher voltage difficult to insulate • higher voltage (would) result in (fatal) electric shock • domestic appliances are not designed for (very) high voltage (input) / (are designed) for 230V	**or** to reduce to 230 V allow 'to reduce to 240 V' do **not** credit 'reduce current to 230V' **not** just 'less dangerous' do **not** credit 'to increase efficiency' / 'to save energy' do **not** credit just 'it's safer'	2
(d)	any **two** (1) each • if the (local) power station breaks down / fails / demand / load exceeds supply • electricity / power can be switched from elsewhere in the system / from other power station(s) • electricity can be generated in places remote from customers • (in total) fewer power stations are needed • power available in rural / remote areas • National Grid allows for (better) control of supply and demand	 **or** words to that effect **or** words to that effect **or** words to that effect do **not** credit just cheaper / more efficient / safer	1 1
total			9

4.2.4.1 Power

Answer 08 · Mark scheme

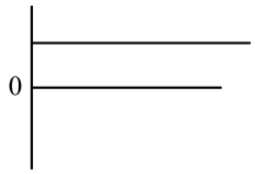
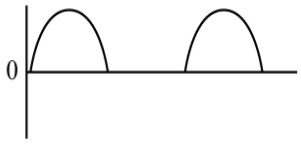
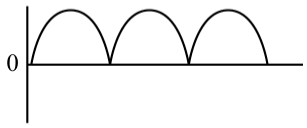
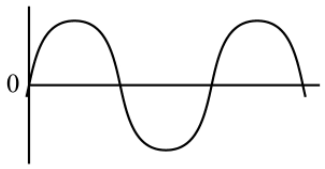
January 2008 | PHY3H | Original Q6 | Legacy

PHY3H

4.2.4.1 Power

Answer 09 · Mark scheme

Question 5

question	answers	extra information	mark
5(a)	d.c. flows in (only) one direction		1
	a.c. changes direction (twice every cycle)	accept a.c. constantly changing direction ignore references to frequency accept answers presented as a clear diagram e.g. dc:    ac:  	1

Question 5 continues on the next page

PHY2H

Question 5 continued

5(b)(i)	10	allow **1** mark for correct transformation and substitution i.e. $\frac{2.3}{230}$ or $\frac{2300}{230}$ an answer 0.01 gains **1** mark	2
5(b)(ii)	13 A	e.c.f. accept the fuse size that is the next listed value greater than answer (b)(i)	1
Total			**5**

4.2.4.1 Power

Answer 09 · Mark scheme January 2009 | PHY2H | Original Q5 | Legacy

PHY2H

Answer 10 · Mark scheme March 2009 | PHY1AP | Original Q2 | Legacy

Two	**A**	falling water (hydroelectric)	**2**
	B	fossil fuel	**1**
	C	tides	**4**
	D	wind	**3**

Answer 11 · Mark scheme June 2009 | PHY1AP | Original Q5 | Legacy

Five	**2**	**3**	**2**	**4**

4.2.4.1 Power

Answer 12 · Mark scheme

June 2009 | PHY3H | Original Q1 | Legacy

Question 1

question	answers	extra information	mark
1(a)(i)	secondary(coil) / output (coil)	do **not** accept just coil	1
1(a)(ii)	core (laminated soft) iron	do **not** accept for either mark it is made out of iron ore allow **1** mark for 'it is made out of iron core'	1 1
1(a)(iii)	magnetic field (which is) changing / alternating	accept magnetism / magnetic force direction (of field) changes / strength (of field) varies scoring second mark is dependent on first mark	1 1
1(b)	...step-up .... step-down ...	both in the correct order	1
1(c)	Do not build new houses .... Build new power lines away	 deduct **1** mark for any other(s) to a minimum total of (0)	1 1
Total			**8**

4.2.4.1 Power

Answer 12 · Mark scheme

June 2009 | PHY3H | Original Q1 | Legacy

PHY3H

Answer 13 · Mark scheme

November 2009 | PHY1AP | Original Q5 | Legacy

Five	**2**	**4**	**4**	**3**

Answer 14 · Mark scheme

June 2010 | PHY1AP | Original Q9 | Legacy

Nine	2	3	3	2

4.2.4.1 Power

Answer 15 · Mark scheme

Question 7

question	answers	extra information	mark
7(a)	(rate of) flow of charge / electrons / ions	accept movement for flow do **not** accept flow of electricity	1
7(b)	7(.0)	accept 6.96 / 6.95 or an answer that would approximate to 6.96 if rounded allow **1** mark for obtaining correct power and changing to watts ie 1600 **or** allow **2** marks for correct substitution and transformation ie 1600 ÷ 230 an answer 0.00696 / 0.007 gains **2** marks allow **1** mark for 1.6 / 230 or 1.7 / 230 an answer 7.39 or 7.4 gains **2** marks	3
	amp (ere)	accept A	1
Total			**5**

4.2.4.1 Power

Answer 16 · Mark scheme

June 2010 | PHY3H | Original Q5 | Legacy

Question 5

question	answers	extra information	mark
5(a)	motor (effect)		1
5(b)(i)	wire kicks further (forward)	accept moves for kicks accept moves more accept 'force (on the wire) increased'	1
5(b)(ii)	wire kicks back(wards) / into (the space in) the (horseshoe) magnet	accept moves for kicks accept 'direction of force reversed'	1
Total			**3**

4.2.4.1 Power

Answer 16 · Mark scheme June 2010 | PHY3H | Original Q5 | Legacy

PHY3H

Answer 17 · Mark scheme November 2010 | PHY1AP | Original Q7 | Legacy

Seven	**3**	**4**	**2**	**1**

4.2.4.1 Power

Answer 18 · Mark scheme

Question 7

question	answers	extra information	mark
7(a)(i)	generator (effect)	accept 'induction'	1
7(a)(ii)	(metal) cable is (an electrical) conductor (which) cuts / moves through the (magnetic) field (lines) / lines of force	mention of heat conduction negates this mark	1 1
7(a)(iii)	conductor / cable is part of a (complete) circuit	'it' refers to conductor	1
7(b)	any **two** from: • shorter cable • reduced speed • different planet (in the Solar System) • increased distance (from planet) • weaker magnetic field	 accept smaller cable accept smaller planet do **not** accept bigger planet do **not** accept smaller magnetic field Jupiter has the strongest magnetic field is insufficient	2
Total			**6**

4.2.4.1 Power

Answer 18 · Mark scheme January 2011 | PHY3H | Original Q7 | Legacy

PHY3H

Answer 19 · Mark scheme March 2011 | PHY1AP | Original Q3 | Legacy

Three	**A**	electrical	**3**
	B	kinetic	**4**
	C	light	**1**
	D	sound	**2**

Answer 20 · Mark scheme March 2011 | PHY1AP | Original Q8 | Legacy

Eight	**2**	**4**	**2**	**4**

Answer 21 · Mark scheme June 2011 | PHY1AP | Original Q7 | Legacy

Seven	**3**	**3**	**2**	**1**

4.2.4.1 Power

Answer 22 · Mark scheme

June 2011 | PHY2H | Original Q1 | Legacy

Question 1

question	answers	extra information	mark
1(a)	brown		1
1(b)	outside/case is plastic / an insulator	accept is double insulated accept non-conductor for plastic do **not** accept it / hairdryer is plastic	1
1(c)(i)	(1) S_1 (2) S_1 and S_3	and no other both required, either order	1 1
1(c)(ii)	S_1 must be ON (for either heater to work) S_1 switches the fan on	do **not** accept reference to 'fan' switch	1 1
1(d)	1495 watt(s) or W	allow **1** mark for correct substitution, ie 6.5 × 230 an answer of 1.495 kW gains **3** marks although the unit is an independent mark for full credit the unit and numerical value must be consistent accept joules per second or J/s	2 1
Total			**9**

4.2.4.1 Power

Answer 22 · Mark scheme June 2011 | PHY2H | Original Q1 | Legacy

PHY2H

4.2.4.1 Power

Answer 23 · Mark scheme

Question 7

question	answers	extra information	mark
7(a)	400 000	allow **1** mark for correct substitution ie $\frac{25000}{?} = \frac{800}{12800}$ **or** $\frac{25}{?} = \frac{800}{12800}$	2
	volt(s) / V	an answer 400 gains **2** marks an answer 400 kilovolts / kV gains **3** marks although the unit mark is independent to gain **3** marks it must be consistent with the numerical value	1
7(b)	any **one** from: • (so that there is) no short circuit • (so that the) current goes round the coil • (so that the) current does not enter the core	do **not** accept any response in terms of heat insulation, safety or electric shock do **not** accept electricity for current	1

Question 7 continues on the next page

4.2.4.1 Power

PHY3H

Question 7 continues

question	answers	extra information	mark
7(c)	(the alternating p.d. in the primary causes) an (alternating) current in the primary	reference to the current in the core negates this mark	1
	(causes an) <u>alternating / changing</u> (magnetic) field in the (iron) core		1
	<u>induces</u> (alternating) p.d. across the <u>secondary</u> (coil)	accept in / through or similar for across accept current for p.d. accept output (coil) for secondary (coil) to gain **3** marks the sequence must be correct	1
Total			**7**

4.2.4.1 Power

Answer 24 · Mark scheme

November 2011 | PHY1AP | Original Q6 | Legacy

Six	**1**	**2**	**3**	**4**

4.2.4.1 Power

Answer 25 · Mark scheme

January 2013 | PH1HP | Original Q6 | Legacy

Question 6

question	answers	extra information	mark
6(a)	any **one** from: • energy / source is constant • energy / source does not rely on uncontrollable factors • can generate all of the time	accept a specific example, eg the weather will not run out is insufficient	1
6(b)	(dismantle and) remove radioactive waste / materials / fuel	accept nuclear for radioactive knock down / shut down is insufficient	1
6(c)	any **two** from: • reduce use of fossil fuelled power stations • use more nuclear power • use (more) renewable energy sources • make power stations more efficient • (use) carbon capture (technology)	accept specific fossil fuel accept use less fossil fuel accept build new nuclear power stations accept a named renewable energy source do **not** accept natural for renewable do **not** accept use less non-renewable (energy) sources	2
6(d)	(by increasing the voltage) the current is reduced this reduces the energy / power loss (from the cable) and this increases the efficiency (of transmission)	 accept reduces amount of waste energy accept heat for energy do **not** accept stops energy loss	1 1 1
Total			**7**

4.2.4.1 Power

Answer 25 · Mark scheme

January 2013 | PH1HP | Original Q6 | Legacy

PH1HP

4.2.4.1 Power

Answer 26 · Mark scheme

June 2013 | PH2HP | Original Q2 | Legacy

Question 2

question	answers	extra information	mark
2(a)(i)	to obtain a range of p.d. values	accept increase / decrease current / p.d. / voltage / resistance accept to change / control the current / p.d. / voltage / resistance to provide resistance is insufficient a variable resistor is insufficient do **not** accept electricity for current	1
2(a)(ii)	temperature of the bulb increases	accept bulb gets hot(ter) accept answers correctly expressed in terms of collisions between (free) electrons and ions / atoms bulb gets brighter is insufficient	1
2(a)(iii)	36 watt(s) / W	allow **1** mark for correct substitution, ie 12 × 3 provided no subsequent step shown accept joules per second / J/s do **not** accept w	2 1

Question 2 continues on the next page . . .

PH2HP

Question 2 continued . . .

question	answers	extra information	mark
2(b)	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5, and apply a 'best-fit' approach to the marking.		6

0 marks	**Level 1 (1–2 marks)**	**Level 2 (3–4 marks)**	**Level 3 (5–6 marks)**
No relevant content.	There is a basic comparison of either a cost aspect or an energy efficiency aspect.	There is a clear comparison of either the cost aspect or energy efficiency aspect **OR** a basic comparison of both cost and energy efficiency aspects.	There is a detailed comparison of both the cost aspect and the energy efficiency aspect. For full marks the comparisons made should support a conclusion as to which type of bulb is preferable.

Examples of the points made in the response:

cost
- halogen are cheaper to buy
- 6 halogen lamps cost the same as one LED
- LEDs last longer
- need to buy 18 / more halogen lamps to last the same time as one LED
- 18 halogens cost £35.10
- costs more to run a halogen than LED
- LED has lower maintenance cost (where many used, eg large departmental store lighting)

energy efficiency
- LED works using a smaller current
- LED wastes less energy
- LEDs are more efficient
- LED is 22% more energy efficient
- LED produces less heat
- LED requires smaller input (power) for same output (power)

simply giving cost figures is insufficient

Total			**11**

4.2.4.1 Power

Answer 26 · Mark scheme

June 2013 | PH2HP | Original Q2 | Legacy

PH2HP

4.2.4.1 Power

Answer 27 · Mark scheme

June 2013 | PH2HP | Original Q6 | Legacy

Question 6

question	answers	extra information	mark
6(a)	35	an answer with more than 2 sig figs that rounds to 35 gains **2** marks allow **2** marks for correct method, ie $\frac{230}{6.5}$ allow **1** mark for I = 6.5 (A) **or** R = $\frac{230}{26}$ an answer 8.8 gains **2** marks an answer with more than 2 sig figs that rounds to 8.8 gains **1** mark	3
6(b)(i)	(maximum) current exceeds maximum safe current for a 2.5 mm^2 wire **or** (maximum) current exceeds 20 (A)	accept power exceeds maximum safe power for a 2.5 mm^2 wire (maximum) current = 26 (A) is insufficient	1
	a 2.5 mm^2 wire would overheat / melt	accept socket for wire do **not** accept plug for wire	1
6(b)(ii)	(contains) live, neutral and earth wires	accept is a three-core cable	1
	cross-sectional area of (live and neutral) wire(s) (minimum of) 4 mm^2	accept 6 mm^2 for 4 mm^2	1
	wire / cable should be insulated	accept a suitable named insulator, eg PVC / rubber / plastic	1

Question 6 continues on the next page . . .

PH2HP

Question 6 continued . . .

question	answers	extra information	mark
6(c)	a.c. is constantly changing direction	accept a.c. flows in two directions accept a.c. changes direction a.c. travels in different directions is insufficient	1
	d.c. flows in one direction only		1
Total			**10**

UMS Conversion Calculator: www.aqa.org.uk/umsconversion

4.2.4.1 Power

Answer 28 · Mark scheme June 2014 | PH2HP | Original Q7 | Legacy

7(a)	drill is double insulated	accept no exposed metal parts accept the outside is an insulator accept plastic is an insulator	1	AO1 2.4.1j
7(b)	4.4	allow **1** mark for correct substitution, ie 1012 = I × 230 provided no subsequent incorrect numerical step	2	AO2 2.4.2c
7(c)	detects a (very small) difference between the current in the live wire and the current in the neutral wire		1	AO1 2.4.1i
Total			**4**	

4.2.4.1 Power

Answer 29 · Mark scheme

June 2015 | PH2HP | Original Q6 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. ref.	ID
6(a)(i)	decreases (to zero) resultant force acts in opposite direction to motion	 accept air resistance and weight for resultant force accept resultant force acts downwards do **not** accept air resistance increases	1 1	AO1 2.1.1c/e	E
6(a)(ii)	velocity includes direction **or** velocity is a vector (quantity)		1	AO1 2.1.2d	E
6(b)(i) mark with 6bii 6biii	3.6	allow **1** mark for correct substitution i.e. ½ x 0.05 x 12^2 provided no subsequent step	2	AO2 2.2.1g	E
6(b)(ii) mark with 6bi, 6biii	3.6 **or** their (b)(i)		1	AO1 2.2	E
6(b)(iii) mark with 6bi, 6bii	7.2 **or** their (b)(ii) ÷ 0.5 correctly calculated	allow **1** mark for correct substitution i.e. 3.6 or their (b)(ii) = 0.05 x 10 x h	2	AO2 2.2.1f	E
6(b)(iv)	**B**		1	AO3 2.1	A
6(c)	range increases up to 45° range decreases from 45°	 the range is a maximum at 45° gains both marks for any two angles that add up	1 1	AO3 2.1	E

4.2.4.1 Power

Answer 29 · Mark scheme

		to 90° the range is the same gains both marks the range increases then decreases gains **1** mark			
Total			**11**		

4.2.4.1 Power

Answer 30 · Mark scheme

June 2016 | PH2HP | Original Q4 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4(a)	pin made from brass because it is (hard and) a (good electrical) conductor outer case plastic/rubber because it is a (good electrical) insulator	 accept copper for brass metal is insufficient heat conductor on its own negates heat insulator on its own negates	 1 1	AO1 2.4.1f
4(b)(i)	live		1	AO1 2.4.1g
4(b)(ii)	makes it hot/warm	melts is insufficient	1	AO1 2.4.2a
4(b)(iii)	8.7	accept an answer that rounds to 8.7 allow **1** mark for correct substitution ie 2000 = 230 × I an answer of 0.0087**or** 0.009 **or** 3.0(4) **or** 5.65 **or** 5.7 gains **1** mark	2	AO2 2.4.2c
4(c)	a (large) current goes from the live wire to the earth wire (which causes) the fuse to (overheat and) melt	accept metal case for live wire accept a current goes from live to earth do not accept electricity for current accept blow for melt break is insufficient do not accept snap / blow up for melt	1 1	AO1 2.4.1k

4.2.4.1 Power

Answer 30 · Mark scheme

June 2016 | PH2HP | Original Q4 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4(d)	reduce chance of an electric shock	accept to reduce the risk of an accident accept prevent electric shock accept prevent electrocution accept prevent or reduce the risk of an (electrical) fire accept an electric shock can kill you accept it can kill you accept so you can use it safely	1	AO3 2.4
Total			9	

4.2.4.1 Power

Answer 30 · Mark scheme

June 2016 | PH2HP | Original Q4 | Legacy



4.2.4.1 Power

Answer 31 · Mark scheme

June 2016 | PH2HP | Original Q5 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(a)	elastic potential		1	AO1 2.1.5b 2.2.1c
5(b)(i)	line is straight	accept line does not curve	1	AO1 2.1.5c
5(b)(ii)	400 newtons per metre **or** N/m	allow **1** mark for correct substitution of any pair of numbers correctly taken from the graph e.g.160 = k × 0.40 if symbols are used they must be correct	2 1	AO2 2.1.5d AO1 2.1.5d
5(b)(iii)	300	allow **1** mark for correctly obtaining force on 1 spring = 100N	2	AO3 2.3.2l
5(c)	52	allow **2** marks for calculating change in gpe for 1 chin-up as 260 (J) or for 12 chin-ups as 3120 (J) an answer 4.3 gains **2** marks allow **1** mark for correct substitution into gpe equation ie gpe = 65 × 10 × 0.4 (×12) **or** correct use of power equation with an incorrect value for energy transferred	3	AO2 2.2.1e
Total			**10**	

4.2.4.1 Power

Answer 31 · Mark scheme

June 2016 | PH2HP | Original Q5 | Legacy



4.2.4.1 Power

Answer 32 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(a)	a magnetic field that is alternating / changing	accept electromagnetic field heat is insufficient	1 1	AO1 3.3.2d
2(b)	20	allow **1** mark for correct substitution, ie $\frac{230}{11.5}$ provided no subsequent step	2	AO2 3.3.2g
2(c)	(most) transformers are not 100% efficient	allow energy / power is lost to the surroundings allow energy / power is lost as heat / sound power is lost is insufficient	1	AO1 3.3.2h
2(d)(i)	0.01 (V) because there is a change in p.d. each time (the number of turns changes)	 allow because all the results (to 2 decimal places) are different accept if results were to 1 decimal place, there might not be a difference	1 1	AO3 3.3.2a 3.3.2b
2(d)(ii)	student 2 moved the coil more slowly (than student 1)	accept student 2 moved the coil at a different speed to student 1 do not accept student 2 moved the coil faster (than student 1)	1	AO3 3.3.2a 3.3.2b
2(d)(iii)	both sets of results show the same pattern	accept trend for pattern results are similar is insufficient results follow a pattern is insufficient	1	AO3 3.3.2a 3.3.2b

Question 2 continues on the next page . . .

4.2.4.1 Power

Answer 32 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(d)(iv)	(electromagnetic) induction	accept it is induced do not accept electric / magnetic induction	1	AO1 3.3.2a
2(e)	any **one** from: • more economical / cheaper for the consumer • easier/cheaper to replace if broken/lost • since fewer transformers need to be made less resources are used	allow more convenient allow in case one gets lost allow fewer plug sockets are needed allow fewer transformers are needed environmentally friendly is insufficient	1	AO3 3.3.2
Total			11	

4.2.4.1 Power

Answer 32 · Mark scheme

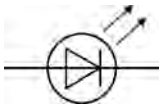
June 2016 | PH3HP | Original Q2 | Legacy



4.2.4.1 Power

Answer 33 · Mark scheme

June 2017 | PH2HP | Original Q5 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(a)(i)		as shown only	1	AO1 2.3.2c
5(a)(ii)	12 (J)	allow **2** marks for correct substitution ie $40 \times 10^{-3} = \frac{E}{300}$ allow **1** mark for obtaining value of P correctly from the graph as 40, 40 x 10^{-3}, 0.04 **or** allow **1** mark for converting time to seconds answers 12000 or 0.2 gain **2** marks an answer 200 gains **1** mark	3	AO2 2.4.2b
5(b)	ions vibrate faster **or** ions vibrate with a bigger amplitude electrons collide more (frequently) with the ions **or** (drift) velocity of electrons decreases	accept atoms for ions throughout accept ions gain energy accept ions vibrate more do not accept ions start to vibrate do not accept ions move around do not accept electrons start to collide there are more collisions is insufficient, unless both electrons and ions are implied	1 1	AO1 2.3.2m

4.2.4.1 Power

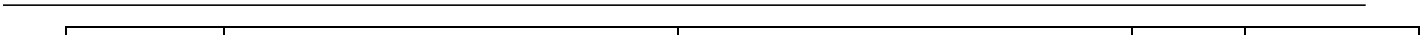
Answer 33 · Mark scheme

5(c)	any **one** from: • they use a smaller current (for the same p.d.) • they are more efficient • they have a lower power input	less energy/power is wasted accept requires less energy ignore use less electricity they last longer is insufficient	1	AO1 2.3.2o
Total			**7**	

4.2.4.1 Power

Answer 33 · Mark scheme

June 2017 | PH2HP | Original Q5 | Legacy



4.2.4.1 Power

Answer 34 · Mark scheme

June 2018 | 8463/1H | Original Q4

Question	Answers	Extra information	Mark	AO/ Spec. Ref
04.1	chemical	in this order only	1	AO1 4.1.1.1
	equal to	allow the same as	1	
04.2	power = $\frac{\text{work done}}{\text{time}}$	allow P = $\frac{W}{t}$	1	AO1 4.1.1.4
04.3		an answer of 360 000 (J) scores **3** marks		AO2 4.1.1.4
	200 = $\frac{W}{1800}$		1	
	W = 200 × 1800		1	
	W = 360 000 (J)		1	
04.4		an answer that rounds to 15.8 (%) scores **2** marks		AO2 4.1.1.1
	11 – 9.5 = 1.5 (m/s)	allow a change in speed between 1.2 and 1.5 (m/s)	1	
	$\left(\frac{1.5}{9.5}\right)$ × 100 = 15.8 (%)	allow an answer consistent with their change in speed	1	
		an answer of 16 (%) scores **2** marks		
04.5	maximum speed is lower		1	AO1 4.1.1.4
	because maximum power output of cyclist is constant	allow maximum force on pedals is constant	1	
	(but) additional work is done (against gravity) **or** gravitational potential energy (of cyclist) is increased	do **not** accept additional work done against friction or air resistance	1	
Total			**11**	

4.2.4.1 Power

Answer 35 · Mark scheme

June 2018 | 8463/1H | Original Q5

Question	Answers	Extra information	Mark	AO/ Spec. Ref
05.1	potential difference	in this order only allow p.d. allow voltage	1	AO1 4.2.1.4
	temperature		1	
05.2	the current increases (when the potential difference increases)		1	AO1 4.2.1.4
	(which) causes the temperature of the filament to increase		1	
	(so) the resistance increases	do **not** accept resistance increases and then levels off	1	
05.3	a higher proportion / percentage of the (total) power / energy input is usefully transferred **or** higher (useful) power / energy output for the same (total) power / energy input	wastes less energy is insufficient	1	AO2 4.1.2.2
05.4	potential difference increases		1	AO2 4.2.2
	current decreases		1	AO1 4.2.2
05.5	1000 (Ω)	reason only scores if R =1000 (Ω)	1	AO2 4.2.1.3
	potential difference is shared in proportion to the resistance	allow a justification using a correct calculation	1	

4.2.4.1 Power

Answer 35 · Mark scheme

June 2018 | 8463/1H | Original Q5

Question	Answers	Extra information	Mark	AO/ Spec. Ref
05.6		an answer of 1.7×10^{-3} (A) scores **4** marks		AO2 4.2.1.3
	$12 = I \times 7000$		1	
	$I = \frac{12}{7000}$		1	
	$I = 1.71 \times 10^{-3}$ (A)	an answer that rounds to 1.7×10^{-3} (A) scores **3** marks	1	
	$I = 1.7 \times 10^{-3}$ (A) **or** $I = 0.0017$ (A)	this answer only	1	
		an answer of 2.4×10^{-3} (A) scores **2** marks		
		if no other marks scored allow **1** mark for calculation of total resistance (7000 Ω)		
Total			**14**	

4.2.4.1 Power

Answer 36 · Mark scheme

June 2018 | 8463/1H | Original Q9

Question	Answers	Extra information	Mark	AO/ Spec. Ref
09.1	risk of electric shock (if someone touched the case)	allow risk of electrocution (if someone touched the case)	1	AO1 4.2.3.2
09.2		an answer of 11 (A) scores **3** marks		AO2 4.2.4.1
	2530 = I × 230	this mark may be awarded if P is incorrectly / not converted	1	
	$I = \frac{2530}{230}$	this mark may be awarded if P is incorrectly / not converted	1	
	I = 11 (A)	this answer only	1	
		an answer of 0.011 (A) scores **2** marks		
09.3		an answer of 0.12 (kg) **or** an answer that rounds to 0.12 (kg) scores **5** marks		AO2 4.2.4.2 4.1.1.3
	E = 2530 × 14	this mark may be awarded if P is incorrectly / not converted	1	
	E = 35 420 (J)	this answer only	1	
	35 420 = m × 4200 × 70	allow their calculated E = m × 4200 × 70	1	
	$m = \frac{35\,420}{4200 \times 70}$	allow $m = \frac{\text{their calculated E}}{4200 \times 70}$	1	
	m = 0.12 (kg)	allow an answer that is consistent with their calculated value of E	1	
Total			**9**	

4.2.4.1 Power

Answer 37 · Mark scheme

June 2018 | 8463/2H | Original Q7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	any **one** from: • too few turns / coils on the secondary • p.d. across the primary was reduced	allow number of turns / coils on the primary was increased ignore human error	1	AO3 4.7.3.4
07.2	the p.d. (across the secondary) goes above 2V	allow p.d. across secondary is higher than p.d. across primary after 20 turns	1	AO3 4.7.3.4
07.3	it increases (until the nails reach a constant temperature)		1	AO1 4.6.3.1

4.2.4.1 Power

Answer 37 · Mark scheme

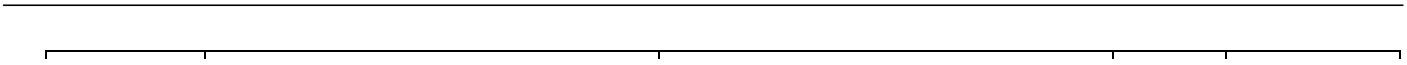
June 2018 | 8463/2H | Original Q7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4		an answer of 1.2 (A) scores **5** marks		AO2 4.7.3.4
	$\frac{640}{4} = \frac{V_p}{1.75}$		1	
	$V_p = \frac{640 \times 1.75}{4}$		1	
	$V_p = 280$ (V)		1	
	$280 \times I_p = 336$	allow their calculated $V_p \times I_p = 336$	1	
	$I_p = 1.2$ (A)	allow an answer that is consistent with their calculated value of V_p	1	
	or			
	$336 = I_s \times 1.75$ (1)			
	$I_s = \frac{336}{1.75}$ (1)			
	$I_s = 192$ (A) (1)			
	$I_p = 192 \times \frac{4}{640}$ (1)	allow I_p= their calculated $I_s \times \frac{4}{640}$		
	$I_p = 1.2$ (A) (1)	allow an answer that is consistent with their calculated value of I_s		
Total			**8**	

4.2.4.1 Power

Answer 37 · Mark scheme

June 2018 | 8463/2H | Original Q7



4.2.4.1 Power

Answer 38 · Mark scheme

June 2019 | 8463/1H | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1.1	The energy transferred each second to the bulb.		1	4.1.1.4 AO1
1.2	power = potential difference × current **or** $P = VI$		1	4.2.4.1 AO1
1.3	$40 = I \times 230$ $I = \frac{40}{230}$ I = 0.17 (A)	an answer of 0.17 (A) scores **3** marks a correct answer that rounds to 0.17 (A) scores **3** marks	1 1 1	4.2.4.1 AO2
1.4	efficiency = $\frac{\text{useful power output}}{\text{total power input}}$		1	4.1.2.2 AO1
1.5	$0.30 = \frac{\text{useful power output}}{9.0}$ useful power output = 0.30 × 9.0 useful power output = 2.7 (W)	an answer of 2.7 (W) scores **3** marks	1 1 1	4.1.2.2 AO2
1.6	bulbs also transfer thermal energy the efficiency of the light bulb also needs to be considered	allow light bulbs emit infrared radiation as well as visible light ignore so people know how bright the bulb is allow the cost to power the light bulb depends on the efficiency allow to see how much energy is wasted	1 1	4.1.2.2 4.1.1.4 AO1 AO3
Total			**11**	

4.2.4.1 Power

Answer 39 · Mark scheme

June 2019 | 8463/1H | Original Q6

Question 6

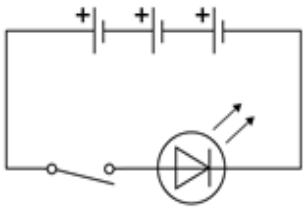
Question	Answers	Extra information	Mark	AO / Spec. Ref.
6.1	50 Hz / hertz	 allow Hertz	1 1	4.2.3.1 AO1
6.2	(both) switches need to be closed / on to complete the series circuit **or** to allow charge to flow **or** so there is a current in the circuit		1 1	4.2.2 AO1
6.3	 $1800 = I^2 \times 32$ $I^2 = \frac{1800}{32}$ **or** $I^2 = 56.25$ I = 7.5 (A)	an answer of 7.5 (A) scores **3** marks an answer of 0.237(A) scores **2** marks this mark may be awarded if P is incorrectly or not converted this mark may be awarded if P is incorrectly or not converted this answer only	 1 1 1	4.2.4.1 AO2
6.4	 $1500 = \frac{450\ 000}{t}$ $t = \frac{450\ 000}{1500}$ t = 300 (s)	an answer of 300 (s) scores **3** marks an answer of 300 000 (s) scores **2** marks this mark may be awarded if P is incorrectly or not converted this mark may be awarded if P is incorrectly or not converted this answer only	 1 1 1	4.1.1.4 AO2
Total			**10**	

4.2.4.1 Power

Answer 40 · Mark scheme

November 2020 | 8463/1H | Original Q2

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1			1	AO1 4.2.1.1
02.2	charge flow = current × time **or** $Q = It$		1	AO1 4.2.1.2
02.3	I = 0.050 (A) Q = 0.050 × 14 400 Q = 720 (C)	 allow a correct substitution using an incorrectly/not converted value of I allow a correct calculation using an incorrectly/not converted value of I	1 1 1	AO2 4.2.1.2
02.4	there is no current in a diode (in the reverse direction) **or** charge will not flow through a diode (in the reverse direction) (because) a diode has a (very) high resistance (in the reverse direction)	allow diode will not conduct (electric charge) do not accept the circuit is not complete	1 1	AO1 4.2.1.4 4.2.1.3
02.5	Efficiency = $\frac{\text{Useful power output}}{\text{Total power input}}$		1	AO1 4.1.2.2

4.2.4.1 Power

Answer 40 · Mark scheme

November 2020 | 8463/1H | Original Q2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	$0.75 = \frac{\text{Useful power output}}{0.24}$ Useful power output = 0.75 × 0.24 Useful power output = 0.18 (W)		1 1 1	AO2 4.1.2.2
Total			11	

4.2.4.1 Power

Answer 41 · Mark scheme

November 2020 | 8463/1H | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	% increase = $\frac{(10\,000 - 3200)}{3200} \times 100$ % increase = 212.5 (%)		1 1	AO3 4.1.3
04.2	Any **two** from: • no sulfur dioxide released • doesn't cause acid rain • no particulates released • doesn't cause global dimming • less carbon dioxide released (per kg of fuel burned) • less global warming • no solid waste • gas mining is less destructive than coal mining	allow less climate change allow less greenhouse gases ignore less air pollution	2	AO1 4.1.3
04.3	mean sea surface temperature shows a (steady) increase over the time period on the graph **or** from 16.45 (°C) to 16.96 (°C)	 conditional on scoring 1st marking point allow between a correct pair of dates at least 10 years apart allow a correct pair of temperatures at least 10 years apart	1 1	AO3 4.1.3

4.2.4.1 Power

Answer 41 · Mark scheme

November 2020 | 8463/1H | Original Q4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	thermistor C (because) the change in resistance is greatest between 0 and 25 °C	 conditional on scoring 1st marking point allow the gradient is highest allow more sensitive to temperature change conditional on scoring 2nd marking point allow between 16 and 17 °C if thermistor C is not chosen, allow for 1 mark each: not thermistor A because there is no/little change in resistance not thermistor B as there is only a small change in resistance not thermistor D as there is no data available between 0 and 40 °C	1 1 1	AO3 4.2.1.4
Total			**9**	

4.2.4.1 Power

Answer 42 · Mark scheme

November 2020 | 8463/1H | Original Q9

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	5.75 = I × 230		1	AO2 4.2.4.1 4.2.1.3
	$I = \frac{5.75}{230}$		1	
	I = 0.025 (A)		1	
	230 = 0.025 × R **or** $R = \frac{230}{0.025}$ R = 9200 (Ω)	allow a correct substitution using an incorrect value of I **or** allow a correct rearrangement using incorrect value of I allow a correct calculation of resistance using an incorrect value of I	1 1	
		alternative approach for 4th and 5th marks: $5.75 = 0.025^2 \times R$ (1) **or** $R = \frac{5.75}{0.025^2}$ R = 9200 (Ω) (1)		
		alternative approach: $5.75 = \frac{230^2}{R}$ (3) $R = \frac{230^2}{5.75}$ (1) R = 9200 (Ω) (1)		

4.2.4.1 Power

Answer 42 · Mark scheme

November 2020 | 8463/1H | Original Q9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.2	one wire in the switch is live the electrician is earthed **or** the electrician is at earth potential (so) there will be a (large) potential difference between the live wire and the electrician / earth (if the electrician touched the wire)	allow the switch / circuit is live allow one wire is at a potential of 230 V	1 1 1	AO1 4.2.3.2
09.3	50 Hz has the lowest (maximum) let-go current a higher / lower / different frequency would allow people to let go at a greater current	 allow a specific numerical example as opposed to a trend	1 1	AO3 4.2.3.1
Total			**10**	

4.2.4.1 Power

Answer 43 · Mark scheme

November 2021 | 8463/1H | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	the polarity (of the supply) does not change	allow potential difference in one direction (only)	1	AO1 4.2.3.1
01.2	energy transferred = power × time		1	AO1 4.1.1.4 4.2.4.2
01.3	162 000 000 = 7200 × t $t = \frac{162\,000\,000}{7200}$ t = 22 500 (s)		1 1 1	AO2 4.1.1.4 4.2.4.2
01.4	$V = I \times R$		1	AO1 4.2.1.3
01.5	480 = 15 × R $R = \frac{480}{15}$ R = 32 (Ω)		1 1 1	AO2 4.2.1.3
01.6	time taken using system **A** is double the time of system **B**		1	AO3 4.2.4.1
Total			**10**	

4.2.4.1 Power

Answer 44 · Mark scheme

November 2021 | 8463/1H | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	$E = \frac{1.25\times10^{18}}{3.16\times10^{7}}$		1	AO2 4.1.1.4
	$E = 3.96 \times 10^{10}$ (J)	an answer that rounds to 3.96×10^{10} (J) scores **1** mark	1	
05.2	t = 86 400 (s)		1	AO2 4.2.1.2
	27 000 = I × 86 400	allow a correct substitution of an incorrectly/not converted value of t	1	
	$I = \frac{27\ 000}{86\ 400}$	allow a correct rearrangement using an incorrectly/not converted value of t	1	
	I = 0.3125 (A)	allow a correct calculation using an incorrectly/not converted value of t allow a correctly calculated answer rounded to 2 or 3 sf	1	
05.3	$0.15 = \frac{\text{useful power output}}{7800}$	allow a correct substitution of an incorrectly/not converted value of total power input	1	AO2 4.1.2.2
	useful power output = 0.15 × 7800	allow a correct rearrangement using an incorrectly/not converted value of total power input	1	
	useful power output = 1170 (W)	this answer only but allow 1200 (W) if correct working shown	1	
05.4	a really large area of land would need to be covered with solar cells		1	AO2 4.1.3
	due to the low useful power output of the solar cells	allow due to the low efficiency of the solar cells	1	

4.2.4.1 Power

Answer 44 · Mark scheme

		or number of hours of daylight is too low (in UK) **or** low solar intensity (in UK) **or** solar radiation (in UK) is too low **or** material for construction of solar cells and/or lithium batteries is in limited supply		

Total			**11**

4.2.4.1 Power

Answer 45 · Mark scheme

November 2021 | 8463/1H | Original Q7

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	I = 0.08 (A)	an incorrect value of I from the graph can score all subsequent marks	1	AO2 4.2.4.1
	$0.230 = 0.08 \times V$	allow a correct substitution of an incorrectly/not converted value of P	1	
	$V = \frac{0.230}{0.08}$	allow a correct rearrangement using an incorrectly/not converted value of P	1	
	V = 2.875 (V) **OR** I = 0.08 (A) (1) V = 0.08 × 36 (2) V = 2.88 (V) (1) **OR** $0.230 = I^2 \times 36$ (1) I = 0.08 (A) (1) V = 0.08 × 36 (1) V = 2.88 (V) (1)	allow a correct calculation using an incorrectly/not converted value of P	1	
07.2	the product of current and resistance = a constant		1	AO2
	calculation of constant (2.88) using three or more pairs of values	if no other marks scored allow for one mark a statement that doubling one quantity (R or I) halves the other quantity	1	AO3 4.2.1.3

4.2.4.1 Power

Answer 45 · Mark scheme

November 2021 | 8463/1H | Original Q7

07.3	current would be (almost) zero (in the variable resistor) (because) the switch has (effectively) zero resistance **or** the potential difference across the variable resistor is (effectively) zero	 the switch's resistance is much lower than the variable resistor allow the switch creates a short circuit	1 1	AO1 AO2 4.2.2 4.2.1.3

Total			**8**

4.2.4.1 Power

Answer 46 · Mark scheme

November 2021 | 8463/1H | Original Q10

Question 10

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.1	(very high p.d. means) very low currents		1	AO1 4.2.4.3
	which means less (thermal) energy is transferred to surroundings	allow less power loss in cables	1	
	which increases the efficiency of power transmission		1	
10.2	electric field strength is very high		1	AO1 4.2.5.2
	causing the air to become ionised	allow the air breaks down allow the air becomes a conductor allow the air conducts charge	1	
	(the kite / string) conducts charge to the person / earth		1	
		ignore answers referring to the kite touching the power cables		
10.3	straight line passing through the origin		1	AO3 4.2.5.2
	line drawn below existing line for all values		1	
10.4	the potential difference across the wires/cable is the same		1	AO1 4.2.2 4.2.1.4
	(but) the resistance of the steel wire is greater (and so less current in the steel)		1	
Total			10	

4.2.4.1 Power

Answer 47 · Mark scheme

June 2022 | 8463/1H | Original Q3

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	$P = V \times I$		1	AO1 4.2.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	$4.4 = 40 \times I$ $I = \frac{4.4}{40}$ $I = 0.11$ (A)		1 1 1	AO2 4.2.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	efficiency = $\frac{\text{useful power output}}{\text{total power input}}$		1	AO1 4.1.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	$0.85 = \frac{P}{4.0}$ $P = 0.85 \times 4.0$ $P = 3.4$ (W)		1 1 1	AO2 4.1.2.2

Total Question 3		8

4.2.4.1 Power

Answer 48 · Mark scheme

June 2023 | 8463/1H | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	increase decrease	must be in this order	1 1	AO1 4.2.4.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	$P = I^2R$		1	AO1 4.2.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	$1.60 \times 10^9 = 2000^2 \times R$ $R = \frac{1.60 \times 10^9}{2000^2}$ $R = 400\ (\Omega)$		1 1 1	AO2 4.2.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	efficiency = $\frac{\text{useful energy output}}{\text{total energy input}}$ **or** efficiency = $\frac{\text{useful output energy transfer}}{\text{total input energy transfer}}$		1	AO1 4.1.2.2

4.2.4.1 Power

Answer 48 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	$0.992 = \frac{\text{useful energy output}}{34.2}$ useful energy output = 0.992 × 34.2 useful energy output = 33.9 (GJ)	 allow a correct answer given to more than 3 s.f.	1 1 1	AO2 4.1.2.2

Total Question 1	10

4.2.4.1 Power

Answer 49 · Mark scheme

June 2023 | 8463/1H | 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. The key steps are identified and logically sequenced.	5–6	AO1 4.2.1.4 RPA4
	Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced.	3–4	
	Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2	
	No relevant content	0	
	Indicative content • ammeter in series with filament lamp • current measured with an ammeter • voltmeter in parallel with filament lamp • p.d. measured with a voltmeter • variable resistor (or variable power pack or variable number of cells) used to vary current in and p.d. across filament lamp • range of p.d. of 0 to 6 V • interval of p.d. of 1 V • reverse connections to power supply to obtain negative values • take repeat readings and calculate a mean • discard anomalies Indicative content may be seen in a circuit diagram. Level 3 answer: needs to include a circuit which would work (if included) and a method to obtain negative values.		

4.2.4.1 Power

Answer 49 · Mark scheme

June 2023 | 8463/1H | Original Q6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	3.0 = 0.16 × *R*	allow a correct substitution of an incorrect value of *I* in the range 0.15 (A) to 0.17 (A)	1	AO2 4.2.1.3
	$R = \frac{3.0}{0.16}$	allow a correct rearrangement of an incorrect value of *I* in the range 0.15 (A) to 0.17 (A)	1	
	R = 18.75 (Ω)	allow 19 (Ω) allow 18.8	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	*t* = 1800 (s)		1	AO2 4.2.4.2
	Q = 0.21 × 1800	all subsequent marks can score if an incorrectly / not converted value of *t* is used	1	4.1.1.4 4.2.1.2 4.2.4.1
	Q = 378 (C)		1	
	E = 378 × 6.0		1	
	E = 2268 (J)	allow an answer to 2 or 3 s.f.	1	
	OR			
	P = 0.21 × 6.0 (1)			
	P = 1.26 (W) (1)			
	t = 1800 (s) (1)	all subsequent marks can score if an incorrectly / not converted value of *t* is used		
	E = 1.26 × 1800 (1)			
	E = 2268 (J) (1)	allow an answer to 2 or 3 s.f.		

4.2.4.1 Power

Answer 49 · Mark scheme

June 2023 | 8463/1H | Original Q6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	(for the power to quadruple) the current and the p.d. would both need to double (but the current doesn't double) because the resistance of the filament lamp increases **or** (but the current doesn't double because the graph shows that) current is not proportional to p.d.	allow the graph does not show direct proportionality ignore the graph is not a straight line ignore the graph is not linear	1 1	AO3 4.2.1.4 4.2.4.1

Total Question 6	16

4.2.4.1 Power

Answer 50 · Mark scheme

June 2023 | 8463/2H | Original Q8

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	iron	allow nickel / cobalt do not allow steel	1	AO1 4.7.3.4
	it is easily magnetised (and demagnetised)	allow it is a magnetic material MP 2 is dependent on MP 1	1	

4.2.4.1 Power

Answer 50 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.2	$\frac{230}{V_s} = \frac{2000}{40}$		1	AO2 4.7.3.4
	$V_s = \frac{40}{2000} \times 230$	subsequent marks can only be awarded if the first equation is correct and has been used	1	
	$V_s = 4.6$ (V)		1	
	$4.6 \times I_s = 6.9$	this mark may be awarded if the pd is incorrectly calculated	1	
	$I_s = 1.5$ A	allow a correctly calculated I_s using an incorrectly calculated pd	1	
	OR			
	$6.9 = I_p \times 230$ (1)			
	$I_p = \frac{6.9}{230}$ (1)	subsequent marks can only be awarded if the first equation is correct and has been used		
	$I_p = 0.03$ (A) (1)			
	$I_s = 0.03 \times \frac{2000}{40}$ (1)	this mark may be awarded if I_p is incorrectly calculated		
	$I_s = 1.5$ (A) (1)	allow a correctly calculated I_s using an incorrectly calculated I_p		

Total Question 8	7

4.2.4.1 Power

Answer 51 · Mark scheme

June 2024 | 8463/1H | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	50 (Hz) 230 (V)	this order only	1 1	AO1 4.2.3.1

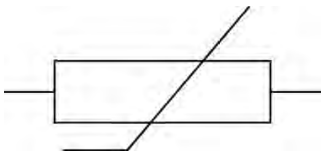
Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	340 mW = 0.34 W		1	AO2 4.2.4.1
	$0.34 = 0.75^2 \times R$	allow a correct substitution of an incorrectly / not converted value of P	1	
	$R = \frac{0.34}{0.75^2}$	allow a correct rearrangement of an incorrectly / not converted value of P	1	
	$R = 0.60\ (\Omega)$	allow an answer consistent with an incorrectly / not converted value of P allow a correct answer given to more than 2 sf	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	the dirt changes the (measured) resistance of the coin **or** the (measured) resistance is different from the expected resistance (of the coin)	allow the measured resistance does not match the resistance of a known coin allow dirt stops charge flow (through the coin) allow dirt stops the current (in the coin)	1	AO3 4.2.1.3

4.2.4.1 Power

Answer 51 · Mark scheme

June 2024 | 8463/1H | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4			1	AO1 4.2.1.1

4.2.4.1 Power

Answer 51 · Mark scheme

June 2024 | 8463/1H | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	R_{Total} = 400 + 80 (= 480 Ω)		1	AO2 4.2.1.3 4.2.2
	12 = I × 480 **or** $I = \frac{12}{480}$	allow a correct substitution / rearrangement with R_{Total} in range 470 - 490 Ω	1	
	I = 0.025 (A)	allow a correct calculation using R_{Total} in range 470 - 490 Ω	1	
	V = 0.025 × 80	allow a correct substitution using their calculated value of I (using $V = IR$) and R_{Th} in range 70 - 90 Ω	1	
	V = 2.0 (V)	allow a correct calculation using their calculated value of I (using $V = IR$) and R_{Th} in range 70 - 90 Ω	1	
	OR			
	total R = 400 + 80 (= 480) (1)			
	ratio (Th:R) = 80:480 (1)	allow a range of R_{Th} between 70 and 90 Ω		
	ratio = 1:6 (1)	allow a correct ratio using a value of R_{Th} between 70 and 90 Ω		
	$V = \frac{1}{6} \times 12$ (1)	allow a correct substitution using a value of R_{Th} between 70 and 90 Ω		
	V = 2.0 (V) (1)	allow an answer in the range 1.8 (V) to 2.2 (V)		

Total Question 5	13

4.2.4.1 Power

Answer 52 · Mark scheme

June 2025 | 8463/1H | Original Q9

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	h = 0.70 (m)	all subsequent marks can score using an incorrectly / not converted value of h	1	AO2 4.1.1.2
	0.343 = m × 9.8 × 0.70		1	
	$m = \frac{0.343}{9.8 \times 0.70}$		1	
	m = 0.050 (kg)		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.2	4.86 = I^2 × 6.0		1	AO2 4.2.1.3
	$I^2 = \frac{4.86}{6.0}$		1	4.2.4.1
	I = 0.90 (A)		1	
	t = 1800 (s)	all subsequent marks can score using an incorrectly / not converted value of t	1	
	Q = 0.90 × 1800	allow a correct substitution using their value of current	1	
	Q = 1620 (C)	allow a correct calculation using their value of current allow an answer of 1600 (C)	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.3	greater mass / volume of water each second	allow water flow will increase ignore increased water speed	1	AO3
	(because) smaller proportion / percentage of energy is wasted	allow greater (useful) power output allow less energy / power wasted	1	AO1 4.1.2.2

Total Question 9	12

4.2.4.1 Power

ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark scheme June 2003

GCSE

Physics

3451

Foundation

Copyright © 2003 AQA and its licensors. All rights reserved.

The Assessment and Qualifications Alliance (AQA) is a company limited by guarantee registered in England and Wales 3644723 and a registered charity number 1073334
Registered address: Addleshaw Booth & Co., Sovereign House, PO Box 8, Sovereign Street, Leeds LS1 1HQ
Kathleen Tattersall: *Director General*

4.2.4.1 Power

INFORMATION FOR EXAMINERS

1. General

The mark scheme for each question shows:

- the marks available for each part of the question;
- the total marks available for the question;
- the typical answer or answers which are expected;
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example:
where consequential marking needs to be considered in a calculation;
or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; e.g. allow smooth / free movement.)

3. Marking points

3.1 Marking of Quality of Written Communication

Examiners are reminded of the need to assess QoWC by the following statement appearing in the appropriate parts of the mark scheme:

The answer to this question requires ideas in good English in a sensible order with correct use of scientific terms. Quality of written communication should be considered in crediting points in the mark scheme.

The maximum marks available to a candidate whose answer is not well expressed will be (the number of marks available –1).

4.2.4.1 Power

3.2 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.3 Use of chemical symbols/formulae

If a candidate writes a chemical symbol/formula instead of a required chemical name, full credit can be given if the symbol/formula is correct and if, in the context of the question, such action is appropriate.

3.4 The marking of quantitative relationships

Full credit can be given for a correct quantitative relationship expressed in:

- named units;
- physical quantities;
- standard symbols;
- a combination of physical quantities and units.

No credit can be given for any quantitative relationship expressed in terms of:

- a combination of physical quantities, units and symbols;
- a diagram, e.g. the ohm's law triangle, unless the rest of the answer shows clearly that the candidate understands the relationships involved.

3.5 Marking procedure for calculations

3.5.1 Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown. However, if the answer is incorrect, mark(s) can be gained by correct substitution/working and this is shown in the 'extra information' column.

3.5.2 Where calculations are based on incorrectly recalled relationships, neither the incorrectly recalled relationship, nor the resulting calculation based on the incorrect relationship, will be credited.

3.6 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.7 Errors carried forward

There should be no error carried forward from a previous answer which has been based on wrong science. Any error in the answers to a structured question should be penalised once only.

Examples

(a) A candidate who calculates average speed using speed = time/distance **and** then proceeds to use this incorrect answer to calculate an acceleration based on the correct quantitative relationship should be given credit for the use of the correct acceleration relationship but none for either numerical answer.

(b) A candidate who incorrectly calculates average speed using speed = distance/time and then proceeds to use this incorrect value to calculate an acceleration based on the correct quantitative relationship, should be given credit for the use of both correct quantitative relationships **and** for the correct substitution and use of the incorrect value in the calculation of the rate of acceleration.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.8 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.9 Brackets

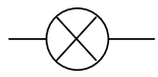
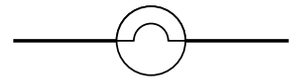
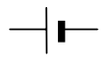
(…..) is used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.10 Unexpected Correct Answers not in the Mark Scheme

The Examiner should use professional judgement to award credit where a candidate has given an unexpected correct answer which is not covered by the mark scheme. The Examiner should consult with the Team Leader to confirm the judgement. The Team Leader should pass this answer on to the Principal Examiner with a view to informing all examiners.

4.2.4.1 Power

3451/F Q1

question	answers	extra information	mark
(a)	circuit symbol for a lamp correct 	accept  accept any standard of drawing providing circuit would work	1
	 circuit symbol for a cell correct		1
	2 lamps drawn in parallel with 3 cells	polarity of cells must be correct (+ to –) but cells may be either way around	1
(b)	4.5		1
(c)	the same as	accept any clear indication of the correct answer	1
total			5

4.2.4.1 Power

3451/F Q2

question	answers	extra information	mark
(a)	gas		1
(b)	fuel burning stations produce electricity at any time / all the time wind generator can only produce when the wind is strong enough	accept fuel available all the time accept it's not always windy	1 1
(c)	no fuel is burnt **or** no fuel is used **or** uses only energy from wind **or** does not emit harmful gases / soot / smoke	do **not** accept wind is natural / environmentally friendly / renewable answer must be in terms of wind, **not** negative of fuel burning specific examples of gases CO_2, SO_2, acid rain and greenhouse gases can be accepted ozone negates credit	1
total			4

4.2.4.1 Power

3451/F Q3

question	answers	extra information	mark
(a)(i)	microwaves		1
(ii)	infra red		1
(iii)	ultrasonic		1
(b)(i)	B		1
(ii)	A		1
(c)	disturbance / vibration / movement direction	accept motion / force do **not** accept energy	1 1
(d)	sound wave	accept any clear indication of the correct answer	1
total			8

4.2.4.1 Power

3451/F Q4

question	answers	extra information	mark
(a)(i)	heat		1
(ii)	temperature increases **or** (cause) convection (currents)	accept gets warmer accept gets hotter	1
(iii)	60% **or** 0.6	60 without % scores **1** mark 0.6 with a unit scores **1** mark 60 with incorrect unit scores **1** mark **or** correct substitution $\frac{120}{200}$ for **1** mark	2
(b)	street more (energy transferred as) light **or** less (energy transferred as) heat **or** useful energy output the highest	 can only score this mark if first mark scored all efficiencies calculated correctly score 2nd mark point	1 1
total			6

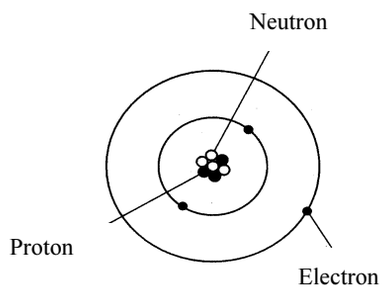
4.2.4.1 Power

3451/F Q5

question	answers	extra information	mark
(a)	MN	accept 5.8, 8 seconds must include unit	1
(b)	LM	accept 0.8, 5.8 seconds must include unit	1
(c)(i)	0.8		1
(ii)	drinking alcohol		1
(d)	straight (by eye) line starting at 0.8 seconds line drawn steeper than LM starting before L	 ignore lines going beyond 2 seconds but line must exceed 2.5 metres per second before terminating	1 1
total			6

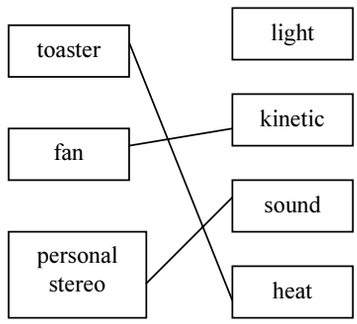
4.2.4.1 Power

3451/F Q6

question	answers	extra information	mark
(a)(i)	each correct label scores 1 mark  		3
(ii)	neutron		1
(iii)	7 number of protons and neutrons **or** number of nucleons **or** number of particles in the nucleus	 accept number of particles in the centre only if first answer = 7	1 1
(b)(i)	50 ± 5		1
(ii)	50 ± 5	accept their (b)(i)	1
(iii)	less	accept any way of indicating the correct answer	1
total			9

4.2.4.1 Power

3451/F Q7

question	answers	extra information	mark
(a)	each correct line scores 1 mark  	if more than 3 lines are drawn mark incorrect ones first, to a maximum of 3 lines	3
(b)	toaster	accept 1.2 kW	1
(c)(i)	400		1
(ii)	£24 **or** 2400p	full credit for their (c)(i) × 6p for full credit the correct numerical answer must have the correct unit an answer of 24 or 2400 with no unit or the incorrect unit scores **1** mark (c)(i) × 6 incorrectly evaluated scores **1** mark	2
(d)	6	allow 6000 for **1** mark allow 3 × 2 for **1** mark	2
total			9

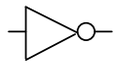
4.2.4.1 Power

3451/F Q8

question	answers	extra information	mark
(a)(i)	point where the rays cross	do not credit if ambiguous	1
(ii)	converging (lens)	do **not** accept convex	1
(b)(i)	point where the rays appear to diverge from	this should appear to be within 10mm in front of the back of the arrows on the approximate centre line need not be accurately constructed using a ruler	1
(ii)	diverging (lens)	do **not** accept concave	1
(c)	converging film smaller than nearer to	accept any clear indication of the correct response e.g. ticking, ringing, writing in after a mistake	1 1 1 1
(d)(i)	(image) bigger than object / enlarge	accept just 'made bigger'	1
(ii)	it / real image can be put on a screen **or** real image on the opposite side of the lens to the object	accept 'not an imaginary or virtual image' assume 'it' refers to a real image do **not** credit 'it can be seen'	1
(e)	**either** (the converging lens is) thick in the middle thin(ner) at the edge **or** (both) sides bend outwards (1) in the middle (1) **or** one side bends in the middle (1) more than the other side bends inwards (in the middle) (1)	thickest in the middle gains **2** marks convex gains **2** marks suitable diagrams gains **2** marks	1 1
total			12

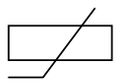
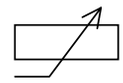
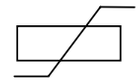
4.2.4.1 Power

3451/F Q9

question	answers	extra information	mark
(a)(i)	off off on	all correct	1
(ii)	AND (gate)	accept and (gate)	1
(iii)	on on on	all correct	1
(iv)	OR (gate)	accept or (gate)	1
(b)(i)	1 0 **or** 0 1 0 1 1 0	do **not** credit on / off responses	1
(ii)		accept mirror image accept  accept with either or both parts shaded accept line through as shading	1
(c)		accept off for 0 and on for 1 throughout	
	0 0	both correct	1
	0 1	both correct	1
	1 1	both correct	1
	1 1	both correct	1

4.2.4.1 Power

3451/F Q9 continued

(d)(i)		accept mirror image **or** inverted do **not** credit  **or**  or similar	1
(ii)	resistance decreases / increases / changes current (through it) increases / decreases / changes **or** temperature changes / increases / decreases (1) resistance changes / decreases / increases (1) (NTC thermistor) both marks independent but must be compatible to score **2** marks	accept 'voltage across it decreases' for **2** marks but only if it is made clear that this refers to a thermistor in series	1 1
total			13

4.2.4.1 Power

3451/F Q10

question	answers	extra information	mark
(a)(i)	friction	accept any way of indicating the correct answer	1
(ii)	gravity	accept any way of indicating the correct answer	1
(b)(i)	accelerates **or** speed / velocity increases	accept faster and faster (**1** mark) do **not** accept faster pace / falls faster or suggestions of a greater but constant speed	1
	downwards / falls	accept towards the Earth / ground this may score in part (b)(ii) if it does not score here and there is no contradiction between the two parts	1
(ii)	constant speed / velocity **or** terminal velocity / speed **or** zero acceleration	stays in the same place negates credit	1
total			5

4.2.4.1 Power

3451/F Q11

question	answers	extra information	mark
(a)(i)	X – mantle		1
	Y – inner core	do **not** accept solid core	1
(ii)	different to the crust **or** contains a lot of (heavy) metals	accept iron and nickel for metals	1
	higher (average) density **or** denser	density higher than 5500 (kg/m^3) gets **2** marks	1
(b)	animals were able to move from one continent to the other		1
	(when bridge broke) animals evolved differently	accept animals adapted differently	1
(c)(i)	earthquakes occur at the boundary between plates **or** earthquakes occur where plates push against each other		1
	there are no plate boundaries running through Britain	accept Britain is not near the edge of a plate	1
(ii)	convection currents (in the mantle) **or** heat released by (natural) radioactive processes		1
total			9

4.2.4.1 Power

3451/F Q12

question	answers	extra information	mark
(a)(i)	outside the Earth **or** not from the Earth	accept alien accept life from / on another planet / space accept our planet for Earth	1
(ii)	radio telescope(s)	do **not** accept telescopes do **not** accept satellite dishes do **not** accept radio receivers **or** transmitters	1
(b)(i)	galaxies	do **not** accept stars	1
(ii)	any **one** from: the pulses were regular pulses from space are usually random (scientists) thought technology had been used to produce the pulses neutron stars were unknown signals from a single point	 accept signals / beats for pulses accept noise for random pulses idea of regular but not continuous	1
(iii)	neutron star is (the matter / mass) left behind after a star / red giant explodes (as a super nova)	 accept after a super nova (explosion) neutron star causing super nova gets no credit	1 1
(c)(i)	carried on the balloon / equipment	accept carried by a rocket / aircraft / satellite birds negates credit	1
(ii)	on comets or meteors	accept meteorites / shooting stars accept returning space craft accept solar wind ignore asteroids accept ufo do **not** accept solar flares do **not** accept satellites	1
total			8

4.2.4.1 Power

3451/F Q13

question	answers	extra information	mark
(a)	silver is a (good) reflector of <u>heat</u> (radiation) **or** silver reflects the heat (radiation)	fact heat = infra red ignore references to light accept shiny for silver good radiator negates the mark ignore references to good conductor do **not** accept bounce back	1
	less heat is lost through the board **or** more heat is retained by the shirt	explanation accept both sides of shirt heated reflects heat back up gets **1** mark only ignore mention of friction	1
(b)	metal soleplate	accept soleplate / bottom / metal do **not** accept outside / case	1
(c)	plastic **or** rubber	accept any named plastic do **not** accept wood	1
	it is a (good) insulator **or** it is a poor conductor	ignore mention of heat if in conjunction with electricity	1
(d)	**Quality of written communication** *The answer to this question requires ideas in good English in a sensible order with correct use of scientific terms. Quality of written communication should be considered in crediting points in the mark scheme.*	*Maximum of **2** marks if ideas not well expressed.*	
	pulls iron bolt down **or** attracts the iron bolt **or** moves bolt out of plunger	answers in terms of charges attracting or repelling gain no credit	1
	plunger pushed / moved to the right (by spring) **or** plunger released		1
	push switch opens / goes to off / goes to right	accept circuit is broken for maximum credit the points must follow a logical sequence 3 correct points but incorrect sequence scores **2** marks only ignore reset action	1
total			8

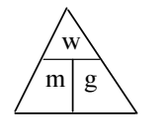
4.2.4.1 Power

3451/F Q14

question	answers	extra information	mark
(a)(i)	any **one** from: the ground the air radon (gas) building materials buildings rocks / granite food cosmic rays **or** solar rays X-rays nuclear weapons testing nuclear power stations / accidents	 do **not** accept mobile phones accept from outer space accept sun but **not** sunlight accept medical uses	1
(ii)	2	allow $\frac{1200}{60\times10}$ **or** $\frac{1200}{600}$ **or** 120 for **1** mark	2
(b)	 alpha: the count rate is (greatly) reduced by the card **or** the card absorbs alphas but not betas beta: the count rate is (greatly) reduced by the metal **or** the thin metal absorbs alphas and betas **or** the thin metal absorbs all of the radiation (from the source) gamma: would pass through the thin metal but count rate is background **or** no radiation passing through **or** a higher reading would be recorded **or** to reduce the count to 2 would require much more than 3 mm of metal	answers must be comparative accept converse answers throughout accept paper for the card accept aluminium for the metal accept aluminium for the metal accept lead / aluminium for the metal	 1 1 1
total			6

4.2.4.1 Power

3451/F Q15

question	answers	extra information	mark
(a)(i)	weight = mass × g.f.s.	accept w = m × g accept gravity for gfs accept  provided subsequent use of Δ correct do **not** accept N = kg × N/kg	1
(ii)	675	75 × 9 for **1** mark	2
(iii)	g.(f.s.) is higher (on Earth than Venus)	accept gravity for g.f.s. do **not** accept g.f.s. is lower unless answer states on Venus	1
(iv)	orbit time for Jupiter is <u>longer</u> / longest (than for the other planets)	do **not** give any credit for an answer that includes a comparison of diameter **or** a comparison of g.f.s.	1
(b)	**Quality of written communication** *The answer to this question requires ideas in good English in a sensible order with correct use of scientific terms. Quality of written communication should be considered in crediting points in the mark scheme.* any **two** from: dust <u>and</u> gas **or** remnants of a super nova pulled together by (force of) <u>gravity</u> nuclear fusion starts	*Maximum of **1** mark if ideas not well expressed.* accept hydrogen for dust and gas do **not** accept hydrogen burns although candidates may include more detail these points are essential to score the credit	2
total			7

4.2.4.1 Power

3451/F Q16

question	answers	extra information	mark
(a)(i)	upright with the contacts at the bottom and still in place and unbent	no need for labels but incorrect label(s) cancel the mark accept a freehand drawing no need for details such as correct dimensions	1
	one blob of mercury touching <u>both</u> contacts	do **not** award mark if contacts bent to touch	1
(b)(i)	(X is a) battery	do **not** credit cell accept (set of) cells accept power supply do **not** accept power pack	1
	(Y is a) LED	**or** light emitting diode	1
(ii)	longer (time)	do **not** accept 'slower time'	1
(iii)	any **two** from: current less (so) rate of flow of charge less **or** less coulombs per second (so) discharge is slower	 do **not** accept current slower accept capacitor has charge for longer **or** charge lasts longer **or** (so total of) electrons take longer to travel round circuit	2
(c)	4200	 translation correct (= 4000) but percentage addition incorrect gains **1** mark translation incorrect but 5% addition is correct gains **1** mark accept 422.1 **or** 42.2 **or** 6.3 for **1** mark	2
	ohms **or** Ω	 4.2 kilohms **or** 4.2 kΩ gains all **3** marks	1
total			10

4.2.4.1 Power

3451/F Q17

question	answers	extra information	mark
(a)	point at which its mass (seems to) act **or** point at which gravity (seems to) act	accept …its weight acts accept correct statements if the intent is clear e.g. … if suspended, the centre of gravity will be directly under the point of suspension e.g. … (if the object is symmetrical), the centre of gravity is on the **or** an axis (of symmetry) do **not** credit just 'it is a point'	1
(b)	**Quality of written communication** *The answer to this question requires good English in a sensible order with correct use of scientific terms. Quality of written communication should be considered in crediting points in the mark scheme.* any **five** from: clamp (steel) rod (horizontally) hang plastic / sheet by rod through (one) hole hang plumb line from rod mark ends of plumb line on the sheet and use the ruler to draw a straight line repeat with other hole centre of mass is where the lines cross check by balancing at this point	*maximum of **4** marks if ideas not well expressed* **no** marks if method quite unworkable maximum of **3** marks if no 'repeat with other hole'	5
(c)(i)	(turning) effect **or** moment force distance	all three correct accept weight accept length	1
(ii)	17.6 Nm **or** newton metre(s)	allow 44 × 0.4 **or** 0.4 × 44 for **1** mark do **not** accept N/m **or** N/cm 1760 Ncm gains all **3** marks	2 1
total			10

GCSE 2004
June Series

ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark Scheme

Physics Specification B
3451/F

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Copyright © 2004 AQA and its licensors

4.2.4.1 Power

Further copies of this Mark Scheme are available from:

Publications Department, Aldon House, 39, Heald Grove, Rusholme, Manchester, M14 4NA
Tel: 0161 953 1170

or

download from the AQA website: www.aqa.org.uk

Copyright © 2004 AQA and its licensors

COPYRIGHT
AQA retains the copyright on all its publications. However, registered centres for AQA are permitted to copy material from this booklet for their own internal use, with the following important exception: AQA cannot give permission to centres to photocopy any material that is acknowledged to a third party even for internal use within the centre.

Set and published by the Assessment and Qualifications Alliance.

The Assessment and Qualifications Alliance (AQA) is a company limited by guarantee registered in England and Wales 3644723 and a registered charity number 1073334. Registered address AQA, Devas Street, Manchester. M15 6EX. *Dr Michael Cresswell Director General*

4.2.4.1 Power

GCSE PHYSICS

INFORMATION FOR EXAMINERS

1. General

The mark scheme for each question shows:

- the marks available for each part of the question;
- the total marks available for the question;
- the typical answer or answers which are expected;
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example:
where consequential marking needs to be considered in a calculation;
or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; e.g. allow smooth / free movement.)

3. Marking points

3.1 Marking of Quality of Written Communication

Where *Quality of written communication* appears in the mark scheme, one mark is to be awarded for either of the following points:

- Using correct scientific terms
- Correct sequencing or linking of ideas or points

The mark scheme will specify which of the points is to be awarded in a particular question. A QoWC mark can be awarded for a scientific answer, even if it is not accurate. It cannot be awarded for a nonsensical or non-scientific answer.
On the script, the QoWC tick should be identified by a 'q' written next to it.

3.2 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Copyright © 2004 AQA and its licensors

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.3 Use of chemical symbols/formulae

If a candidate writes a chemical symbol/formula instead of a required chemical name, full credit can be given if the symbol/formula is correct and if, in the context of the question, such action is appropriate.

3.4 The marking of quantitative relationships

Full credit can be given for a correct quantitative relationship expressed in:

- named units;
- physical quantities;
- standard symbols;
- a combination of physical quantities and units.

No credit can be given for any quantitative relationship expressed in terms of:

- a combination of physical quantities, units and symbols;
- a diagram, e.g. the ohm's law triangle, unless the rest of the answer shows clearly that the candidate understands the relationships involved.

3.5 Marking procedure for calculations

3.5.1 Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.
However:

- if the answer is incorrect, mark(s) can be gained by correct substitution/working and this is shown in the 'extra information' column;
- if the answer is correct, but an incorrect relationship is written in the working, then no marks can be awarded (see 3.5.2).

3.5.2 Where calculations are based on incorrectly recalled relationships, neither the incorrectly recalled relationship, nor the resulting calculation based on the incorrect relationship, will be credited.

3.6 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

Copyright © 2004 AQA and its licensors

3.7 Errors carried forward

There should be no error carried forward from a previous answer which has been based on wrong science. Any error in the answers to a structured question should be penalised once only.

Examples

(a) A candidate who calculates average speed using speed = time/distance **and** then proceeds to use this incorrect answer to calculate an acceleration based on the correct quantitative relationship should be given credit for the use of the correct acceleration relationship but none for either numerical answer.

(b) A candidate who incorrectly calculates average speed using speed = distance/time and then proceeds to use this incorrect value to calculate an acceleration based on the correct quantitative relationship, should be given credit for the use of both correct quantitative relationships **and** for the correct substitution and use of the incorrect value in the calculation of the rate of acceleration.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.8 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.9 Brackets

(…..) is used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.10 Interpretation of marginal points

There will be times when the answer is almost, but not quite, correct. Some examiners would award a mark while others would not. In any one script, an attempt should be made to balance these nearly correct answers by giving the mark on some occasions but not on others. If this is not done, the marking would end up being too lenient or too harsh.

3.11 Unexpected Correct Answers not in the Mark Scheme

The Examiner should use professional judgement to award credit where a candidate has given an unexpected correct answer which is not covered by the mark scheme. The Examiner should consult with the Team Leader to confirm the judgement. The Team Leader should pass this answer on to the Principal Examiner with a view to informing all examiners.

Copyright © 2004 AQA and its licensors

4.2.4.1 Power

GCSE Physics
Foundation Tier 3451/F

3451F Q1

question	answers	extra information	mark
(a)	comet	correct order only	1
	elliptical		1
	Milky Way		1
	Universe		1
(b)(i)	D A C B	allow **2** marks for two letters in the correct place allow **1** mark for one letter in the correct place	3
(ii)	A		1
total			8

Copyright © 2004 AQA and its licensors

4.2.4.1 Power

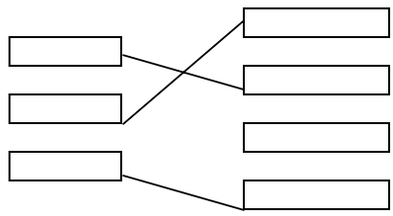
3451F Q2

question	answers	extra information	mark
(a)	95		1
(b)	alpha	accept correct symbol	1
(c)	any **two** from: • radiation is outside the body • radiation will not reach (living) cells • radiation absorbed by the air	 accept detector is on ceiling or high up the wall accept radiation cannot pass through the body / skin accept cannot pass through the plastic casing do **not** accept because it is alpha radiation – unless qualified do **not** accept does not give off harmful substance do **not** accept cannot pass through building materials etc.	2
(d)	less (than)		1
total			5

Copyright © 2004 AQA and its licensors

4.2.4.1 Power

3451F Q3

question	answers	extra information	mark
(a)	generator	accept dynamo accept alternator	1
(b)(i)	1400	ignore units	1
(ii)	0.3 or 30%	any incorrect unit penalise **1** mark allow **1** mark for the correct use of 600 **or** 0.3% **or** 30	2
(c)	**1** mark for each correct link 	if more than 3 lines are drawn, mark only 3 lines starting with those that are incorrect	3
(d)(i)	110	no tolerance	1
(ii)	12	no tolerance	1
(iii)	wind speed may be too low to operate the generator	accept wind may not always blow accept power depends on wind speed accept does not generate if wind speed is too high accept does not generate if wind speed is above 12 (m/s) accept does not generate if wind speed is below 1.6 (m/s) accept it is unreliable do **not** accept answers referring to cost only	1
total			10

Copyright © 2004 AQA and its licensors

4.2.4.1 Power

3451F Q4

question	answers	extra information	mark
(a)	B E A D	allow **1** mark for each letter in the correct place, to a maximum of **3** marks	3
(b)	(a spark) may cause the (petrol vapour) to explode / ignite connect tanker to earth with a (conducting) wire / chain **or** earth the tanker	accept petrol for (petrol vapour) accept catch fire for explode accept ground for earth	1 1
(c)	**Quality of written communication** any **two** from: • when current greater than fuse rating / value • fuse (becomes hot and) melts / burns out • circuit is broken	for a logical sequence accept when current too great for appliance do **not** accept 'if there is too much current' do **not** accept voltage or electricity accept fuse blows / breaks accept circuit switched off this cannot score credit on its own	1 2
total			8

Copyright © 2004 AQA and its licensors

4.2.4.1 Power

3451F Q5

question	answers	extra information	mark
(a)(i)	crust		1
(ii)	inner core is <u>solid</u> outer core is liquid	do **not** accept just rock inner core is denser / hotter than outer core gets **2** marks accept one is solid and one is liquid for **1** mark accept they are different densities for **1** mark wrong way round = **0** marks	1 1
(b)	seismograph		1
(c)	difficult to measure (slow) movement (1) of plates (1) dependent mark **or** difficult to measure friction / forces (1) between plates (1) dependent mark		1 1
(d)	geothermal		1
(e)(i)	5000		1
(ii)	2500		1
total			9

Copyright © 2004 AQA and its licensors

4.2.4.1 Power

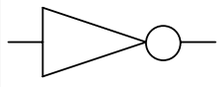
3451F Q6

	answers	extra information	mark
(a)	converging image object image object shorter		1 1 1 1 1 1
(b)(i)	(Earth's) gravity	accept centripetal accept minor misspellings, however, do **not** credit any response which could be 'centrifugal'	1
(ii)	to(wards) (the centre of the) Earth	allow inwards do **not** accept downwards	1
(c)(i)	**either** friction (force) **or** centripetal force between the tyres / wheels and (the surface of) the road	 allow grip allow on the tyres / wheels **or** towards the centre of the bend / arc / circle	 1 1
(ii)	mass **or** speed **or** momentum radius / diameter	allow weight allow velocity do **not** credit 'curvature' or 'circumference'	1 1
(d)	centripetal	accept minor misspellings (see above)	1
total			13

Copyright © 2004 AQA and its licensors

4.2.4.1 Power

3451F Q7

	answers	extra information	mark
(a)(i)	two switches in series **and** circuit complete	ignore small imperfections	1
(ii)	two switches in parallel **and** circuit complete	ignore small imperfections	1
(iii)	one switch in parallel with the cell / lamp (but **not** both)	ignore small imperfections	1
(iv)	(i) AND (ii) OR (iii) NOT	accept 'and' accept 'or' accept 'not'	1 1 1
(b)(i)	when it is light the sensor sends on / high / 1 signal to the gate off / low / 0 sent to the lamp **or** when it is dark the sensor sends off / low / 0 signal to the gate (1) on / high / 1 sent to the lamp (1)		1 1
(ii)	any suitable application	e.g. to switch a security light on (and off) e.g. to switch a light on when it is dark do **not** credit just '… to switch a light on / off'	1
(c)(i)		accept shading-in of either or both parts end connections are not required accept any orientation	1
(ii)	1 0 **or** 0 1 0 1 1 0	all correct	1
(iii)	truth (table)		1
total			12

Copyright © 2004 AQA and its licensors

4.2.4.1 Power

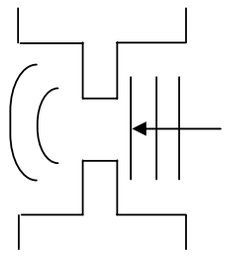
3451F Q8

question	answers	extra information	mark
(a)	60		1
(b)	$5\frac{1}{2}$ hours	must include unit	1
(c)	30		1
(d)	30 minutes or $\frac{1}{2}$ hour	must include unit	1
(e)	D **and** E least steep part of the graph	accept finish for E accept correct numbers from axes with units accept covers smallest distance in a set time accept only moves 5 km in $1\frac{1}{2}$ hours (accept anything between 5 and 6) ignore horse is tired	1 1
total			6

Copyright © 2004 AQA and its licensors

4.2.4.1 Power

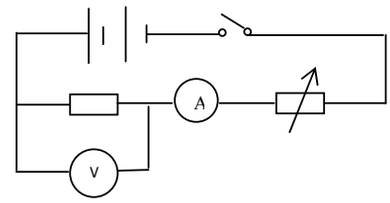
3451F Q9

question	answers	extra information	mark
(a)(i)	any **one** from: • (doctors) to see inside a patients body **or** endoscope • telephone cables • optical fibre / fibre optic lamps **or** (artificial) Christmas trees • data transfer **or** internet connection	 accept keyhole surgery do **not** accept flex **or** wires for cable accept decorative / ornamental lighting accept any feasible practical suggestion for taking light to a difficult to access place do **not** accept lighting unqualified do **not** accept lamp unqualified do **not** accept communications unless clarified	1
(ii)	(incident) ray angle greater than critical angle total internal reflection occurs	either order accept (incident) ray greater than 42° accept TIR do **not** accept just description of TIR	1 1
(b)(i)	waves shown diffracting in the correct direction 	ignore wavelength	1
(ii)	diffraction	accept diffract / diffracted	1
total			5

Copyright © 2004 AQA and its licensors

4.2.4.1 Power

3451F Q10

question	answers	extra information	mark
(a)	all symbols correct	 accept push switch symbol switch may be open or closed any lines through symbols = **0** marks	1
	correct circuit drawn voltmeter must be across resistor only	polarity of cells not relevant provided they are joined correctly two cells are required in the diagram ignore the order of the components allow small gaps in circuit omission of any component = **0** marks	1
(b)(i)	potential difference = current × resistance	accept voltage or p.d. for potential difference accept $V = I \times R$ accept  provided subsequent use correct do **not** accept C for current	1
(ii)	2	 allow **1** mark for correct substitution wrong working loses both marks	2
(iii)	straight line drawn <u>through the origin</u> straight line passes through $I = 0.4, V =$ their (b)(ii) / 2 **and** 0.0	judge by eye this mark may be awarded if all points shown including these points are correct even if no line is drawn N.B. a curve scores **0** marks	1 1 dep
(c)	temperature <u>increases</u>	accept filament lamp / it gets <u>hotter</u> allow heat for temperature	1
total			8

Copyright © 2004 AQA and its licensors

4.2.4.1 Power

3451F Q11

question	answers	extra information	mark
(a)(i)	gamma rays	accept gamma accept correct symbol	1
(ii)	infra red	accept IR	1
(b)	ultraviolet <u>absorbed</u> by ink (energy) given out as light	 accept glows / luminous accept for **both** marks the ink is fluorescent do **not** accept answers in terms of uv being reflected	1 1
(c)	any **two** from: • UV can damage / kill / ionise / alter (normal) cells • change DNA structure **or** mutate • (normal) cells may become cancerous	 do **not** accept attacks cells **or** burns skin accept may cause (skin) cancer accept abnormal cell multiplication	2
(d)(i)	microwaves **and** infra red	both answers needed in either order do **not** accept heat for IR	1
(ii)	0.9	allow **1** mark for the <u>correct</u> use of 1.8 (kW) $(1.8 \times \frac{1}{2}$ or $1.8 \times 30)$ i.e. adding the correct 2 power values	2
total			9

Copyright © 2004 AQA and its licensors

4.2.4.1 Power

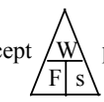
3451F Q12

question	answers	extra information	mark
(a)(i)	accelerating	accept getting faster accept speed / velocity increasing	1
(ii)	acceleration <u>increases</u>	accept velocity / speed increases <u>more</u> rapidly do **not** accept velocity / speed increases	1
(b)(i)	$\text{acceleration} = \frac{\text{change in velocity}}{\text{time (taken)}}$	accept $a = \frac{v - u}{t}$ **or** $a = \frac{v_1 - v_2}{t}$ do **not** accept velocity for change in velocity do **not** accept change in speed do **not** accept $a = \frac{v}{t}$	1
(ii)	15	allow **1** mark for an answer of 900 **or** for <u>correct</u> use of 540 seconds	2
(iii)	velocity includes direction	accept velocity is a vector (quantity) accept converse answer	1
(c)	force of gravity (between <u>shuttle</u> and Earth) plus correct orbital speed (makes <u>shuttle</u> move in a curve)	accept gravitational pull if used correctly accept forward motion **or** constant speed for orbital speed accept it is travelling fast enough accept for **2** marks the force of gravity provides the <u>centripetal</u> force	1 1
(d)	black is a good emitter of radiation **or** to limit the temperature rise inside the shuttle	accept heat for radiation accept the tiles are good insulation do **not** accept black absorbs heat on its own do **not** accept tiles are heat proof	1
total			9

Copyright © 2004 AQA and its licensors

4.2.4.1 Power

3451F Q13

question	answers	extra information	mark
(a)(i)	work (done) = force (applied) × distance (moved)	accept W = F × s or W = F × d accept  provided subsequent method is correct	1
(ii)	240 000 joules	allow **1** mark for correct substitution **or** correct use of 1200 (N) accept J do **not** accept j / Nm	2 1
(b)	800 (watts)	accept 0.8 kW accept their (a)(ii) ÷ 300 correctly evaluated for **2** marks allow **1** mark for correct substitution (a)(ii) ÷ 5 correctly evaluated for **1** mark	2
(c)(i)	any **one** from: • needs to raise the chair / lift • lifting more than one chair • energy transfer to the surroundings correctly qualified	 allow lifting more than 2 people implication of a heavier weight accept loss for transfer do **not** accept motor inefficient do **not** accept motor gets hot do **not** accept friction unless the location is specified as external to the motor	1
(ii)	electrical potential	accept electric **both** answers required for the mark	1
total			8

Copyright © 2004 AQA and its licensors

4.2.4.1 Power

3451F Q14

	answers	extra information	mark
(a)(i)	current		1
(ii)	resistance decreases	 accept 'the flow of electrons / current (through it) increases' for **1** mark do **not** credit just '… it will get warmer'	1 1
(b)	input sensor → controlled by the processor processor → detects changes in the environment output device → decides what action is needed	all pairs correct one pair correct for **1** mark	2
(c)(i)	potential divider	accept voltage divider	1
(ii)	4 (volts)	$6 \times \frac{30}{45}$ for **1** mark	2
(iii)	across the new resistor…(will) increase across R_2 … (will) decrease	 N.B. independent marks	1 1
total			10

Copyright © 2004 AQA and its licensors

4.2.4.1 Power

3451F Q15

	answers	extra information	mark
(a)	relay (normally open) (switch)	each mark is independent	1
	… switch on a (larger) current (in another circuit) **or** switch on a higher voltage circuit	do **not** accept switch on another circuit **or** smaller / equal current	1
	light emitting diode / LED	do **not** credit LDR	1
	… in one / direct / certain direction **or** from left to right	**or** when the cathode is connected to the negative terminal / side **or** when the left-hand side is connected to the positive terminal / side do **not** credit just '… is big enough' do **not** accept 'positive direction'	1
	AND gate	accept 'and' gate do **not** accept numerical values unless expanded	1
	… (both) inputs are on / high / 1 **or** current flows in both inputs		1
(b)	**Quality of written communication**	If in a sensible order which clearly indicates advantages or disadvantages, including answers in the form of a table **or** as bullet points Q ✓ Q X	1
	any **three** from: • advantage of mobile phones • drawback of mobile phones • benefit of the Internet • drawback of the Internet	e.g. more convenient for service engineers e.g. calls can be received away from base e.g. privacy can be more easily invaded e.g. drivers can be distracted e.g. microwaves / radio waves can / may cause damage to the brain e.g. access to educational material e.g. some material is salacious e.g. spam (on external e-mail) these are examples candidates may be credited for a variety of responses	3
total			10

Copyright © 2004 AQA and its licensors

4.2.4.1 Power

3451F Q16

question	answers	extra information	mark
(a)	**Y** and **Z**		1
	they have the same number of protons **or** same atomic number	accept they have the same number of electrons **or** same number of protons **and** electrons allow only different in number of neutrons N.B. independent marks	1
(b)	**Quality of written communication**	for correct use of terms underlined in B **or** C Q ✓ Q X	1
	A – alpha particle passes straight through the empty space of the atom **or** it is a long way from the nucleus B – alpha particle <u>deflected</u> / <u>repelled</u> / <u>repulsed</u> by the (positive) <u>nucleus</u> C – alpha particle heading straight for the <u>nucleus</u> is <u>deflected</u> / <u>repelled</u> / <u>repulsed</u> backwards	describes 3 tracks correctly for **2** marks describes 2 or 1 track correctly for **1** mark do **not** accept hits the nucleus do **not** accept answers referring to refraction do **not** accept answers in terms of reflected backwards unless qualified in terms of repulsion mention of difference in charge on nucleus negates that track	max 2
total			5

Copyright © 2004 AQA and its licensors

GCSE 2004
June Series

ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark Scheme

Science: Double Award

Specification B (Co-ordinated)

3462/3F

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Copyright © 2004 AQA and its licensors

4.2.4.1 Power

Further copies of this Mark Scheme are available from:

Publications Department, Aldon House, 39, Heald Grove, Rusholme, Manchester, M14 4NA
Tel: 0161 953 1170

or

download from the AQA website: www.aqa.org.uk

Copyright © 2004 AQA and its licensors

COPYRIGHT
AQA retains the copyright on all its publications. However, registered centres for AQA are permitted to copy material from this booklet for their own internal use, with the following important exception: AQA cannot give permission to centres to photocopy any material that is acknowledged to a third party even for internal use within the centre.

Set and published by the Assessment and Qualifications Alliance.

The Assessment and Qualifications Alliance (AQA) is a company limited by guarantee registered in England and Wales 3644723 and a registered charity number 1073334. Registered address AQA, Devas Street, Manchester. M15 6EX. *Dr Michael Cresswell Director General*

4.2.4.1 Power

SCIENCE: DOUBLE AWARD CO-ORDINATED

INFORMATION FOR EXAMINERS

1. General

The mark scheme for each question shows:

- the marks available for each part of the question;
- the total marks available for the question;
- the typical answer or answers which are expected;
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example:
where consequential marking needs to be considered in a calculation;
or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; e.g. allow smooth / free movement.)

3. Marking points

3.1 Marking of Quality of Written Communication

Where *Quality of written communication* appears in the mark scheme, one mark is to be awarded for either of the following points:

- Using correct scientific terms
- Correct sequencing or linking of ideas or points

The mark scheme will specify which of the points is to be awarded in a particular question. A QoWC mark can be awarded for a scientific answer, even if it is not accurate. It cannot be awarded for a nonsensical or non-scientific answer.
On the script, the QoWC tick should be identified by a 'q' written next to it.

3.2 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Copyright © 2004 AQA and its licensors

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.3 Use of chemical symbols/formulae

If a candidate writes a chemical symbol/formula instead of a required chemical name, full credit can be given if the symbol/formula is correct and if, in the context of the question, such action is appropriate.

3.4 The marking of quantitative relationships

Full credit can be given for a correct quantitative relationship expressed in:

- named units;
- physical quantities;
- standard symbols;
- a combination of physical quantities and units.

No credit can be given for any quantitative relationship expressed in terms of:

- a combination of physical quantities, units and symbols;
- a diagram, e.g. the ohm's law triangle, unless the rest of the answer shows clearly that the candidate understands the relationships involved.

3.5 Marking procedure for calculations

3.5.1 Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.
However:

- if the answer is incorrect, mark(s) can be gained by correct substitution/working and this is shown in the 'extra information' column;
- if the answer is correct, but an incorrect relationship is written in the working, then no marks can be awarded (see 3.5.2).

3.5.2 Where calculations are based on incorrectly recalled relationships, neither the incorrectly recalled relationship, nor the resulting calculation based on the incorrect relationship, will be credited.

3.6 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

Copyright © 2004 AQA and its licensors

4.2.4.1 Power

3.7 Errors carried forward

There should be no error carried forward from a previous answer which has been based on wrong science. Any error in the answers to a structured question should be penalised once only.

Examples

(a) A candidate who calculates average speed using speed = time/distance **and** then proceeds to use this incorrect answer to calculate an acceleration based on the correct quantitative relationship should be given credit for the use of the correct acceleration relationship but none for either numerical answer.

(b) A candidate who incorrectly calculates average speed using speed = distance/time and then proceeds to use this incorrect value to calculate an acceleration based on the correct quantitative relationship, should be given credit for the use of both correct quantitative relationships **and** for the correct substitution and use of the incorrect value in the calculation of the rate of acceleration.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.8 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.9 Brackets

(…..) is used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.10 Interpretation of marginal points

There will be times when the answer is almost, but not quite, correct. Some examiners would award a mark while others would not. In any one script, an attempt should be made to balance these nearly correct answers by giving the mark on some occasions but not on others. If this is not done, the marking would end up being too lenient or too harsh.

3.11 Unexpected Correct Answers not in the Mark Scheme

The Examiner should use professional judgement to award credit where a candidate has given an unexpected correct answer which is not covered by the mark scheme. The Examiner should consult with the Team Leader to confirm the judgement. The Team Leader should pass this answer on to the Principal Examiner with a view to informing all examiners.

Copyright © 2004 AQA and its licensors

4.2.4.1 Power

Double Award
Foundation Tier 3462/3F

3462/3F Q1

question	answers	extra information	mark
(a)	comet	correct order only	1
	elliptical		1
	Milky Way		1
	Universe		1
(b)(i)	D A C B	allow **2** marks for two letters in the correct place allow **1** mark for one letter in the correct place	3
(ii)	A		1
total			8

Copyright © 2004 AQA and its licensors

4.2.4.1 Power

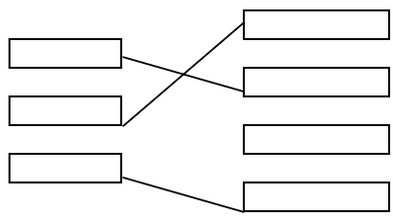
3462/3F Q2

question	answers	extra information	mark
(a)	95		1
(b)	alpha	accept correct symbol	1
(c)	any **two** from: • radiation is outside the body • radiation will not reach (living) cells • radiation absorbed by the air	 accept detector is on ceiling or high up the wall accept radiation cannot pass through the body / skin accept cannot pass through the plastic casing do **not** accept because it is alpha radiation – unless qualified do **not** accept does not give off harmful substance do **not** accept cannot pass through building materials etc.	2
(d)	less (than)		1
total			5

Copyright © 2004 AQA and its licensors

4.2.4.1 Power

3462/3F Q3

question	answers	extra information	mark
(a)	generator	accept dynamo accept alternator	1
(b)(i)	1400	ignore units	1
(ii)	0.3 or 30%	any incorrect unit penalise **1** mark allow **1** mark for the correct use of 600 **or** 0.3% **or** 30	2
(c)	**1** mark for each correct link 	if more than 3 lines are drawn, mark only 3 lines starting with those that are incorrect	3
(d)(i)	110	no tolerance	1
(ii)	12	no tolerance	1
(iii)	wind speed may be too low to operate the generator	accept wind may not always blow accept power depends on wind speed accept does not generate if wind speed is too high accept does not generate if wind speed is above 12 (m/s) accept does not generate if wind speed is below 1.6 (m/s) accept it is unreliable do **not** accept answers referring to cost only	1
total			10

Copyright © 2004 AQA and its licensors

4.2.4.1 Power

3462/3F Q4

question	answers	extra information	mark
(a)	B E A D	allow **1** mark for each letter in the correct place, to a maximum of **3** marks	3
(b)	(a spark) may cause the (petrol vapour) to explode / ignite	accept petrol for (petrol vapour) accept catch fire for explode	1
	connect tanker to earth with a (conducting) wire / chain **or** earth the tanker	accept ground for earth	1
(c)	**Quality of written communication**	for a logical sequence	1
	any **two** from:		2
	• when current greater than fuse rating / value	accept when current too great for appliance do **not** accept 'if there is too much current' do **not** accept voltage or electricity	
	• fuse (becomes hot and) melts / burns out	accept fuse blows / breaks	
	• circuit is broken	accept circuit switched off this cannot score credit on its own	
total			8

Copyright © 2004 AQA and its licensors

4.2.4.1 Power

3462/3F Q5

question	answers	extra information	mark
(a)(i)	crust		1
(ii)	inner core is <u>solid</u> outer core is liquid	do **not** accept just rock inner core is denser / hotter than outer core gets **2** marks accept one is solid and one is liquid for **1** mark accept they are different densities for **1** mark wrong way round = **0** marks	1 1
(b)	seismograph		1
(c)	difficult to measure (slow) movement (1) of plates (1) dependent mark **or** difficult to measure friction / forces (1) between plates (1) dependent mark		1 1
(d)	geothermal		1
(e)(i)	5000		1
(ii)	2500		1
total			9

Copyright © 2004 AQA and its licensors

4.2.4.1 Power

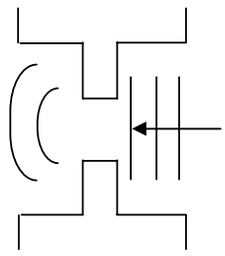
3462/3F Q6

question	answers	extra information	mark
(a)	60		1
(b)	$5\frac{1}{2}$ hours	must include unit	1
(c)	30		1
(d)	30 minutes or $\frac{1}{2}$ hour	must include unit	1
(e)	D **and** E least steep part of the graph	accept finish for E accept correct numbers from axes with units accept covers smallest distance in a set time accept only moves 5 km in $1\frac{1}{2}$ hours (accept anything between 5 and 6) ignore horse is tired	1 1
total			6

Copyright © 2004 AQA and its licensors

4.2.4.1 Power

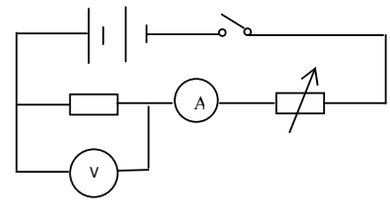
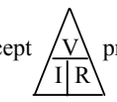
3462/3F Q7

question	answers	extra information	mark
(a)(i)	any **one** from: • (doctors) to see inside a patients body **or** endoscope • telephone cables • optical fibre / fibre optic lamps **or** (artificial) Christmas trees • data transfer **or** internet connection	 accept keyhole surgery do **not** accept flex **or** wires for cable accept decorative / ornamental lighting accept any feasible practical suggestion for taking light to a difficult to access place do **not** accept lighting unqualified do **not** accept lamp unqualified do **not** accept communications unless clarified	1
(ii)	(incident) ray angle greater than critical angle total internal reflection occurs	either order accept (incident) ray greater than 42° accept TIR do **not** accept just description of TIR	1 1
(b)(i)	waves shown diffracting in the correct direction 	ignore wavelength	1
(ii)	diffraction	accept diffract / diffracted	1
total			5

Copyright © 2004 AQA and its licensors

4.2.4.1 Power

3462/3F Q8

question	answers	extra information	mark
(a)	all symbols correct	 accept push switch symbol switch may be open or closed any lines through symbols = **0** marks	1
	correct circuit drawn voltmeter must be across resistor only	polarity of cells not relevant provided they are joined correctly two cells are required in the diagram ignore the order of the components allow small gaps in circuit omission of any component = **0** marks	1
(b)(i)	potential difference = current × resistance	accept voltage or p.d. for potential difference accept $V = I \times R$ accept  provided subsequent use correct do **not** accept C for current	1
(ii)	2	 allow **1** mark for correct substitution wrong working loses both marks	2
(iii)	straight line drawn <u>through the origin</u> straight line passes through $I = 0.4, V =$ their (b)(ii) / 2 **and** 0.0	judge by eye this mark may be awarded if all points shown including these points are correct even if no line is drawn N.B. a curve scores **0** marks	1 1 dep
(c)	temperature <u>increases</u>	accept filament lamp / it gets <u>hotter</u> allow heat for temperature	1
total			8

Copyright © 2004 AQA and its licensors

4.2.4.1 Power

3462/3F Q9

question	answers	extra information	mark
(a)(i)	gamma rays	accept gamma accept correct symbol	1
(ii)	infra red	accept IR	1
(b)	ultraviolet <u>absorbed</u> by ink (energy) given out as light	 accept glows / luminous accept for **both** marks the ink is fluorescent do **not** accept answers in terms of uv being reflected	1 1
(c)	any **two** from: • UV can damage / kill / ionise / alter (normal) cells • change DNA structure **or** mutate • (normal) cells may become cancerous	 do **not** accept attacks cells **or** burns skin accept may cause (skin) cancer accept abnormal cell multiplication	2
(d)(i)	microwaves **and** infra red	both answers needed in either order do **not** accept heat for IR	1
(ii)	0.9	 allow **1** mark for the <u>correct</u> use of 1.8 (kW) $(1.8 \times \frac{1}{2}$ or $1.8 \times 30)$ i.e. adding the correct 2 power values	2
total			9

Copyright © 2004 AQA and its licensors

4.2.4.1 Power

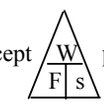
3462/3F Q10

question	answers	extra information	mark
(a)(i)	accelerating	accept getting faster accept speed / velocity increasing	1
(ii)	acceleration <u>increases</u>	accept velocity / speed increases <u>more</u> rapidly do **not** accept velocity / speed increases	1
(b)(i)	$\text{acceleration} = \frac{\text{change in velocity}}{\text{time (taken)}}$	accept $a = \frac{v - u}{t}$ **or** $a = \frac{v_1 - v_2}{t}$ do **not** accept velocity for change in velocity do **not** accept change in speed do **not** accept $a = \frac{v}{t}$	1
(ii)	15	allow **1** mark for an answer of 900 **or** for <u>correct</u> use of 540 seconds	2
(iii)	velocity includes direction	accept velocity is a vector (quantity) accept converse answer	1
(c)	force of gravity (between <u>shuttle</u> and Earth) plus correct orbital speed (makes <u>shuttle</u> move in a curve)	accept gravitational pull if used correctly accept forward motion **or** constant speed for orbital speed accept it is travelling fast enough accept for **2** marks the force of gravity provides the <u>centripetal</u> force	1 1
(d)	black is a good emitter of radiation **or** to limit the temperature rise inside the shuttle	accept heat for radiation accept the tiles are good insulation do **not** accept black absorbs heat on its own do **not** accept tiles are heat proof	1
total			9

Copyright © 2004 AQA and its licensors

4.2.4.1 Power

3462/3F Q11

question	answers	extra information	mark
(a)(i)	work (done) = force (applied) × distance (moved)	accept W = F × s or W = F × d accept  provided subsequent method is correct	1
(ii)	240 000 joules	allow **1** mark for correct substitution **or** correct use of 1200 (N) accept J do **not** accept j / Nm	2 1
(b)	800 (watts)	accept 0.8 kW accept their (a)(ii) ÷ 300 correctly evaluated for **2** marks allow **1** mark for correct substitution (a)(ii) ÷ 5 correctly evaluated for **1** mark	2
(c)(i)	any **one** from: • needs to raise the chair / lift • lifting more than one chair • energy transfer to the surroundings correctly qualified	 allow lifting more than 2 people implication of a heavier weight accept loss for transfer do **not** accept motor inefficient do **not** accept motor gets hot do **not** accept friction unless the location is specified as external to the motor	1
(ii)	electrical potential	accept electric **both** answers required for the mark	1
total			8

Copyright © 2004 AQA and its licensors

4.2.4.1 Power

3462/3F Q12

question	answers	extra information	mark
(a)	**Y** and **Z**		1
	they have the same number of protons **or** same atomic number	accept they have the same number of electrons **or** same number of protons **and** electrons allow only different in number of neutrons N.B. independent marks	1
(b)	**Quality of written communication**	for correct use of terms underlined in B **or** C Q ✓ Q X	1
	A – alpha particle passes straight through the empty space of the atom **or** it is a long way from the nucleus B – alpha particle deflected / repelled / repulsed by the (positive) nucleus C – alpha particle heading straight for the nucleus is deflected / repelled / repulsed backwards	describes 3 tracks correctly for **2** marks describes 2 or 1 track correctly for **1** mark do **not** accept hits the nucleus do **not** accept answers referring to refraction do **not** accept answers in terms of reflected backwards unless qualified in terms of repulsion mention of difference in charge on nucleus negates that track	max 2
total			5

Copyright © 2004 AQA and its licensors

4.2.4.1 Power

Answer 37 · Examiner comments

June 2018 | 8463/2H | Original Q7

Question 7 (Standard/high and High demand)

07.1 Many students had the correct idea, but imprecise detail such as ‘wrong number of turns’ or ‘number of turns was miscounted’ were insufficient to score the mark.

07.2 Many students tried to answer the question from a general knowledge about transformers, rather than using information from the graph, and so did not gain credit.

07.3 Most of the answers were correct. A very small number of students wrote ‘hotter’ but made no reference to infrared or thought it was just a temperature increase.

07.4 This question involved a two stage calculation, a new feature of the examination. Nearly 33 % of students knew the equations to use and how to use them, scoring all five marks. A further 35% of students correctly used one equation to give a partially correct answer, scoring three marks.

4.2.4.1 Power

Answer 40 · Examiner comments — November 2020 | 8463/1H | Original Q2

Question 2 (Standard demand)

02.1 69% of students chose the correct circuit.

02.2 86% of students answered this question correctly. The equation was acceptable using symbols or words. Students should be encouraged not to give multiple answers due to the list principle being applied: right + wrong = 0 marks. eg Q = It and I = t/Q would score zero.

02.3 The majority of students who knew the correct equation were able to substitute values of current and time into the equation and work it out. However, the value of current used was often incorrect, either because the student did not realise the need to convert 50 mA to amps, or the conversion was incorrect. Conversion values ranged from 0.00005 A to 50 000 000 A. 40% of students scored all 3 marks, while 43% scored 2 marks.

02.4 Very few students recognised that the LED is a diode and therefore only allows current in the forward direction. Students who did not refer to the diode mainly answered in one of two ways: thinking that no current can flow if the batteries are reversed in a circuit (no reference to the diode), or taking the question to mean that one of the cells was reversed, rather than all of them, and would therefore be 'working against each other'. Many students incorrectly thought that reversing the cells would make a gap in the circuit. Many students discussed polarity without mentioning the LED, so scored zero. Incorrect charge flow or incorrect current were not enough to score the first mark. Only 10% of students scored both marks, while 15% of students scored 1 mark.

Answer 40 · Examiner comments — November 2020 | 8463/1H | Original Q2

02.5 Students should use the wording of the prompts in the question. For this equation there are no abbreviations for the words 'useful', 'total', 'input' and 'output'. The '×100' is not needed for the equation. 86% of students scored this mark.

02.6 88% of students scored 3 marks. However, a common mistake was to multiply the final answer by 100, so only the first two marking points would score.

4.2.4.1 Power

Answer 41 · Examiner comments

November 2020 | 8463/1H | Original Q4

Question 4 (Standard/High demand)

04.1 34% of students scored 2 marks on this question. Common incorrect answers were 68% and 312.5% both of which scored 0 marks. Calculation of percentage increase is a maths skill in the maths requirements of all GCSE Science qualifications.

04.2 Only 10% of students scored 2 marks, while 43% scored 1 mark. Many students incorrectly thought that gas was renewable and/or did not release carbon dioxide. Less air pollution or less toxic gases was insufficient to score a mark. Comparison of start up times was insufficient as it does not relate to environmental advantages. Other commonly seen incorrect ideas included the idea that a gas-fired power station uses gas from the air, which does not have to be extracted or mined as coal does, or gas-fired power stations not producing carbon dioxide. Stating facts about a coal-fired power station but not comparing it with a gas-fired power station was insufficient.

04.3 63% of students scored 2 marks, while 28% of students scored 1 mark. Students who scored 1 mark usually didn't refer to a time period on the graph, just indicating the general upward trend, ignoring the fact that between some time periods eg 1998 to 2008, the mean sea surface temperature actually decreased. An overview statement would have helped them score the second mark.

04.4 Only 5% of students scored 3 marks on this challenging question. Very few realised that the important factor was the change in resistance with temperature in the region of temperatures corresponding to the sea temperature values. The majority of students chose thermistor A 'because it has the lowest resistance'. 18% of students scored 1 mark and 73% of students scored no marks.

4.2.4.1 Power

Answer 42 · Examiner comments November 2020 | 8463/1H | Original Q9

Question 9 (High demand)

09.1 53% of students scored 5 marks on this multi-step calculation. Lower-scoring students didn't score marks for stating and trying to use incorrect physics equations or rearranging correct equations incorrectly. The main reasons for not scoring full marks included: knowing one form of an equation correctly, but re-arranging it incorrectly, eg stating P = I V then re-arranging it to I = V/P, mixing up two half-known equations eg $P = I^2 V$, not realising that the 5 marks for this question warranted more than using one basic equation, eg stating R = V/I and substituting the given value of power for I.

09.2 Students often didn't score the third mark because of their technical inaccuracies referring to potential difference of the live wire or the electrician instead of potential. Many students mixed up quantities like potential difference with current and charge in confused answers. The question discriminated well between students with 15% of students scoring 3 marks, 15% of students scoring 2 marks and 35% of students scoring 1 mark.

09.3 18% of students scored 2 marks, while 44% of students scored 1 mark. A good proportion of students appeared to understand what the graph was showing, but often had difficulty in expressing their ideas clearly. A number of students thought that a higher current would be a disadvantage, so stated either that the current was lower at frequencies other than 50Hz, or 're-wrote' the question to answer why 50Hz was the safest frequency. Simply reading off values from the graph was insufficient without an explanation of what the implications were.

Answer 43 · Examiner comments November 2021 | 8463/1H | Original Q1

Question 1 (Common Question)
Very few students answered **01.1** correctly, but students were much more successful with equation recall and the subsequent calculations that followed, with around 80% answering **01.2** and **01.3** correctly and over 90% answering **01.4** and **01.5** correctly.

Answer 44 · Examiner comments November 2021 | 8463/1H | Original Q5

Question 5
Calculations in question **05** were well answered, but students often failed to convert units, converted units incorrectly or made 'power of ten' errors, so did not gain full marks. Students found **05.4** difficult with almost no students scoring 2 marks and only 25% of students scoring 1 mark.

Answer 45 · Examiner comments November 2021 | 8463/1H | Original Q7

Question 7
Question **07.1** discriminated well between students and there were multiple ways of arriving at the answer, using a selection of electricity equations. To score 2 marks in **07.2** students needed to select 3 sets of values to show that the constant was the same and very few students managed to do this. Many students simply stated that as one quantity increased, the other quantity decreased, revealing that they did not understand the term inversely proportional.

4.2.4.1 Power

Answer 46 · Examiner comments — November 2021 | 8463/1H | Original Q10

Question 10

Question 10 was poorly answered across the question. Few students were able to explain the benefit of transmitting electricity at a high potential difference in **10.1**. Many students stated, incorrectly, that static electricity was responsible for the danger involved in flying a kite near power cables. Question **10.3** was poorly answered and many students chose to continue the existing graph line, rather than draw their own. Very few students appreciated in **10.4** that the wires would behave as if they are in parallel, despite the question stating this.

Answer 48 · Examiner comments — June 2023 | 8463/1H | Original Q1

Question 1 (Standard Demand)

01.1 71% of students scored 2 marks on this question about transformers.

01.2 98% of students identified the correct equation. In this exam series, students were provided with all the equations on an Equations Sheet.

01.3 86% of students scored 3 marks. Many students failed to square the current so scored zero for the substitution and subsequent rearrangement.

01.4 84% of students answered correctly. In this exam series, students were provided with all the equations on an Equations Sheet. Students who quoted the version of the efficiency equation with power input and power output scored zero.

01.5 95% of students scored 3 marks. An answer of 33.9264 scored 3 marks as significant figures was not being tested in this question part. An answer given to 2 s.f. could score 3 marks with working. If the answer was rounded, the rounding needed to be correct.

4.2.4.1 Power

Answer 49 · Examiner comments — June 2023 | 8463/1H | Original Q6

Question 6 (High Demand)

06.1 Question **06.1** was generally well attempted and students who had carried out the current-potential difference characteristics required practical would have had an advantage over those who hadn't. For this question, 14 % of students scored 5 or 6 marks and 36 % of students scored 3 or 4 marks.
A circuit diagram wasn't necessary for 6 marks, but students benefitted from drawing a circuit diagram as they didn't then need to describe the circuit, although many students still did. In their circuit diagram minor errors, like gaps between components and minor slips in circuit symbols, were ignored as long as the meaning was clear. However, a voltmeter in series means that the circuit would not work, so limited any written answer to Level 1. For Level 2 a student needed to make it clear how the p.d. and current could be varied, several methods are given in the mark scheme. For Level 3, students needed to have a method to achieve negative results. Students were often quite vague about how this was done, some thought it sufficient to reverse the connections to the ammeter or the voltmeter.. For 6 marks, students also needed to refer to the correct interval and range of readings from the graph.

06.2 91% of students scored 3 marks on this question. In this exam series students were provided with all the equations on an Equations Sheet.

06.3 77 % of students scored 5 marks on this question. 16% of students scored 4 marks, usually for mis-converting or not converting time into seconds. In this exam series, students were provided with all the equations on an Equations Sheet which improved their success at answering calculation questions.

06.4 Only 2 % of students scored 2 marks and 11 % of students scored 1 mark. This question was targeted at grade 8-9 students so required a precisely worded answer. Most students thought that the student believed that power and p.d. were directly proportional but had done the calculation incorrectly, so the power should be 2.0 W not 4.0 W. Statements like 'if power was proportional to p.d. then the power should be 2 W not 4 W' were commonly seen and scored zero.

Answer 50 · Examiner comments — June 2023 | 8463/2H | Original Q8

08.1

Most students knew that iron is used for the core of a transformer and most of those were able to give an explanation. A significant number of students thought that iron was used because it is a good conductor of electricity, which demonstrates a misunderstanding of how transformers work.

08.2

55% of students gainiedall5 marks Most of the other students scored at least 3 marks for a partially correct answer. There were alternative ways of calculating the correct answer using the transformer and power equations, and it was pleasing to see so many students having the confidence to use them appropriately.

4.2.4.1 Power

Answer 51 · Examiner comments — June 2024 | 8463/1H | Original Q5

Question 5 (Standard/High Demand)

05.1 72% of students scored 2 marks, while 15% of students scored 1 mark. A number of students thought mains p.d. was 240 V. It was officially changed to 230 V in 1987 and this is the value given in the specification. However, it was more common for students to get the p.d. correct and the frequency incorrect.

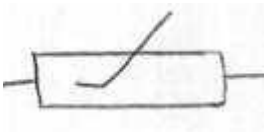
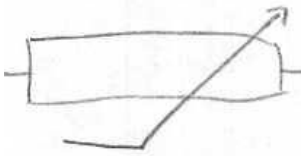
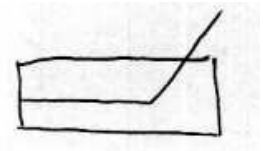
05.2 A grade 6-7 calculation of resistance, which discriminated well between students. The conversion of milliwatts to watts proved a problem for the vast majority of students. 53% scored all 4 marks, while 36% scored 3 marks.

© 2024 AQA and its licensors. All rights reserved.

Answer 51 · Examiner comments — June 2024 | 8463/1H | Original Q5

05.3 64% of students scored a mark for suggesting why dirty coins are not recognised by the machine. Answers which were insufficient, but ignored, included 'Can't measure resistance' and 'Dirt is an insulator'..

05.4 63% of students scored a mark for drawing the thermistor symbol. Answers that were not acceptable included the following examples.

05.5 This grade 8-9 calculation, worth 5 marks, question discriminated well between students of different abilities. If a student did not calculate the total resistance and then use that value to calculate the current in the circuit, then they didn't score the first 3 marks. If a student calculated the current in the circuit using just the 400 Ω resistor, then they could use that value to score the 4th and 5th marks for the calculation of the p.d. across the thermistor, using $V = IR$.
Answers with a p.d. greater 12 V usually scored zero marks, due to fundamental Physics errors.
18% of students scored 5 marks, while 31% of students scored 2 marks. 46% of students scored 0 marks. In this exam series all equations were provided for the students on the Physics Equations Sheet.

4.2.4.1 Power

Answer 52 · Examiner comments June 2025 | 8463/1H | Original Q9

09.1

Many of the students did not convert the 70 cm into metres and some students converted the energy unnecessarily. Not converting the height stopped marking point 1 from scoring and converting the energy unnecessarily stopped 1 marking point from being scored too. Some students, despite setting out their calculations correctly, did not use brackets around the denominator and arrived at an answer of 0.0245 or 2.45. Nearly 80 % of the students scored full marks on this question.

09.2

Many students found it easy to score full marks on this multi-step calculation. The most common mistake was not to convert the time which resulted in an answer of 27 and scored 5 marks. Converting the time incorrectly e.g. converting time into 0.5 hours also scored 5 marks. About 90% of the students scored either 5 or 6 marks.

Answer 52 · Examiner comments June 2025 | 8463/1H | Original Q9

09.3

Many students understood that the flow rate would increase. This was often correctly linked to either more useful energy transferred or less wasted energy. Some students expressed their ideas in terms of power. Just over 40 % of the students scored 2 marks, while just over 40 % scored 1 mark.

4.2.4.1 Power

AQA

GCSE
PHYSICS

8463/1H: Paper 1 (Higher tier)
Report on the Examination

8463
June 2022

Version: 1.0

4.2.4.1 Power

Further copies of this Report are available from aqa.org.uk

Copyright © 2022 AQA and its licensors. All rights reserved.
AQA retains the copyright on all its publications. However, registered schools/colleges for AQA are permitted to copy material from this booklet for their own internal use, with the following important exception: AQA cannot give permission to schools/colleges to photocopy any material that is acknowledged to a third party even for internal use within the centre.

4.2.4.1 Power

General

Grade 4-5 calculation questions ask for students to recall an equation, before using it in a subsequent calculation. In the 2022 series, students were given an Equations Sheet which had all the equations printed on it. Subsequently, the performance on the more straightforward calculations has improved on previous years.

The multistep calculations targeted at candidates working at grades 8-9, questions **09.1** and **10.1**, were well attempted with many students answering correctly. Of these two questions, students were slightly more successful on question **09.1** with about 55% of students scoring full marks, whereas for question **10.1** approximately 45% of students scored full marks.

Question **02.1** was generally well attempted and students who had carried out the density required practical had an advantage over those who hadn't. For this question, about 35% of students scored 6 marks and approximately 25% of students scored 5 marks.

Handwriting continues to be a problem for a number of students, making it very difficult for examiners to read what has been written. Students who have handwriting that is difficult to read may benefit from a scribe or from word processing their answers in exams.

Question 11

Due to incorrect Advance Information guidance being issued for this question, and to avoid students being disadvantaged, Question 11 was discounted and all students were awarded full (9) marks.

Levels of demand

Questions are set at three levels of demand for this paper:

- **Standard demand** questions are designed to broadly target grades 4–5.
- **Standard/high demand** questions are designed to broadly target grades 6–7.
- **High demand** questions are designed to broadly target grades 8–9.

A student's final grade, however, is based on their attainment across the qualification as a whole, not just on questions that may have been targeted at the level at which they are working.

4.2.4.1 Power

Question 1 (Standard demand)

01.1 About 55% of students scored 2 marks. The unit conversion caused a problem for many students and powers of 10 errors were frequently seen. A correct calculation using an incorrectly or not converted value for power would score 1 mark.

01.2 Students were generally successful at answering this question with approximately 40% scoring 2 marks and about 50% scoring 1 mark. Most students wrote variations of the first and third bullet points in the markscheme. A number of students wrote that the turbines may be broken, which was enough to score a mark for the idea of maintenance.

01.3 'Turbine will rotate faster' was insufficient to score a mark. 'Rotate more smoothly' was not enough to score the 'less friction' mark. Students who stated that 'no energy was wasted' did not score the second marking point. Approximately 35% of students scored 3 marks, 35% of students scored 2 marks and 20% of students scored 1 mark.

01.4 About 30% of students scored 2 marks, while approximately 50% of students scored 1 mark. Many students answered in terms of 'saving energy' which was insufficient. Other students answered in terms of absolute statements which did not score, 'energy efficient appliances waste no energy' for example.

Question 2 (Standard demand)

02.1 Generally very well answered with about 35% of students gaining 6 marks and 25% scoring 5 marks. Students were told that this required practical would appear in the 2022 series via the Advance Information. A number of students quoted the density equation incorrectly, although this was given on the Equations Sheet for the 2022 series. There were extremely few students who didn't attempt the question and less than 1% of students who attempted the question scored zero.

02.2 Approximately 85% of students answered this question correctly. Of the incorrect answers seen, a significant proportion gave the maximum and minimum values the wrong way round. Another common mistake was to write maximum: 2.55 and minimum 0.10, which showed a clear misunderstanding of expressing an uncertainty.

02.3 About 95% of students answered this question correctly.

02.4 Approximately 45% of students scored 2 marks and 40% scored 1 mark. 'In case an error / mistake was made the first time' was insufficient. 'To check the repeatability of the data' was ignored, as this wouldn't improve the accuracy of the data. 'Get rid of anomalies' was assumed to mean 'remove anomalies', but 'stops anomalies from occurring' did not score. Likewise 'stops random errors' did not score.

4.2.4.1 Power

Question 3 (Standard demand)

03.1 Over 99% of students answered this question correctly as they had all the Physics equations on the Equations Sheet for the 2022 series.

03.2 Nearly 95% of students answered this question correctly. In this series all students were given all the equations on the Equations Sheet. The first mark is for the substitution into the equation as it appears on the equations sheet. Some students failed to score any marks by incorrectly rearranging the equation, then substituting into the incorrectly rearranged equation.

03.3 Over 99% of students answered this question correctly as they had all the Physics equations on the Equations Sheet for the 2022 series.

03.4 95% of students answered this question correctly. In this series all students were given all the equations on the Equations Sheet. The first mark is for the substitution into the equation as it appears on the Equations Sheet. Some students failed to score any marks by incorrectly rearranging the equation, then substituting into the incorrectly rearranged equation.

Question 4 (Standard/High demand)

04.1 A large number of students found it difficult to identify the independent and dependent variables in the investigation that was described. Control variables appeared often in students' answers. 'Temperature change' seemed to be the most common incorrect answer for the dependent variable. About 50% of students scored 2 marks and approximately 35% of students scored 1 mark.

04.2 65% of students answered correctly. The most common incorrect answer was 87.4 °C.

04.3 About 35% of students answered this question correctly. Common incorrect answers referred to the resolution, or just repeated the question and said 'difficult to read' which was insufficient.

04.4 Approximately 75% of students scored 3 marks and about 10% of students scored 2 marks. Power of 10 errors were common and usually resulted in 2 marks being scored for an incorrectly or not converted value of energy.

04.5 Many students found relating the time for the temperature to decrease to thermal conductivity difficult. About 15% of students scored 2 marks, while 40% scored 1 mark. Answers in terms of good / bad insulators were insufficient to score a mark.

4.2.4.1 Power

Question 5 (Standard/High demand)

05.1 Approximately 45% of students scored 1 mark, with about 5% of students scored 3 marks. Around 30% of students scored no marks. The first marking point of this explanation was most likely to score, the third marking point was least likely to score.

05.2 About 30% of students scored all 3 marks for this explanation. 10% of students scored 2 marks and 10% scored 1 mark. A lot of student answers were not creditworthy, with mixed up descriptions of ion transfer, electron transfer, proton transfer, protons weighing more than electrons and transfer of electrons increasing the mass of the rod on the balance. As a result about 50% of students scored zero.

05.3 Approximately 60% of students scored the mark. Some students evidently did not know what a zero error was. Answers like 'it means there is no error' being a good example of this. Some answers were insufficient, 'the actual mass of the rod is not required' being not enough to score the mark. 'Weight' was allowed for 'mass' when used correctly as the reading on the balance does depend on the weight of the object. An answer of 'only the change in weight was needed' would have scored the mark.

05.4 Some very good explanations were seen and about 10% of students scored all 3 marks. The first marking point was least likely to score. The third marking point needed to be linked to the second marking point before it could be scored.

Question 6 (Standard/High demand)

06.1 This question discriminated well between students. About 15% scored 4 marks with 20% gaining 3 marks. The first two marking points were most commonly scored. Students who said that 'no energy was lost' as a consequence of the step-up transformer's effect did not score the third marking point.

06.2 Approximately 55% of students scored 2 marks, while 15% of students scored 1 mark. Students who scored no marks usually confused the quantity that was decreased (pd) with the quantity that increased (current). Some student answers lacked technical accuracy referring to energy, power or charge incorrectly.

06.3 Two thirds of students scored 4 marks for this calculation, whereas about 20% of students scored 3 marks. A common mistake was to try to multiply the answer by the number of seconds in a day, which would probably only score the significant figure mark if correct, as the Physics equations were applied incorrectly.
Common mistakes were to round the answer to 1 400 000 000 C, which would score 3 marks if the full s.f. answer was seen, or round the answer to 141, which would score 3 marks for the supporting calculations if seen. A common error was to miscount the number of zeroes, so would only score 3 marks.

Question 7 (Standard/High demand)

07.1 54% of students could state what an alpha particle consists of. The list principle was applied when students wrote '2 protons and 2 neutrons – a helium atom', which did not score.

07.2 65% of students completed the nuclear equation correctly, scoring 2 marks, whereas 24% scored just 1 mark.

07.3 Students generally made good attempts to answer this question and marking points 1, 2 and 4 were seen most often. To score the 5th marking point students need to make a comparative statement, internal versus external damage. The third marking point was least likely to score, as students rarely referred to dose or the living cells / tissues / organs inside the body. Some students incorrectly thought that ionisation was a process that happened to cells, rather than atoms, so often didn't score the fifth marking point for this reason. Very few students scored 5 marks and the question discriminated well between students of differing ability.

Question 8 (Standard/High demand)

08.1 About 90% of students gave the correct measuring instrument. While it wasn't seen often, an answer of a 'volumetric pipette' was also creditworthy. 'Pipette' was insufficient.

08.2 Around 90% of students correctly identified the hazard in the investigation.

08.3 For this calculation, about 45% of students scored 5 marks and 20% of students scored 4 marks. A common mistake was to calculate *L* using one of the masses given in the question, rather than the change in mass. The resulting numerical answer would score zero as the equation was not being used correctly.

08.4 About 15% of students scored 2 marks for this explanation and 10% of students scored 1 mark. Many students reached incorrect conclusions and many students simply reworded the information given in the question.

08.5 7% of students scored 2 marks and 3% of students scored 1 mark. Many students reached incorrect conclusions and many students reworded the information given in the question without adding to it.

Question 9 (High demand)

09.1 Approximately 55% of students scored 5 marks, but in the 2022 series students were provided with an Equations Sheet with all the equations. A commonly seen answer was 73 500, which scored 4 marks for not converting the height into metres.

09.2 5% scored 2 marks and about 30% scored 1 mark. Many students failed to score a mark by pointing to the 'inaccuracy of the measured mass / height / gravitational field strength', or referring to the measurements as being 'low resolution'. 'Mass may have been greater than 60 kg' or 'time may have been longer / shorter than 1.40 seconds' were other common incorrect answers.

09.3 About 75% of students identified the correct conclusion.

Question 10 (High demand)

10.1 About 45% of students scored 6 marks for this extended calculation, but in the 2022 series students were provided with an Equations Sheet with all the equations. Therefore, students were supported when it came to attempting this question. With an alternative approach using equations from paper 2, students' answers were marked on whichever approach brought them closest to the correct final answer. An answer of 6 m/s with no supporting working did not score full marks as students could achieve this answer by multiplying the spring constant and the extension together, which would give them the maximum force acting on the toy aeroplane.

10.2 About 65% of students scored the mark. The most common incorrect answers seen were gravitational potential or elastic potential.

10.3 Approximately 20% of students scored a mark. Many students failed to score a mark because they gave a factor without a specific change e.g. 'extension of spring', rather than 'increase the extension of the spring'.

Question 11 (High demand)

Due to incorrect Advance Information guidance being issued for this question, and to avoid students being disadvantaged, Question 11 was discounted and all students were awarded full (9) marks.

4.2.4.1 Power

Use of statistics

Statistics used in this report may be taken from incomplete processing data. However, this data still gives a true account of 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.