AQA GCSE Physics | 8463

SPECIFICATION POINT 4.2.1.3

Current, resistance and potential difference

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**74**
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.

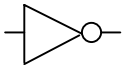
Name: _____ **Date:** _____

Where a precise marking extract is unavailable, the full source document is included in an appendix. Any missing mark scheme is explicitly identified.

4.2.1.3 Current, resistance and potential difference

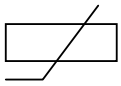
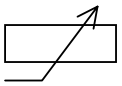
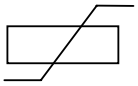
Answer 01 · Mark scheme

June 2003 | 3451F | Original Q1 | Legacy

(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

4.2.1.3 Current, resistance and potential difference

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

4.2.1.3 Current, resistance and potential difference

Answer 01 · Mark scheme June 2003 | 3451F | Original Q1 | Legacy

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

4.2.1.3 Current, resistance and potential difference

Answer 01 · Mark scheme June 2003 | 3451F | Original Q1 | Legacy

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

4.2.1.3 Current, resistance and potential difference

Answer 01 · Mark scheme June 2003 | 3451F | Original Q1 | Legacy

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

4.2.1.3 Current, resistance and potential difference

Answer 01 · Mark scheme June 2003 | 3451F | Original Q1 | Legacy

3451/F Q13

question	answers	extra information	mark
(a)	silver is a (good) reflector of heat (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

4.2.1.3 Current, resistance and potential difference

Answer 01 · Mark scheme June 2003 | 3451F | Original Q1 | Legacy

3451/F Q14

question	answers	extra information	mark
(a)(i)	any **one** from:		1
	the ground	do **not** accept mobile phones	
	the air		
	radon (gas)		
	building materials		
	buildings		
	rocks / granite		
	food		
	cosmic rays **or** solar rays	accept from outer space accept sun but **not** sunlight	
	X-rays	accept medical uses	
	nuclear weapons testing		
	nuclear power stations / accidents		

Answer 02 · Mark scheme June 2003 | 3451F | Original Q16 | Legacy

The full source mark scheme begins on page 122. Follow original question 16 in that document.

Answer 03 · Mark scheme June 2003 | 3462F3 | Original Q1 | Legacy

The full source mark scheme begins on page 144. Follow original question 1 in that document.

Answer 04 · Mark scheme June 2004 | 3451F | Original Q10 | Legacy

The full source mark scheme begins on page 161. Follow original question 10 in that document.

4.2.1.3 Current, resistance and potential difference

Answer 05 · Mark scheme

June 2004 | 3451F | Original Q14 | Legacy

The full source mark scheme begins on page 161. Follow original question 14 in that document.

Answer 06 · Mark scheme

June 2004 | 3462F3 | Original Q8 | Legacy

The full source mark scheme begins on page 182. Follow original question 8 in that document.

Answer 07 · Mark scheme

June 2005 | 3451 | Original Q11 | Legacy

The full source mark scheme begins on page 199. Follow original question 11 in that document.

Answer 08 · Mark scheme

June 2005 | 3462 | Original Q9 | Legacy

The full source mark scheme begins on page 217. Follow original question 9 in that document.

Answer 09 · Mark scheme

June 2006 | 3451 | Original Q10 | Legacy

The full source mark scheme begins on page 231. Follow original question 10 in that document.

4.2.1.3 Current, resistance and potential difference

Answer 10 · Mark scheme

June 2006 | 3451 | Original Q12 | Legacy

The full source mark scheme begins on page 231. Follow original question 12 in that document.

Answer 11 · Mark scheme

June 2006 | 3462 | Original Q10 | Legacy

The full source mark scheme begins on page 251. Follow original question 10 in that document.

4.2.1.3 Current, resistance and potential difference

Question 4

question	answers	extra information	mark
(a)(i)	hairdryer 13 saw 3 mixer 13	all correct allow **1** mark for 2 correct	2
(ii)	fuse melts	accept blows/ breaks/ snaps for melts do **not** accept blows up do **not** accept fuse gets hot on its own do **not** accept does not work on its own	1
(b)(i)	920	allow **1** mark for correct substitution	2
(ii)	no earth (wire) outside / case may become live **or** danger of electric shock	cause a fire insufficient	1 1
(c)(i)	L and N	both required	1
(ii)	9 (volts)	correct answer only	1
total			9

4.2.1.3 Current, resistance and potential difference

Answer 12 · Mark scheme

January 2008 | PHY2F | Original Q4 | Legacy

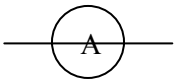
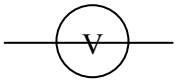
PHY2F

4.2.1.3 Current, resistance and potential difference

Answer 13 · Mark scheme

January 2008 | PHY2F | Original Q6 | Legacy

Question 6

question	answers	extra information	mark
(a)(i)	ammeter symbol correct and drawn in series	accept  do **not** accept lower case a	1
	voltmeter symbol correct and drawn in parallel with the material	do **not** accept 	1
(ii)	adjust / use the variable resistor **or** change the number of cells	accept change the resistance accept battery for cell accept change the p.d / accept change the voltage accept increase / decrease for change	1
(b)(i)	data is <u>continuous</u> (variable)		1
(ii)	36 (Ω)	correct answer only	1
(iii)	5.4 or their (b)(ii) × 0.15	allow **1** mark for correct substitution	2
(c)(i)	the thick<u>er</u> the putty the low<u>er</u> the resistance	answer must be comparative accept the converse	1

4.2.1.3 Current, resistance and potential difference

PHY2F

Question 6 continued

question	answers	extra information	mark
(ii)	any **one** from: • measuring length incorrectly • measuring current incorrectly • measuring voltage incorrectly • ammeter / voltmeter incorrectly calibrated • thickness of putty not uniform • meter has a zero error	 accept may be different length do **not** accept different currents do **not** accept different voltage accept any sensible source of error eg putty at different temperatures do **not** accept human error without an explanation do **not** accept pieces of putty not the same unless qualified do **not** accept amount of putty not same do **not** accept systematic / random error	1
(iii)	repeat readings	accept check results again accept do experiment again accept do it again accept compare own results with other groups do **not** accept take more readings	1
total			10

4.2.1.3 Current, resistance and potential difference

Answer 13 · Mark scheme

January 2008 | PHY2F | Original Q6 | Legacy

PHY2F

Answer 14 · Mark scheme

March 2008 | PHY1BP | Original Q8 | Legacy

Eight	**4**	**1**	**1**	**1**

4.2.1.3 Current, resistance and potential difference

Answer 15 · Mark scheme

Question 5

	answers	extra information	mark
(a)(i)	4 (V)	allow **1** mark for correct substitution	2
(ii)	5 (V) or (9 – their (a)(i)) correctly calculated	e.c.f do **not** allow a negative answer	1
(b)(i)	thermistor	c.a.o	1
(ii)	0°C to 20°C		1
total			5

4.2.1.3 Current, resistance and potential difference

Answer 15 · Mark scheme

June 2008 | PHY2F | Original Q5 | Legacy

PHY2F

June 08

4.2.1.3 Current, resistance and potential difference

Answer 16 · Mark scheme

Question 4

question	answers	extra information	mark
4(a)	voltmeter	and no other do **not** accept voltage	1
4(b)(i)	variable resistor		1
4(b)(ii)	0.10 – 0.30	accept 0.1 – 0.3 accept 0.3 – 0.1 accept 0.30 – 0.10	1
4(b)(iii)	3.3 (W)	allow **1** mark for correct data choice allow ***2*** marks for substitution of correct data i.e. 0.30 × 11.0 the following answers gain **2** marks 0.10 / 0.30 / 0.80 / 1.75 allow **1** mark for substitution of incorrect of data incorrectly calculated e.g. 0.20 × 4.0 = 0.6 scores **1** mark	3
4(c)	increases		1
Total			**7**

4.2.1.3 Current, resistance and potential difference

Answer 16 · Mark scheme

January 2009 | PHY2F | Original Q4 | Legacy

PHY2F

Answer 17 · Mark scheme

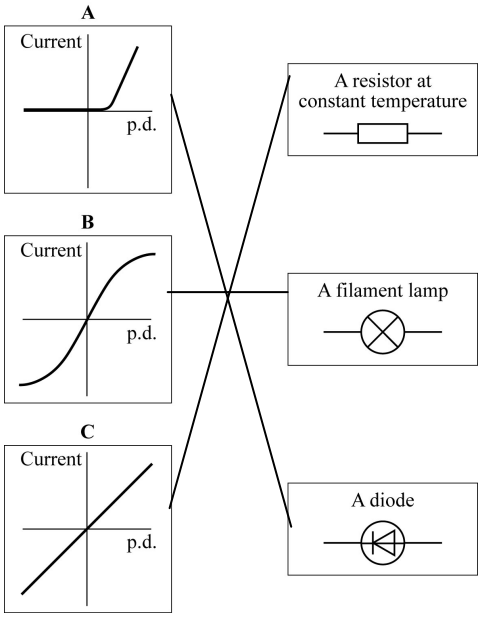
January 2009 | PHY3F | Original Q1 | Legacy

No matching mark scheme was available in the supplied archive for this question.

4.2.1.3 Current, resistance and potential difference

Answer 18 · Mark scheme

Question 1

question	answers	extra information	mark
1(a)	**three** lines drawn correctly  	allow **1** mark for 1 correct line if more than one line goes from a graph, both are incorrect	2
1(b)	**J**		1
Total			**3**

4.2.1.3 Current, resistance and potential difference

Answer 18 · Mark scheme June 2009 | PHY2F | Original Q1 | Legacy

PHY2F

4.2.1.3 Current, resistance and potential difference

Answer 19 · Mark scheme June 2009 | PHY2F | Original Q4 | Legacy

Question 4

question	answers	extra information	mark
4(a)(i)	6		1
4(a)(ii)	6 (volts)	accept their (a)(i) ignore any units	1
4(b)	0.30	accept 0.3	1
4(c)	smaller(than)	accept correct alternatives to smaller than e.g. less than	1
	a bigger current flows through the lamp	only accept if 'smaller than' is given accept converse accept a correct calculation accept resistance is half of 60 accept resistance = 30 (Ω) do **not** accept answers in terms of p.d	1
Total			**5**

4.2.1.3 Current, resistance and potential difference

Answer 19 · Mark scheme June 2009 | PHY2F | Original Q4 | Legacy

PHY2F

4.2.1.3 Current, resistance and potential difference

Answer 20 · Mark scheme

June 2009 | PHY2F | Original Q8 | Legacy

Question 8

question	answers	extra information	mark
8(a)(i)	gained electrons		1
8(a)(ii)	see if it exerts a force on another (charged) object **or** see if it will pick up (small) pieces of paper	accept repels another negative(ly charged)object accept attracts a positive(ly charged) object accept attracts or repels a charged object accept any correct way of showing an electrostatic effect i.e. bend a (slow moving) stream of water (from a tap) do **not** accept see if you get an electric shock on its own	1
8(b)(i)	plastic is an insulator stop them discharging **or** stop them being earthed	accept plastic is a poor conductor any mention of heat negates this mark accept keeps the charge on the person accept stop them being grounded accept electricity cannot go to earth do **not** accept so don't get an electric shock	1 1
8(b)(ii)	type of clothing could affect (build up of) charge/data	accept it is a variable/ factor (that needs to be controlled) do **not** accept fair test on its own	1
8(b)(iii)	there is a clear pattern **or** enough precision to tell difference (between the materials) **or** accept none of the results are within 0.1kV of the shock line or each other	accept there is a wide range of results	1

Question 8 continues on the next page . . .

4.2.1.3 Current, resistance and potential difference

Answer 20 · Mark scheme

June 2009 | PHY2F | Original Q8 | Legacy

PHY2F

Question 8 continued . . .

question	answers	extra information	mark
8(b)(iv)	any **two** from: • the material normally used has a value above the p.d likely to cause a shock • use a material that reduces pd (below 3.6 kV) • so people are less likely to be shocked • can put 'non-shock' seating in adverts • may sell more seats/ cars	accept use a material that reduces charge (on the person) accept so people will not feel a shock owtte	2
Total			**8**

4.2.1.3 Current, resistance and potential difference

Answer 21 · Mark scheme June 2009 | PHY3F | Original Q8 | Legacy

Question 8

question	answers	extra information	mark
8(a)	C → B (1st two boxes) D → A (end two boxes)	allow **1** mark for either linkage in any position	1 1
8(b)	any **two** from: • more powerful / stronger magnet • smaller gap between coil and magnet • coil with more turns / longer coil • coil with bigger area	do **not** accept just bigger magnet accept more coils do **not** accept just bigger coil do **not** accept just more wire do **not** accept shake faster do **not** accept shake for longer	2
8(c)(i)	the longer the torch is shaken, the longer the light lasts	accept the converse accept it is a (strong) positive (non-linear) relationship do **not** accept '.... are (directly) proportional ....'	1

Question 8 is continued on the next page . . .

4.2.1.3 Current, resistance and potential difference

Answer 21 · Mark scheme

June 2009 | PHY3F | Original Q8 | Legacy

PHY3F

Question 8 continued . . .

question	answers	extra information	mark
8(c) (ii)	any **two** from: • if this investigation is repeated the result would not be the same • rate / amplitude / angle of shaking could vary • personal judgement when the LED / light has 'gone out' • results / data / measurements have not been repeated / averaged		2
Total			**7**

4.2.1.3 Current, resistance and potential difference

Answer 22 · Mark scheme

Question 1

question	answers	extra information	mark
1(a)	switch	allow answer circled in box	1
1(b)	24		1
1(c)	equal to 0.25 A		1
1(d)	4		1
Total			**4**

4.2.1.3 Current, resistance and potential difference

Answer 22 · Mark scheme

January 2010 | PHY2F | Original Q1 | Legacy

PHY2F

4.2.1.3 Current, resistance and potential difference

Answer 23 · Mark scheme

Question 5

question	answers	extra information	mark
5(a)	a light-dependent resistor		1
5(b)	any **three** from: • resistance starts at 500 (kilohms) • (resistance) falls rapidly as intensity increases from 0 • (resistance) halves between 10 and 20 lux • (resistance) falls slightly between 20 and 50 lux **or** • (resistance) almost constant / levels out between 20 and 50 lux • at 50 lux, resistance = 10 (kilohms)	for full credit the word resistance must be used correctly at least once accept resistance falls accept brightness for intensity an answer resistance falls as intensity increases gains **2** marks - this may be combined with one of the bullet point marks for full credit	3
5(c)(i)	decrease		1
5(c)(ii)	resistance increases	this can score without (c)(i)	1

Question 5 continues on the next page . . .

4.2.1.3 Current, resistance and potential difference

Answer 23 · Mark scheme

January 2010 | PHY2F | Original Q5 | Legacy

PHY2F

Question 5 continued . . .

question	answers	extra information	mark
5(d)	A circuit to switch on security lighting when it gets dark.		1
Total			**7**

4.2.1.3 Current, resistance and potential difference

Answer 23 · Mark scheme

January 2010 | PHY2F | Original Q5 | Legacy

PHY2F

4.2.1.3 Current, resistance and potential difference

Answer 24 · Mark scheme

June 2010 | PHY2F | Original Q2 | Legacy

Question 2

question	answers	extra information	mark
2	**L** **N** **M** **K**	all four in the correct order **2** marks for 2 correct **1** mark for 1 correct	3
Total			**3**

4.2.1.3 Current, resistance and potential difference

Answer 24 · Mark scheme June 2010 | PHY2F | Original Q2 | Legacy

PHY2F

4.2.1.3 Current, resistance and potential difference

Answer 25 · Mark scheme

June 2010 | PHY3F | Original Q4 | Legacy

Question 4

question	answers	extra information	mark
4(a)(i)	iron		1
4(a)(ii)	step-down (transformer)		1
4(b)	any **one** from: • after the power station • after the generator • before the power lines • before the pylons		1
4(c)	each correct (1) current coil field core ends	in its correct place	5
Total			**8**

4.2.1.3 Current, resistance and potential difference

Answer 25 · Mark scheme June 2010 | PHY3F | Original Q4 | Legacy

PHY3F

4.2.1.3 Current, resistance and potential difference

Answer 26 · Mark scheme

January 2011 | PHY2F | Original Q2 | Legacy

Question 2

question	answers	extra information	mark
2(a)(i)	4.5		1
2(a)(ii)	2.25 or their (a)(i) ÷ 2 correctly calculated		1
2(a)(iii)	V_2		1
2(b)(i)	30		1
2(b)(ii)	8	allow **1** mark for correct substitution ie 0.4 × 20 allow **1** mark for answers of 4 or 12	2
2(b)(iii)	**Y**		1
Total			**7**

4.2.1.3 Current, resistance and potential difference

Answer 26 · Mark scheme January 2011 | PHY2F | Original Q2 | Legacy

PHY2F

4.2.1.3 Current, resistance and potential difference

Answer 27 · Mark scheme

Question 4

question	answers	extra information	mark
4(a)(i)	**D**		1
4(a)(ii)	plastic or rubber	accept a specific type of plastic accept electrical insulator	1
4(b)	460	allow **1** mark for correct substitution ie 2 × 230	2
4(c)	any **two** from: • not all appliances need a 13 A fuse • can choose the most suitable fuse (for the appliance) • (in the event of a fault) 13 A fuse may allow too much current to flow through an appliance **or** fuse may not melt (before appliance is damaged) • may already have the fuse	idea that 13 A is (much) bigger than required by many appliances do **not** accept some appliances require more than 13 A do **not** accept 13 A fuse will blow accept install correct fuse for the appliance idea of reusing a fuse do **not** accept cheaper unless explained correctly	2
Total			**6**

4.2.1.3 Current, resistance and potential difference

Answer 27 · Mark scheme January 2011 | PHY2F | Original Q4 | Legacy

PHY2F

4.2.1.3 Current, resistance and potential difference

Answer 28 · Mark scheme

June 2011 | PHY2F | Original Q4 | Legacy

Question 4

question	answers	extra information	mark
4(a)	fleece rubs against shirt **or** friction (between fleece and shirt)	it refers to the fleece	1
	(causing) <u>electrons</u> to transfer from one to the other	accept a specific direction of transfer do **not** accept charge for electrons positive electrons negates this mark movement of protons negates this mark	1
4(b)	Electrical charges move easily through metals. An electric current is a flow of electrical charge.		1 1
4(c)(i)	copper (good electrical) conductor	reason only scores if copper chosen accept it is a metal any mention of heat conduction negates this mark	1 1
4(c)(ii)	lower than		1

Question 4 continues on the next page

PHY2F

Question 4 continued

question	answers	extra information	mark
4(c)(iii)	accept any sensible suggestion, eg: • too many variables (to control) • lightning strikes / storms are random / unpredictable • do not know which building will be struck • do not know when a building will be struck • do not know when lightning will happen • (very) difficult to create same conditions in a laboratory • lightning storms are not the same	it is not safe is insufficient do **not** accept lightning does not strike the same place twice	1
Total			**8**

4.2.1.3 Current, resistance and potential difference

Answer 28 · Mark scheme June 2011 | PHY2F | Original Q4 | Legacy

PHY2F

4.2.1.3 Current, resistance and potential difference

Answer 29 · Mark scheme

June 2011 | PHY2F | Original Q6 | Legacy

Question 6

question	answers	extra information	mark
6(a)	brown		1
6(b)	outside / case is plastic / an insulator	accept is double insulated accept non-conductor for plastic do **not** accept it / hairdryer is plastic	1
6(c)(i)	(1) S_1 (2) S_1 and S_3	and no other both required, either order	1 1
6(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
6(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**

4.2.1.3 Current, resistance and potential difference

Answer 29 · Mark scheme June 2011 | PHY2F | Original Q6 | Legacy

PHY2F

4.2.1.3 Current, resistance and potential difference

Answer 30 · Mark scheme

June 2012 | PH2FP | Original Q2 | Legacy

Question 2

question	answers	extra information	mark
2(a)(i)	15		1
2(a)(ii)	4.5 or their (a)(i) x 0.3 correctly calculated	allow **1** mark for correct substitution, ie 0.3 x 15/their (a)(i), provided no subsequent step	2
2(a)(iii)	decrease		1
2(b)	**Y** (only one that) shows a direct current / p.d. **or** a battery / cell gives a direct current **or** a battery/cell gives a constant current/p.d.	accept any correct indication reason only scores if **Y** is chosen accept voltage for p.d. accept both **X** and **Z** are a.c. accept it's a constant current/p.d. it is not changing is insufficient	1 1
Total			**6**

4.2.1.3 Current, resistance and potential difference

Answer 30 · Mark scheme

June 2012 | PH2FP | Original Q2 | Legacy

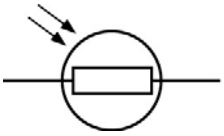
PH2FP

4.2.1.3 Current, resistance and potential difference

Answer 31 · Mark scheme

June 2012 | PH2FP | Original Q4 | Legacy

Question 4

question	answers	extra information	mark
4(a)(i)	correct symbol ringed 		1
4(a)(ii)	accept any suggestion that would change light intensity, eg: • torch on or off • distance between torch and LDR • lights in room on or off • shadow over the LDR	accept power of torch do **not** accept watts/wattage of torch	1
4(b)	resistance decreases from 600 kΩ to 200 kΩ	accept by 400 kΩ	1 1
4(c)(i)	no numbers for light intensity **or** light intensity is categoric / a description/not continuous	not enough results is insufficient	1
4(c)(ii)	YES both show that resistance increases with decreasing (light) intensity / brightness	mark is for the reason accept they both get the same results/pattern	1
4(d)	A circuit that automatically switches outside lights on when it gets dark.		1
Total			**7**

4.2.1.3 Current, resistance and potential difference

Answer 31 · Mark scheme

June 2012 | PH2FP | Original Q4 | Legacy

PH2FP

4.2.1.3 Current, resistance and potential difference

Answer 32 · Mark scheme

January 2013 | PH2FP | Original Q3 | Legacy

Question 3

question	answers	extra information	mark
3(a)	25(Ω)		1
3(b)(i)	2(V)	allow **1** mark for showing a correct method, ie 6/3	2
3(b)(ii)	equal to		1
Total			**4**

4.2.1.3 Current, resistance and potential difference

Answer 32 · Mark scheme

January 2013 | PH2FP | Original Q3 | Legacy

PH2FP

4.2.1.3 Current, resistance and potential difference

Answer 33 · Mark scheme

June 2013 | PH2FP | Original Q2 | Legacy

Question 2

question	answers	extra information	mark
2(a)	L		1
2(b)	6 (V)		1
2(c)	horizontal line drawn drawn in correct position	 judge by eye	1 1
Total			4

4.2.1.3 Current, resistance and potential difference

Answer 33 · Mark scheme

June 2013 | PH2FP | Original Q2 | Legacy

PH2FP

4.2.1.3 Current, resistance and potential difference

Answer 34 · Mark scheme

June 2013 | PH2FP | Original Q8 | Legacy

Question 8

question	answers	extra information	mark
8(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
8(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
8(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 8 continues on the next page . . .

PH2FP

Question 8 continued . . .

question	answers	extra information	mark
8(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**

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

4.2.1.3 Current, resistance and potential difference

Answer 35 · Mark scheme

June 2013 | PH3FP | Original Q5 | Legacy

Question 5

question	answers	extra information	mark
5(a)	A		1
5(b)(i)	9000	an answer of 9 k(N) gains **1** mark	1
5(b)(ii)	increase	accept other comparative terms, eg give a bigger affect / change is insufficient	1
5(b)(iii)	smaller	accept other comparative terms, eg less	1
5(c)	Q N M	all three in correct boxes one statement in correct box gains **1** mark	2
5(d)	any **two** from: • increase the current / p.d. (supplied to the coil) • increase number of turns (on the coil) • increase the area (of the coil) • increase the (strength of the permanent) magnetic field	 accept reduce the resistance of the coil **or** increase cross sectional area of wire accept more cells / batteries **or** turn up the power supply increase power is insufficient accept increase the width of the coil increase width / size is insufficient accept move the magnets closer to the coil accept use stronger magnets do **not** accept use larger magnets	2
5(e)	an economic		1
Total			**9**

4.2.1.3 Current, resistance and potential difference

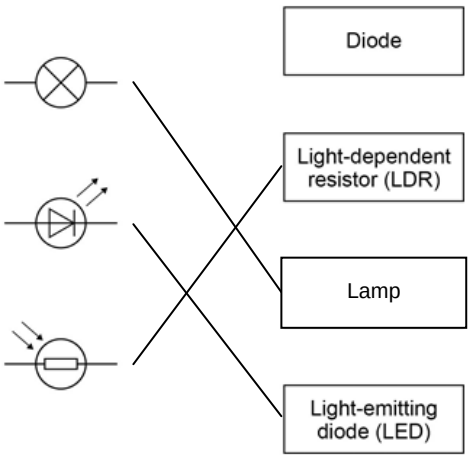
Answer 35 · Mark scheme

June 2013 | PH3FP | Original Q5 | Legacy

PH3FP

4.2.1.3 Current, resistance and potential difference

Answer 36 · Mark scheme June 2014 | PH2FP | Original Q3 | Legacy

3(a)		allow **1** mark for each correct line if more than one line is drawn from any symbol then all of those lines are wrong	3	AO1 2.3.2
3(b)(i)	half		1	AO1 2.3.2k
3(b)(ii)	3(V)		1	AO2 2.3.2k
3(b)(iii)	V_1		1	AO2 2.3.2k

Question 3 continues on the next page . . .

Answer 36 · Mark scheme

Question 3 continued . . .

Question	Answers	Extra information	Mark	AO spec ref
3(c)(i)	potential difference / voltage of the power supply	accept the power supply accept the voltage / volts accept number of cells / batteries accept (same) cells / batteries do not accept same ammeter / switch / wires	1	AO3 2.3.2i
3(c)(ii)	bar drawn – height 1.(00)A	ignore width of bar allow **1** mark for bar shorter than 3rd bar	2	AO2 2.3.2i
3(c)(iii)	as the number of resistors increases the current decreases		1	AO3 2.3.2i
Total			**10**	

4.2.1.3 Current, resistance and potential difference

Answer 36 · Mark scheme

June 2014 | PH2FP | Original Q3 | Legacy

Question	Answers	Extra information	Mark	AO spec ref

Answer 37 · Mark scheme

June 2014 | PH3FP | Original Q9 | Legacy

The full source mark scheme begins on page 265. Follow original question 9 in that document.

Answer 38 · Mark scheme

June 2015 | PH2FP | Original Q1 | Legacy

The full source mark scheme begins on page 282. Follow original question 1 in that document.

Answer 39 · Mark scheme

June 2015 | PH2FP | Original Q7 | Legacy

The full source mark scheme begins on page 282. Follow original question 7 in that document.

4.2.1.3 Current, resistance and potential difference

Answer 40 · Mark scheme

June 2015 | PH3FP | Original Q6 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. ref.
6(a)	induced		1	AO1 P3.3.2b
6(b)	any **two** from: • use the same (strength) magnet • the speed that the magnet is moved • the area of the turns • the magnetic pole being moved towards the coil (of wire)	same size magnet is insufficient accept movement of the magnet same type/length of wire is insufficient use the same voltmeter is insufficient	2	AO3 P3.3.2b
6(c)(i)	voltmeter misread **or** number of turns miscounted	result misread is insufficient human error is insufficient allow the magnet was moved at a (slightly) different speed (into the coil) than for the other readings allow spacing between the turns had changed	1	AO2 P3.3.2
6(c)(ii)	line of best fit passing through all points except (100, 0.034)	line does not need to go back to origin	1	AO3 P3.3.2
6(d)	any **one** from: • can re-check data / readings • can take more readings (in a given time) • easier to identify maximum value	accept can go back to data can store data is insufficient automatically records data is insufficient accept is more accurate accept eliminates human error	1	AO3 P3.3.2b
Total			6	

4.2.1.3 Current, resistance and potential difference

Answer 40 · Mark scheme

June 2015 | PH3FP | Original Q6 | Legacy



4.2.1.3 Current, resistance and potential difference

Answer 41 · Mark scheme June 2016 | PH2FP | Original Q2 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(a)	20		1	AO2 2.4.1b
2(b)	50		1	AO1 2.4.1c
2(c)(i)	115		1	AO2 2.3.2k
2(c)(ii)	230		1	AO1 2.3.2l
2(c)(iii)	if one goes out the other still works **or** brighter	accept power (output) is greater can be switched on/off independently is insufficient	1	AO2 2.3
2(d)	the outside/casing is plastic and plastic is an insulator	there is plastic around the wires is insufficient it is plastic is insufficient an answer the light fitting is double insulated gains both marks	1 1	AO1 2.4.1j
2(e)	(residual current) circuit breaker	accept RCCB accept RCBO accept RCCD accept RCB accept miniature circuit breaker / MCB trip switch is insufficient breaker is insufficient do not accept earth wire	1	AO1 2.4.1i
Total			**8**	

4.2.1.3 Current, resistance and potential difference

Answer 41 · Mark scheme

June 2016 | PH2FP | Original Q2 | Legacy



4.2.1.3 Current, resistance and potential difference

Answer 42 · Mark scheme June 2016 | PH2FP | Original Q5 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(a)	4		1	AO2 2.3.2j
5(b)(i)	2	allow **1** mark for correct substitution ie $I = \frac{20}{10}$ provided no subsequent step	2	AO2 2.3.2a
5(b)(ii)	5	allow **1** mark for correct substitution ie $V = \frac{100}{20}$ provided no subsequent step	2	AO2 2.3.2b
Total			**5**	

4.2.1.3 Current, resistance and potential difference

Answer 42 · Mark scheme

June 2016 | PH2FP | Original Q5 | Legacy



4.2.1.3 Current, resistance and potential difference

Answer 43 · Mark scheme June 2016 | PH2FP | Original Q7 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
7(a)	last box ticked 		1	AO1 2.3.2c
7(b)(i)	use hotter water (than 60 °C) **or** add ice cubes	accept use boiling water accept use water at any stated temperature above 60 °C accept add water at any stated temperature below 12 °C use different temperatures is insufficient	1	AO3 2.3.2q
7(b)(ii)	the current increases as the temperature increases		1	AO2 2.3.2q
7(b)(iii)	0.02 (A)		1	AO2 2.3.2q
7(b)(iv)	5 (V) **or** their **(b)(iii)** × 250 correctly calculated	allow **1** mark for correct substitution ie V = 0.02 × 250 **or** V = their **(b)(iii)** × 250	2	AO2 2.3.2h
7(b)(v)	the resistance increases		1	AO3 2.3.2q
Total			**7**	

4.2.1.3 Current, resistance and potential difference

Answer 43 · Mark scheme

June 2016 | PH2FP | Original Q7 | Legacy



4.2.1.3 Current, resistance and potential difference

Answer 44 · Mark scheme

June 2016 | PH3FP | Original Q9 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
9(a)	a magnetic field that is alternating / changing	accept electromagnetic field heat is insufficient	1 1	AO1 3.3.2d
9(b)	20	allow **1** mark for correct substitution, ie $\frac{230}{11.5}$ provided no subsequent step	2	AO2 3.3.2g
9(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
9(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
9(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
9(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 9 continues on the next page . . .

4.2.1.3 Current, resistance and potential difference

Answer 44 · Mark scheme

June 2016 | PH3FP | Original Q9 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
9(d)(iv)	(electromagnetic) induction	accept it is induced do not accept electric / magnetic induction	1	AO1 3.3.2a
9(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	

4.2.1.3 Current, resistance and potential difference

Answer 45 · Mark scheme

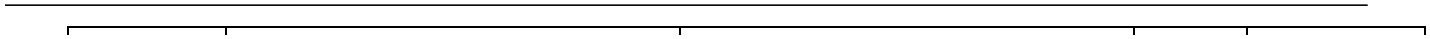
June 2017 | PH2FP | Original Q1 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1(a)(i)	electrons		1	AO1 2.3.1b
1(a)(ii)	positive		1	AO1 2.3.1b
1(b)(i)	repel	accept a correct description eg push away from	1	AO1 2.3.1d
1(b)(ii)	(the forces are) equal (in magnitude)	accept in equilibrium accept balanced accept the same	1	AO3 2.3.1c
1(c)(i)	copper		1	AO1 2.3.1e
1(c)(ii)	the temperature increases		1	AO2 2.4.2a
1(c)(iii)	2000	allow **1** mark for correct substitution ie $I = \frac{4}{0.002}$ provided no subsequent step	2	AO2 2.3.2a
Total			**8**	

4.2.1.3 Current, resistance and potential difference

Answer 45 · Mark scheme

June 2017 | PH2FP | Original Q1 | Legacy



4.2.1.3 Current, resistance and potential difference

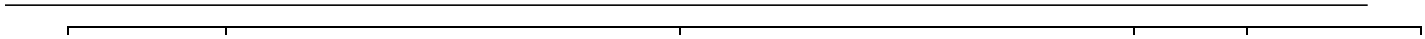
Answer 46 · Mark scheme June 2017 | PH2FP | Original Q3 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
3(a)(i)	2.16	allow **1** mark for correct substitution ie V = 0.12 x 18 provided no subsequent step	2	AO2 2.3.2h
3(a)(ii)	4.5 - **V**		1	AO2 2.3.2k
3(b)(i)	C		1	AO1 2.3.2m
3(b)(ii)	A		1	AO1 2.3.2n
Total			**5**	

4.2.1.3 Current, resistance and potential difference

Answer 46 · Mark scheme

June 2017 | PH2FP | Original Q3 | Legacy



4.2.1.3 Current, resistance and potential difference

Answer 47 · Mark scheme

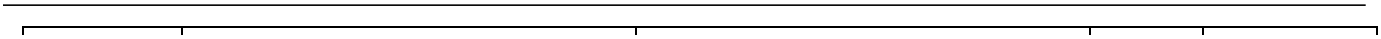
June 2017 | PH3FP | Original Q2 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(a)(i)	less than		1	AO1 3.3.2f
2(a)(ii)	because there are fewer turns (on the secondary coil)	do not accept coils for turns accept because it is a step down transformer reason only scores if correct answer is chosen in part 2 (a)(i)	1	AO1 3.3.2f
2(b)	(soft) iron		1	3.3.2c
2(c)	A potential difference is induced across the secondary coil.		1	AO1 3.3.2d
2(d)	50 hertz		1	AO1 3.3.2j
2(e)	2 (W)		1	AO1 3.3.2h
Total			**6**	

4.2.1.3 Current, resistance and potential difference

Answer 47 · Mark scheme

June 2017 | PH3FP | Original Q2 | Legacy



4.2.1.3 Current, resistance and potential difference

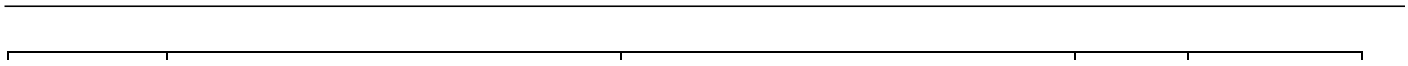
Answer 48 · Mark scheme June 2018 | 8463/1F | Original Q2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	0.08 (s)		1	AO3 4.2.1.3
02.2	the current goes higher than normal value **or** the current goes higher than 1.5 A	allow the current goes (too) high	1	AO1 4.2.1.3
02.3	P = 1.5 × 24 P = 36 (W)	an answer of 36 (W) scores **2** marks	1 1	AO2 4.2.4.1
02.4	LED lamps waste a smaller proportion of the input energy than filament lamps		1	AO1 4.1.2.2
Total			**5**	

4.2.1.3 Current, resistance and potential difference

Answer 48 · Mark scheme

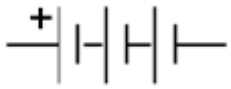
June 2018 | 8463/1F | Original Q2



4.2.1.3 Current, resistance and potential difference

Answer 49 · Mark scheme

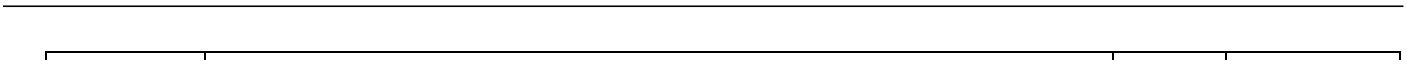
June 2018 | 8463/1F | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	correct circuit symbol 3 cells joined in series in correct orientation eg 	 ignore absence of + symbol	1 1	AO1 4.2.1.1
03.2	$R = \frac{12}{1.6}$ R = 7.5 (Ω)	an answer of 7.5 (Ω) scores **2** marks	 1 1	AO2 4.2.1.3
03.3	4.0 (Ω)	allow their answer to question **03.2** − 3.5 correctly calculated	1	AO2 4.2.2
03.4	it decreases the current would be higher (for the same p.d.) **or** more than one path for charge to flow **or** total resistance is always less than the smallest individual resistance	 reason only scores if correct box is chosen allow current for charge	1 1	AO1 4.2.2
Total			**7**	

4.2.1.3 Current, resistance and potential difference

Answer 49 · Mark scheme

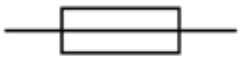
June 2018 | 8463/1F | Original Q3



4.2.1.3 Current, resistance and potential difference

Answer 50 · Mark scheme

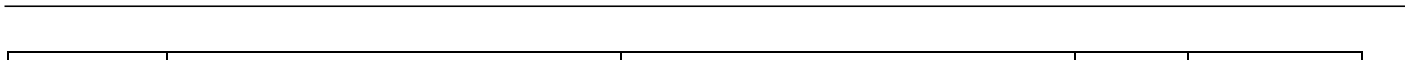
June 2018 | 8463/1F | Original Q7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1			1	AO1 4.2.1.1
07.2	E = 13 × 230 E = 2990 (J)	an answer 2990 (J) scores **2** marks	1 1	AO2 4.2.4.2
07.3	charge flow = current x time	allow Q = It	1	AO1 4.2.1.2
07.4	1.52 = I × 0.40 $I = \frac{1.52}{0.40}$ I = 3.8 (A)	an answer of 3.8 (A) scores **3** marks	1 1 1	AO2 4.2.1.2
07.5	E = 0.00175 × 205 000 E = 359 (J)	an answer of 359 (J) scores **2** marks allow an answer that rounds to 360 (J) for **2** marks	1 1	AO2 4.3.2.3
Total			**9**	

4.2.1.3 Current, resistance and potential difference

Answer 50 · Mark scheme

June 2018 | 8463/1F | Original Q7



4.2.1.3 Current, resistance and potential difference

Answer 51 · Mark scheme June 2018 | 8463/1F | Original Q12

Question	Answers	Extra information	Mark	AO/ Spec. Ref
12.1	ammeter and voltmeter symbols correct voltmeter in parallel with wire ammeter in series with wire		1 1 1	AO1 4.2.1.1 4.2.1.3
12.2	**Level 3:** The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.		5–6	AO1 4.2.1.3
	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 • length measured • length varied • current measured • potential difference measured • repeat readings • calculate resistance for each length • resistance = $\frac{\text{potential difference}}{\text{current}}$ • plot a graph of resistance against length • hazard: high current • may cause wire to melt / overheat • may cause burns (to skin) • use low currents			

4.2.1.3 Current, resistance and potential difference

Answer 51 · Mark scheme

June 2018 | 8463/1F | Original Q12

Question	Answers	Extra information	Mark	AO/ Spec. Ref
12.3	the temperature of the wire would not change		1	AO3 4.2.1.3
12.4	the accuracy of the student's results would be higher the resolution of the length measurement would be higher		1 1	AO3 4.2.1.3
Total			**12**	

4.2.1.3 Current, resistance and potential difference

Answer 52 · Mark scheme June 2018 | 8463/2F | Original Q4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	top of each paper clip labelled N / north **and** bottom of each paper clip labelled S / south	both parts required	1	AO2 4.7.1.1
04.2	so the paper clips have the same weight / mass which allows the results for different numbers of turns to be compared (fairly)	 allow fair test allow the control variable (is the weight / mass of a paper clip) allow to obtain valid results ignore accurate results	1 1	AO3 4.7.2.1
04.3	as the number of turns increases so does the number of paper clips (held) in a linear pattern	allow positive correlation directly proportional scores **2** marks allow a correct description of directly proportional for **2** marks	1 1	AO3 4.7.2.1
04.4	some of the paper clips were already magnetised		1	AO3 4.7.2.1

4.2.1.3 Current, resistance and potential difference

Answer 52 · Mark scheme

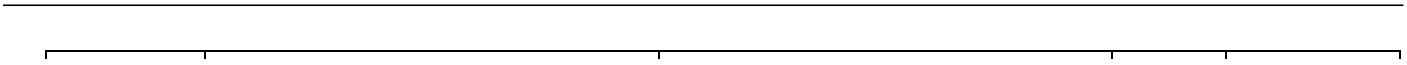
June 2018 | 8463/2F | Original Q4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	discount the result of 18	ignore repeat experiment / measurements	1	AO3 4.7.2.1
	as the three new results are similar (and not close to 18)		1	
	and use 15 (the mean of the new results)	allow find the mean of the remaining results (16,14 and 15) if no other marks have been awarded: calculate the mean (of all four results) (1) round down to 15 (1) – this mark only scores if the mean of 15.75 has been calculated	1	
04.6	keep number of turns constant	allow a specific number of turns	1	AO3 4.7.2.1
	(use the variable resistor to) change the current (several times)	change the p.d. is insufficient	1	
	(for each current value) count how many paper clips the electromagnet will hold		1	
Total			**12**	

4.2.1.3 Current, resistance and potential difference

Answer 52 · Mark scheme

June 2018 | 8463/2F | Original Q4

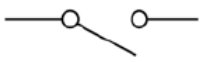


4.2.1.3 Current, resistance and potential difference

Answer 53 · Mark scheme

June 2019 | 8463/1F | Original Q7

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
7.1	M		1	4.2.2 AO1
7.2	 **or** 		1	4.2.1.1 AO1
7.3	current $= \frac{24}{30}$ current = 0.80 (A)	an answer of 0.8 (A) scores **2** marks	1 1	4.2.1.2 AO2
7.4	E = 60 × 3.6 E = 216 (J)	an answer of 216 (J) scores **2** marks	1 1	4.2.4.2 AO2
7.5	The reading in **Y** would be lower		1	4.2.2 AO1
7.6	The total resistance of **Y** is greater		1	4.2.2 AO1
7.7	potential difference = current × resistance **or** $V = IR$		1	4.2.1.3 AO1
7.8	3.6 = 0.80 × R $R = \frac{3.6}{0.80}$ R = 4.5 (Ω)	an answer of 4.5 (Ω) scores **3** marks	1 1 1	4.2.1.3 AO2
Total			**12**	

Answer 54 · Mark scheme

Question 9

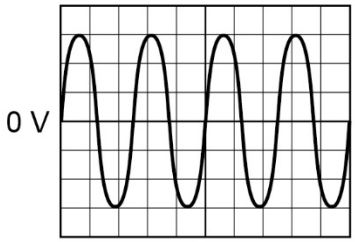
Question	Answers	Extra information	Mark	AO / Spec. Ref.
9.1	The energy transferred each second to the bulb.		1	4.1.1.4 AO1
9.2	power = potential difference × current **or** $P = VI$		1	4.2.4.1 AO1
9.3	$40 = I \times 230$ $I = \frac{40}{230}$ $I = 0.17$ (A)	an answer of 0.17 (A) scores **3** marks a correct answer that rounds to 0.17 (A) scores **3** marks	1 1 1	4.2.4.1 AO2
9.4	efficiency = $\frac{\text{useful power output}}{\text{total power input}}$		1	4.1.2.2 AO1
9.5	$0.30 = \frac{\text{useful power output}}{9.0}$ 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
9.6	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**	

4.2.1.3 Current, resistance and potential difference

Answer 55 · Mark scheme

November 2020 | 8463/1F | Original Q3

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	50 Hz		1	AO1 4.2.3.1
03.2			1	AO1 4.2.3.1
03.3	P = 0.020 × 230 P = 4.6 (W)		1 1	AO2 4.2.4.1
03.4	E = 180 × 230 E = 41 400 (J)		1 1	AO2 4.2.4.2
03.5	Hazard: live wire **or** high potential difference Risk: electric shock **or** electrocution	ignore current in his body allow (electrical) burn allow death (by electric shock) allow 1 mark for hazard and risk in incorrect order	1 1	AO3 4.2.3.2
Total			**8**	

4.2.1.3 Current, resistance and potential difference

Answer 56 · Mark scheme

November 2020 | 8463/1F | Original Q4

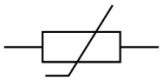
Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	$R = \frac{36.0}{3}$ R = 12.0 (Ω)		1 1	AO2 4.2.2 RPA 3
04.2	0.1 Ω		1	AO3 4.2.2 RPA 3
04.3	The measurements are grouped closely together		1	AO3 4.2.2 RPA 3
04.4	The results give a straight line that would go through the origin.		1	AO2 4.2.2 RPA 3
04.5	84 (Ω)	allow an answer between 83 and 85 (Ω) inclusive	1	AO3 4.2.2 RPA 3
04.6	decreases decreases		1 1	AO1 4.2.2 RPA 3
Total			**8**	

Answer 57 · Mark scheme

November 2020 | 8463/1F | Original Q7

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	kg °C	allow kilogram allow degrees Celsius	1 1	AO1 4.1.1.3 RPA 1
07.2			1	AO1 4.2.1.1 RPA 1
07.3	$P = 12^2 \times 15$ P = 2160 (W)		1 1	AO2 4.2.4.1 RPA 1
07.4	The heating element in the kettle takes time to heat up		1	AO1 4.1.1.1 RPA 1
07.5	**Level 3:** The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.		5–6	AO1 4.1.1.1 RPA 1
	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: • measure the mass of water using a balance **or** measure the volume of water using a measuring cylinder • measure the initial temperature of the water • pour the water into the kettle • put temperature probe in the water **or** put a thermometer in the water • switch kettle on • record temperature • measure time with a stopclock • use an interval of 5 seconds			

4.2.1.3 Current, resistance and potential difference

Answer 57 · Mark scheme

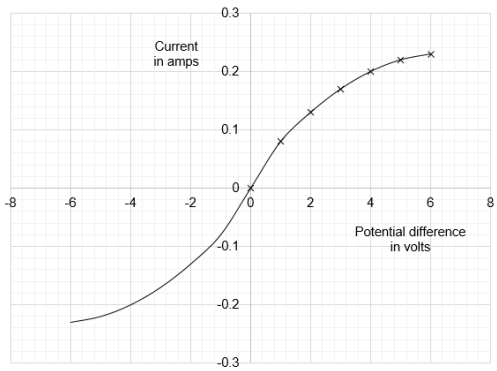
Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.6	ΔΘ = 80 (°C)		1	AO2 4.1.1.3 RPA 1
	E = 0.50 × 4200 × 80	allow E = 0.50 × 4200 × their value of ΔΘ	1	
	E = 168 000 (J)	allow an answer consistent with their value of ΔΘ	1	
07.7	m = 0.005 (kg)		1	AO2 4.3.2.3
	E = 0.005 × 2 260 000	this mark may score if m is not/incorrectly converted	1	
	E = 11 300 (J)	allow an answer consistent with their value of m	1	
Total			**18**	

4.2.1.3 Current, resistance and potential difference

Answer 58 · Mark scheme

November 2020 | 8463/1F | Original Q8

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	ammeter and voltmeter symbols correct voltmeter in parallel with lamp ammeter in series with lamp		1 1 1	AO1 4.2.1.1 RPA 4
08.2	smooth curved line of correct shape passing through - 4.0 V, - 0.2 A **or** – 6.0 V, - 0.23 A  	do not accept a line that becomes horizontal 2nd mark conditional on scoring 1st mark	1 1	AO2 4.2.1.4 RPA 4
08.3	potential difference = current × resistance **or** $V = IR$		1	AO1 4.2.1.3 RPA 4
08.4	I = 0.08 (A) 1.0 = 0.08 × R $R = \frac{1.0}{0.08}$ R = 12.5 (Ω)	 allow 1.0 = their I × R provided their I has been obtained from the graph allow $R = \frac{1.0}{\text{their I}}$ allow an answer consistent with their I	1 1 1 1	AO2 4.2.1.3 RPA 4

4.2.1.3 Current, resistance and potential difference

Answer 58 · Mark scheme

November 2020 | 8463/1F | Original Q8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.5	ammeter displays a reading when not connected (to a circuit)		1	AO3 4.2.1.4 RPA 4
Total			**11**	

4.2.1.3 Current, resistance and potential difference

Answer 59 · Mark scheme

November 2021 | 8463/1F | Original Q2

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	A: transmission / power cables B: step-down transformer	allow transmission / power lines allow cables ignore wires	1 1	AO1 4.2.4.3
02.2	less thermal energy is transferred to the surroundings.		1	AO1 4.2.4.3
02.3	charge flow = $\frac{500\,000\,000}{25\,000}$ charge flow = 20 000 (C)		1 1	AO2 4.2.4.2
02.4	total current = 7.20 (A) P = 230 × 7.20 P = 1656 (W)	 allow a correct substitution of an incorrect total current allow a correct calculation using an incorrect total current	1 1 1	AO2 4.2.4.1
02.5	dishwasher has the largest current **or** has the largest power (input)		1 1	AO3 4.2.4.1 4.2.4.2
02.6	E = 600 × 32 000 000 E = 19 200 000 000 (J) **or** E = 1.92 × 10^{10} (J)		1 1	AO2 4.1.1.4
Total			**12**	

4.2.1.3 Current, resistance and potential difference

Answer 60 · Mark scheme

November 2021 | 8463/1F | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	increased decreased stayed the same		1 1 1	AO3 4.2.1.3 4.2.2
04.2	random error		1	AO3 4.2.1.3 4.2.2
04.3	A_2 = 0.12 (A) A_5 = 0.36 (A)		1 1	AO1 4.2.2
04.4	$P = 0.12^2 \times 15$ P = 0.216 (W)		1 1	AO2 4.2.4.1
Total			**8**	

4.2.1.3 Current, resistance and potential difference

Answer 61 · Mark scheme

November 2021 | 8463/1F | Original Q9

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	the polarity (of the supply) does not change	allow potential difference in one direction (only)	1	AO1 4.2.3.1
09.2	energy transferred = power × time		1	AO1 4.1.1.4 4.2.4.2
09.3	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
09.4	$V = I \times R$		1	AO1 4.2.1.3
09.5	480 = 15 × R $R = \frac{480}{15}$ R = 32 (Ω)		1 1 1	AO2 4.2.1.3
09.6	time taken using system **A** is double the time of system **B**		1	AO3 4.2.4.1
Total			**10**	

Question 11

Question	Answers	Mark	AO/ Spec. Ref
11.1	**Level 3**: The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	5–6	AO1 4.2.1.4 RPA4
	Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the plan is not fully logically sequenced.	3–4	
	Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2	
	No relevant content	0	
	Indicative content • measure the current in **R** using the ammeter • measure the p.d. across **R** using the voltmeter • vary the resistance of the variable resistor (or vary the number of cells or use a variable power supply) • record a range of values of current and p.d. • ensure current is low to avoid temperature increase • switch circuit off between readings • reverse connection of **R** to power supply • repeat measurements of I and V in negative direction • plot a graph of current against p.d.		

4.2.1.3 Current, resistance and potential difference

Answer 62 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
11.2	current and p.d. would not be directly proportional **or** I-V graph would not be straight **or** I-V graph would be curved (because) resistance of **R** would increase		1 1	AO3 4.2.1.4 RPA4
11.3	0.2 (A)		1	AO3 4.2.2 RPA4
11.4	any **one** from: • less chance of misreading • no parallax error • it can give a reading closer to the true value	 allow position of eye(s) does not affect reading allow 'it is more accurate' ignore 'no human error' ignore 'easier to read'	1	AO3 4.2.2 RPA4
Total			**10**	

4.2.1.3 Current, resistance and potential difference

Answer 63 · Mark scheme

June 2022 | 8463/1F | Original Q7

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	<table><tr><th>Energy resources</th><th>Renewable</th><th>Non-renewable</th></tr><tr><td>biofuel</td><td>✓</td><td></td></tr><tr><td>coal</td><td></td><td>✓</td></tr><tr><td>nuclear</td><td></td><td>✓</td></tr><tr><td>tides</td><td>✓</td><td></td></tr></table> 4 correct scores **2** marks 3 correct scores **1** mark		2	AO1 4.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2	potential difference current energy potential difference	this order only allow p.d.	1 1 1 1	AO1 4.2.4.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.3	charge flow = current × time **or** $Q = It$		1	AO1 4.2.1.2

4.2.1.3 Current, resistance and potential difference

Answer 63 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4	t = 300 (s)		1	AO2
	Q = 130 000 × 300	allow a correct substitution using an incorrectly / not converted value of t	1	AO2
	Q = 39 000 000 ***or*** $Q = 3.9 \times 10^7$	allow a correct calculation using an incorrectly / not converted value of t	1	AO2
	coulombs / C		1	AO1 4.2.1.2

Total Question 7		**11**

4.2.1.3 Current, resistance and potential difference

Answer 64 · Mark scheme

June 2022 | 8463/1F | Original Q11

Question 11

Question	Answers	Extra information	Mark	AO / Spec. Ref.
11.1	$P = V \times I$		1	AO1 4.2.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
11.2	$4.4 = 40 \times I$ $I = \frac{4.4}{40}$ $I = 0.11$ (A)		1 1 1	AO2 4.2.4.1

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

Question	Answers	Extra information	Mark	AO / Spec. Ref.
11.4	$0.85 = \frac{P}{4.0}$ $P = 0.85 \times 4.0$ $P = 3.4$ (W)		1 1 1	AO2 4.1.2.2

Total Question 11		8

4.2.1.3 Current, resistance and potential difference

Answer 65 · Mark scheme

June 2023 | 8463/1F | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	switch		1	AO1 4.2.1.1 RPA4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	current potential difference	 allow p.d. allow voltage in this order only	1 1	AO1 4.2.1.4 RPA4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3				AO1 4.2.2 4.2.1.3 RPA4

Quantity	Decrease	Stay the same	Increase
Current in the circuit	✓		
Potential difference across the lamp	✓		
Total resistance of the circuit			✓

1
1
1

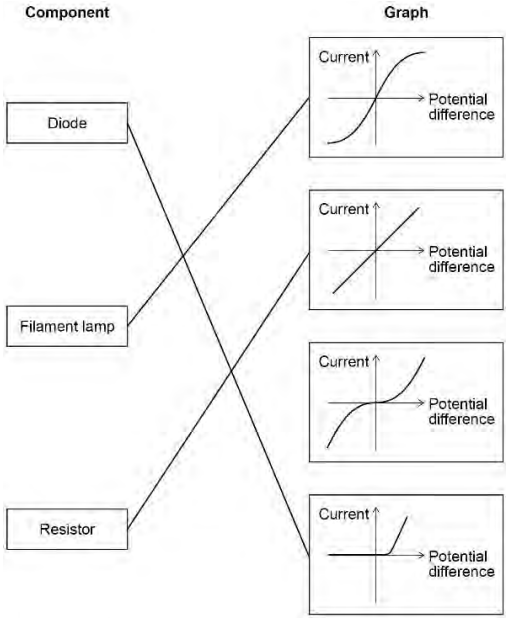
any extra tick in a row negates the mark for that row

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	current = $\frac{15}{60}$ current = 0.25 (A)		1 1	AO2 4.2.1.2

4.2.1.3 Current, resistance and potential difference

Answer 65 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	$R = \frac{6.0}{0.12}$ $R = 50\ (\Omega)$		1 1	AO2 4.2.1.3

Question	Answers	Mark	AO / Spec. Ref.
01.6	 2 marks for all 3 correct 1 mark for 1 or 2 correct additional line from a box on the left negates the mark for that box	2	AO1 4.2.1.4 RPA4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.7	a zero error		1	AO3 4.2.1.4 RPA4

Total Question 1	13

4.2.1.3 Current, resistance and potential difference

Answer 66 · Mark scheme

June 2023 | 8463/1F | Original Q8

Question 8

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

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.2	$P = I^2R$		1	AO1 4.2.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.3	$1.60 \times 10^9 = 2000^2 \times R$ $R = \frac{1.60 \times 10^9}{2000^2}$ $R = 400\ (\Omega)$		1 1 1	AO2 4.2.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.4	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

4.2.1.3 Current, resistance and potential difference

Answer 66 · Mark scheme

June 2023 | 8463/1F | Original Q8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.5	$0.992 = \frac{\text{useful energy output}}{34.2}$ 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 8	**10**

4.2.1.3 Current, resistance and potential difference

Answer 67 · Mark scheme

June 2023 | 8463/1F | Original Q10

Question 10

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.1	polarity of the potential difference doesn't change	allow direction of the potential difference doesn't change	1	AO1 4.2.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.2	$E = QV$		1	AO1 4.2.4.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.3	$5010 = Q \times 12$ $Q = \frac{5010}{12}$ $Q = 417.5$ (C)	 allow 418 (C)	1 1 1	AO2 4.2.4.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.4	$5010 = 0.015 \times L$ $L = \frac{5010}{0.015}$ $L = 334\,000$ (J/kg)		1 1 1	AO2 4.3.2.3

4.2.1.3 Current, resistance and potential difference

Answer 67 · Mark scheme

June 2023 | 8463/1F | Original Q10

Question	Answers	Mark	AO / Spec. Ref.
10.5	**Level 3:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	5–6	AO1 4.3.1.1 4.3.2.1
	Level 2: Relevant points (reasons / causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.	3–4	
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	
	No relevant content	0	
	Indicative content • particles in a solid are in a regular pattern • particles in a liquid are in a random arrangement • particles in a solid are vibrating about fixed positions • particles in a liquid are moving freely • as the ice changes to water the temperature remains constant • because as the ice changes to water the potential energy of the particles increases • as the water warms the particles move faster • so the kinetic energy of the particles increases • internal energy is the total kinetic and potential energy of all the particles ignore any references to density of ice vs liquid water ignore any references to spacing of particles		

Total Question 10	14

4.2.1.3 Current, resistance and potential difference

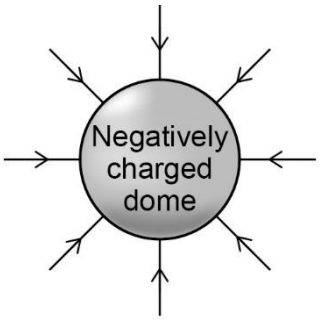
Answer 68 · Mark scheme

June 2024 | 8463/1F | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	negative		1	AO1 4.2.5.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	repulsion		1	AO1 4.2.5.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3			1	AO1 4.2.5.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	resistance		1	AO1 4.2.5.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	ionised		1	AO1 4.2.5.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.6	electrons		1	AO1 4.2.5.2

4.2.1.3 Current, resistance and potential difference

Answer 68 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.7	energy transferred = 0.000 002 × 300 000 energy transferred = 0.6 (J)		1 1	AO2 4.2.4.2

Total Question 1	**8**

4.2.1.3 Current, resistance and potential difference

Answer 69 · Mark scheme

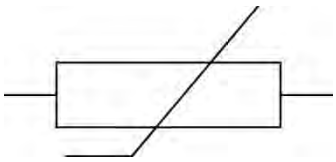
June 2024 | 8463/1F | Original Q2

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	50 hertz		1	AO1 4.2.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	230 volts		1	AO1 4.2.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	resistance = $\frac{0.45}{0.75}$ resistance = 0.60 (Ω)		1 1	AO2 4.2.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4			1	AO1 4.2.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	pd across battery - pd across thermistor		1	AO3 4.2.2

4.2.1.3 Current, resistance and potential difference

Answer 69 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	1.5 V (thermistor has the) same resistance as resistor **or** both (components) have a resistance of 200 (Ω)	 MP2 dependent on scoring MP1 allow pd shared equally (between components of equal resistance) allow pd will be half (of the total pd)	1 1	AO3 4.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.7	resistance at 15 °C = 200 (Ω) change in resistance = 400 (Ω)	 allow a correct change in resistance from a misread resistance within the range 180 to 220 Ω	1 1	AO2 4.2.1.4

Total Question 2	**10**

4.2.1.3 Current, resistance and potential difference

Answer 70 · Mark scheme

June 2024 | 8463/1F | Original Q8

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	$\mathbf{X} = \frac{0.26 + 0.21 + 0.25}{3}$ $\mathbf{X} = 0.24$ (A)	 allow $\mathbf{X} = \frac{0.26 + 0.25}{2} = 0.255$ for 2 marks	1 1	AO2 4.2.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.2	current = 0.17 (A) power = 3.0 × 0.17 power = 0.51 (W)	 allow a correct substitution using a value of I in the range 0.16 to 0.18 A allow an answer consistent using a value of I in the range 0.16 to 0.18 A answers of 0.456, 5.1 or 51 score **2** marks	1 1 1	AO2 4.2.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.3	decreases		1	AO2 4.2.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.4	filament lamp		1	AO3 4.2.1.4

Total Question 8	7

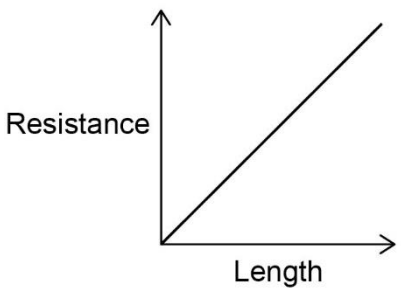
4.2.1.3 Current, resistance and potential difference

Answer 71 · Mark scheme

June 2024 | 8463/1F | Original Q11

Question 11

Question	Answers	Mark	AO / Spec. Ref.
11.1	**Level 3**: The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.	5–6	AO1 4.2.1.3 RPA3
	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 • measure the length of the wire (between the crocodile clips) using the ruler • length varied by moving crocodile clips • current measured with ammeter • potential difference measured with voltmeter • calculate resistance for each length • use $V = IR$ to calculate resistance • record current and pd for different lengths • repeat readings of current and pd for each length and mean values calculated • remove any anomalous readings • ensure values of current are low to minimise heating of wire • ensure circuit is disconnected between readings **Level 2:** Varying the length of the wire. Measurements / equipment needed for pd and current.		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
11.2			1	AO1 4.2.1.3 4.2.1.4 RPA3

4.2.1.3 Current, resistance and potential difference

Answer 71 · Mark scheme

June 2024 | 8463/1F | Original Q11

Question	Answers	Extra information	Mark	AO / Spec. Ref.
11.3	potential difference is (very) low		1	AO1
	(so) no risk of electric shock **or** (so) no risk of electrocution	allow less risk of electric shock allow so wire won't melt allow so wire won't get hot	1	AO3 4.2.1.3 RPA3

Total Question 11	9

Answer 72 · Mark scheme

June 2025 | 8463/1F | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	(earth wire) green and yellow (live wire) brown (neutral wire) blue		1 1 1	AO1 4.2.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2			1	AO1 4.2.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	potential difference = $\frac{2420}{11.0}$ potential difference = 220 (V)		1 1	AO2 4.2.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	resistance = $\frac{2420}{11^2}$ resistance = 20 (Ω)		1 1	AO2 4.2.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	a greater percentage of energy is usefully transferred by kettle **A** kettle **A** takes less time to boil the same volume of water		1 1	AO3 4.1.1.4 4.1.2.2

Total Question 5	10

Answer 73 · Mark scheme

June 2025 | 8463/1F | Original Q7

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	current = $\frac{6.0}{12}$ current = 0.50 (A)		1 1	AO2 4.2.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2	energy transferred = 6.0 × 8.0 energy transferred = 48 (J)		1 1	AO2 4.2.4.2

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

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4	$0.70 = \frac{1.96}{\text{total input energy transfer}}$ total input energy transfer = $\frac{1.96}{0.70}$ total input energy transfer = 2.8 (J)		1 1 1	AO2 4.1.2.2

4.2.1.3 Current, resistance and potential difference

Answer 73 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.5	0.74 to 0.78 inclusive		1	AO2 4.1.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.6	the line is curved **or** the line does not pass through the origin	allow the line is not straight allow the line is not linear	1	AO2 4.1.2.2

Total Question 7	**10**

Answer 74 · Mark scheme

Question 10

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.1	any **one** from: • change the resistance of the variable resistor • change the number of cells in the battery • change the potential difference of the power supply / pack • add additional resistors / components to the circuit	allow use the variable resistor allow add another battery allow use a battery with a higher / lower potential difference	1	AO1 4.2.1.4 RPA4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.2	$V = I \times R$		1	AO1 4.2.1.3 RPA4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.3	$I = 0.125$ (A)	allow a value in the range 0.12 (A) to 0.13 (A)	1	AO2 4.2.1.3 RPA4
	$3.0 = 0.125 \times R$	allow a correct substitution using a value of current in the range 0.10 (A) to 0.15 (A)	1	
	$R = \frac{3.0}{0.125}$	allow a correct rearrangement using a value of current in the range 0.10 (A) to 0.15 (A)	1	
	$R = 24$ (Ω)	allow a correct calculation using a value of current in the range 0.10 (A) to 0.15 (A)	1	

4.2.1.3 Current, resistance and potential difference

Answer 74 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.4	(the LED / circuit has a) large resistance in the reverse direction	 MP2 dependent on MP1 if no other marks scored allow 1 mark for: LEDs only allow current in one direction	1 1	AO1 4.2.1.3 4.2.1.4 RPA4

Total Question 10	**8**

4.2.1.3 Current, resistance and potential difference

ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark scheme June 2003

GCSE

Physics

3451

Foundation

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Kathleen Tattersall: *Director General*

4.2.1.3 Current, resistance and potential difference

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).

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

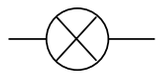
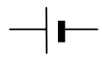
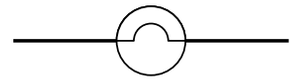
(…..) is used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

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.

4.2.1.3 Current, resistance and potential difference

3451/F Q1

question	answers	extra information	mark
(a)	circuit symbol for a lamp correct   circuit symbol for a cell correct	accept  accept any standard of drawing providing circuit would work	1 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

4.2.1.3 Current, resistance and potential difference

3451/F Q2

question	answers	extra information	mark
(a)	gas		1
(b)	fuel burning stations produce electricity at any time / all the time	accept fuel available all the time	1
	wind generator can only produce when the wind is strong enough	accept it's not always windy	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

4.2.1.3 Current, resistance and potential difference

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

4.2.1.3 Current, resistance and potential difference

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

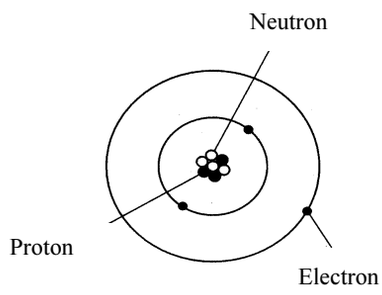
4.2.1.3 Current, resistance and potential difference

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

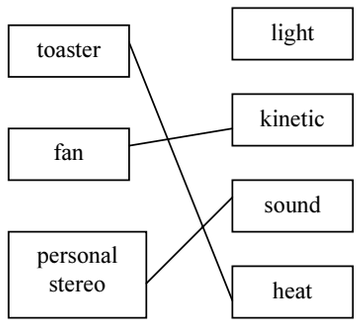
4.2.1.3 Current, resistance and potential difference

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

4.2.1.3 Current, resistance and potential difference

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

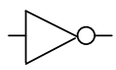
4.2.1.3 Current, resistance and potential difference

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

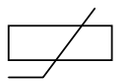
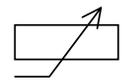
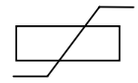
4.2.1.3 Current, resistance and potential difference

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

4.2.1.3 Current, resistance and potential difference

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

4.2.1.3 Current, resistance and potential difference

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

4.2.1.3 Current, resistance and potential difference

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

4.2.1.3 Current, resistance and potential difference

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

4.2.1.3 Current, resistance and potential difference

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

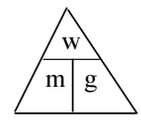
4.2.1.3 Current, resistance and potential difference

3451/F Q14

question	answers	extra information	mark
(a)(i)	any **one** from:		1
	the ground	do **not** accept mobile phones	
	the air		
	radon (gas)		
	building materials		
	buildings		
	rocks / granite		
	food		
	cosmic <u>rays</u> **or** solar <u>rays</u>	accept from outer space accept sun but **not** sunlight	
	X-rays	accept medical uses	
	nuclear weapons testing		
	nuclear power stations / accidents		
(ii)	2	allow $\frac{1200}{60\times10}$ **or** $\frac{1200}{600}$ **or** 120 for **1** mark	2
(b)		answers must be comparative accept converse answers throughout	
	alpha: the count rate is (greatly) reduced by the card **or** the card absorbs alphas <u>but not betas</u>	accept paper for the card	1
	beta: the count rate is (greatly) reduced by the metal **or** the thin metal absorbs alphas <u>and</u> betas **or** the thin metal absorbs all of the radiation (from the source)	accept aluminium for the metal	1
	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 <u>much more</u> than 3 mm of metal	accept aluminium for the metal accept lead / aluminium for the metal	1
total			6

4.2.1.3 Current, resistance and potential difference

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

4.2.1.3 Current, resistance and potential difference

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

4.2.1.3 Current, resistance and potential difference

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

ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark scheme June 2003

GCSE

Science: Double Award Co-ordinated

3462

Paper 3F

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Kathleen Tattersall: *Director General*

4.2.1.3 Current, resistance and potential difference

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).

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.

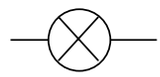
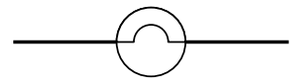
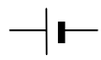
3.10 Unexpected Correct Answers not in the Mark Scheme

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.

4.2.1.3 Current, resistance and potential difference

Double Award
Foundation Tier 3462/3F

3462/3F 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

4.2.1.3 Current, resistance and potential difference

3462/3F 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

4.2.1.3 Current, resistance and potential difference

3462/3F 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

4.2.1.3 Current, resistance and potential difference

3462/3F 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

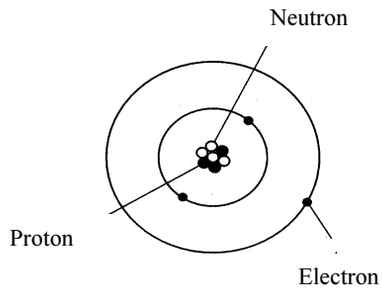
4.2.1.3 Current, resistance and potential difference

3462/3F 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		1
	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
total			6

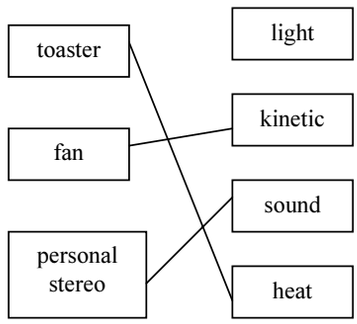
4.2.1.3 Current, resistance and potential difference

3462/3F 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

4.2.1.3 Current, resistance and potential difference

3462/3F 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

4.2.1.3 Current, resistance and potential difference

3462/3F Q8

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

4.2.1.3 Current, resistance and potential difference

3462/3F Q9

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

4.2.1.3 Current, resistance and potential difference

3462/3F Q10

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

4.2.1.3 Current, resistance and potential difference

3462/3F Q11

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

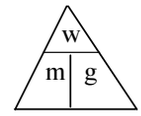
4.2.1.3 Current, resistance and potential difference

3462/3F Q12

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

4.2.1.3 Current, resistance and potential difference

3462/3F Q13

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

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.

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4.2.1.3 Current, resistance and potential difference

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4.2.1.3 Current, resistance and potential difference

GCSE PHYSICS

INFORMATION FOR EXAMINERS

1. General

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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'.

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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.

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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.

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4.2.1.3 Current, resistance and potential difference

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

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4.2.1.3 Current, resistance and potential difference

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

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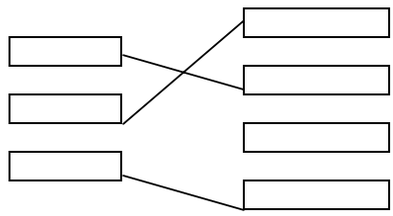
4.2.1.3 Current, resistance and potential difference

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

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4.2.1.3 Current, resistance and potential difference

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	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

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4.2.1.3 Current, resistance and potential difference

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

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4.2.1.3 Current, resistance and potential difference

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

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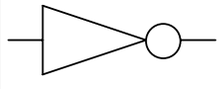
4.2.1.3 Current, resistance and potential difference

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

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4.2.1.3 Current, resistance and potential difference

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	accept finish for E accept correct numbers from axes with units	1
	least steep part of the graph	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
total			6

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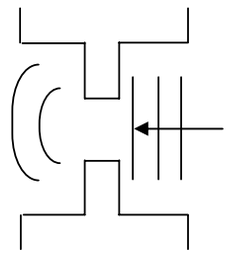
4.2.1.3 Current, resistance and potential difference

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

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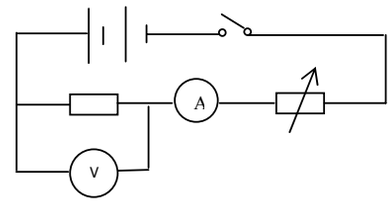
4.2.1.3 Current, resistance and potential difference

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

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4.2.1.3 Current, resistance and potential difference

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

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4.2.1.3 Current, resistance and potential difference

3451F Q12

question	answers	extra information	mark
(a)(i)	accelerating	accept getting faster accept speed / velocity increasing	1
(ii)	acceleration increases	accept velocity / speed increases more 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 correct use of 540 seconds	2
(iii)	velocity includes direction	accept velocity is a vector (quantity) accept converse answer	1
(c)	force of gravity (between shuttle and Earth) plus correct orbital speed (makes shuttle 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 centripetal 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

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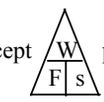
4.2.1.3 Current, resistance and potential difference

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

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4.2.1.3 Current, resistance and potential difference

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

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4.2.1.3 Current, resistance and potential difference

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	1
	… (both) inputs are on / high / 1 **or** current flows in both inputs	do **not** accept numerical values unless expanded	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

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4.2.1.3 Current, resistance and potential difference

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

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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.

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4.2.1.3 Current, resistance and potential difference

Further copies of this Mark Scheme are available from:

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4.2.1.3 Current, resistance and potential difference

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'.

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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).

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

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4.2.1.3 Current, resistance and potential difference

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.

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

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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.

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4.2.1.3 Current, resistance and potential difference

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

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4.2.1.3 Current, resistance and potential difference

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

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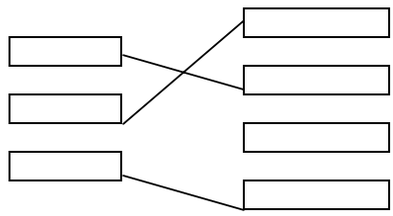
4.2.1.3 Current, resistance and potential difference

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

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4.2.1.3 Current, resistance and potential difference

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

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4.2.1.3 Current, resistance and potential difference

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

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4.2.1.3 Current, resistance and potential difference

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

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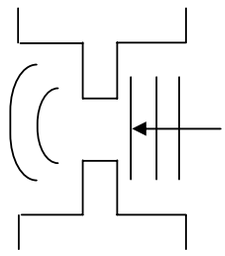
4.2.1.3 Current, resistance and potential difference

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

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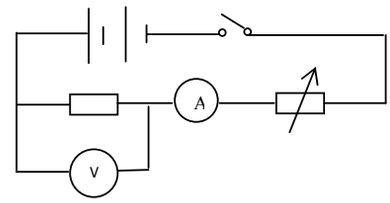
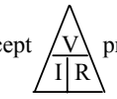
4.2.1.3 Current, resistance and potential difference

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

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4.2.1.3 Current, resistance and potential difference

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

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4.2.1.3 Current, resistance and potential difference

3462/3F Q10

question	answers	extra information	mark
(a)(i)	accelerating	accept getting faster accept speed / velocity increasing	1
(ii)	acceleration increases	accept velocity / speed increases more 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 correct use of 540 seconds	2
(iii)	velocity includes direction	accept velocity is a vector (quantity) accept converse answer	1
(c)	force of gravity (between shuttle and Earth) plus correct orbital speed (makes shuttle 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 centripetal 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

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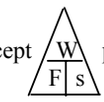
4.2.1.3 Current, resistance and potential difference

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

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4.2.1.3 Current, resistance and potential difference

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

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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Physics 3451/F
Specification B

Mark Scheme

2005 examination – June series

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.

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Physics (Specification B)
Foundation Tier 3451/F

3451/F Q1

question	answers	extra information	mark
(a)(i)	less than	accept any correct indication	1
(ii)	more than	accept any correct indication	1
(b)	any **two** from: stays above the same place above the equator one orbit takes 24 hours	 do **not** accept stays in the same place do **not** accept goes around equator unless qualified do **not** accept orbit at same speed as Earth do **not** accept orbit at a constant speed accept has same angular speed / velocity as Earth	2
total			4

3451/F Q2

question	answers	extra information	mark
(a)	comet		1
(b)	large group / number / collection of stars	ignore reference to planets accept millions of stars do **not** accept thousands of stars do **not** accept loads of stars	1
(c)	giant supernova neutron		1 1 1
total			5

4.2.1.3 Current, resistance and potential difference

3451/F Q3

question	answers	extra information	mark
(a)(i)	radio		1
(ii)	gamma	accept microwave accept infrared	1
(iii)	ultra violet		1
(iv)	microwaves		1
(b)	the same as		1
(c)	X-rays do not go through lead	references to gamma rays are incorrect accept lead protects them from the X-rays accept not exposed to X-rays	1
	lead stops / reduces risk of X-rays harming / damaging / killing (persons) <u>cells</u>	accept X-rays (may) cause cancer accept organs for cell do **not** accept references to electric shock do **not** accept stops bones of people showing on X-ray answers involving the horse wearing an apron are incorrect	1
	Quality of written communication	award for a sensible sequence of **two** points	1
total			8

4.2.1.3 Current, resistance and potential difference

Physics B – AQA GCSE Mark Scheme, 2005 June series

3451/F Q4

question	answers	extra information	mark
(a)	light electrical		1 1
(b)	15% **or** 0.15	correct substitution gains **1** mark only an answer of 15 with no unit **or** an incorrect unit gains **1** mark an answer of 0.15 given with a unit gains **1** mark	2
(c)	the ticket machine is a long way from other electricity supplies		1
(d)	any figure between 5 and 10 inclusive	unit not required but if given must match numerical answer	1
total			6

3451/F Q5

question	answers	extra information	mark
(a)(i)	radon (gas)	do **not** accept gas	1
(ii)	background		1
(b)	bigger	accept any word which means bigger	1
(c)	**Z** alpha will not pass through aluminium or lead	if Z is not given, the reason does not score accept alpha cannot go through metals / dense material accept there is nothing to stop the radiation accept alpha will not pass through aluminium do **not** accept alpha will not pass through lead do **not** accept alpha stopped by air	1 1
total			5

4.2.1.3 Current, resistance and potential difference

3451/F Q6

question	answers	extra information	mark
(a)	loses negative charge / electrons	do **not** accept positive charge transfers to the comb do **not** accept friction	1
(b)	**A** attract		1
	B repel		1
	C attract		1
(c)	**F A D E**	allow **2** marks for 2 letters in the correct place allow **1** mark for 1 letter in the correct place	3
total			7

4.2.1.3 Current, resistance and potential difference

Physics B – AQA GCSE Mark Scheme, 2005 June series

3451/F Q7

question	answers	extra information	mark
(a)	all points correctly plotted	tolerance ± $\frac{1}{2}$ square on y axis only allow **1** mark for 3 correctly plotted points	2
	attempt made to draw a smooth curve	do **not** accept dot-to-dot line	1
(b)(i)	3 days ± 0.2 **or** any value correctly obtained using their graph line	if no line drawn in (a), answer must be exactly 3	1
(ii)	3 days or their (b)(i)		1
(c)	radon-222	accept radon **or** 222 accept alpha or 3.8 correct isotope required for reason to score	1
	has the shortest half-life	accept the others have longer half-lives	1
total			7

4.2.1.3 Current, resistance and potential difference

3451/F Q8

question	answers	extra information	mark
(a)	fossils of Cynognathus are found in Africa and South America		1
	the shapes ……. almost fit together	only two boxes should be ticked deduct **1** mark for each additional box to a minimum mark of **0**	1
(b)	continental		1
	crust		1
	tectonic		1
total			5

4.2.1.3 Current, resistance and potential difference

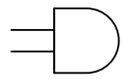
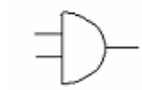
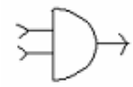
3451/F Q9

question	answers	extra information	mark
(a)	capacitor	accept condenser	1
	LDR	**or** light dependent resistor accept 'ldr', 'Ldr' etc.	1
	relay (normally open)	do **not** accept 'relay normally closed'	1
(b)(i)	battery	accept '(battery of) cells' do **not** accept 'battery / cell'	1
(ii)	LED	**or** light emitting diode accept 'led' or 'Led' do **not** accept just 'diode'	1
(iii)	B will light (but C will not)	accept '(only) B will work' accept 'one is on the other is off' do **not** accept 'C is on and B is off'	1
(iv)	any **one** from: B is connected the right way round (and C is not) a (light emitting) diode only allows (a significant) current to flow in one direction B's anode is connected to the positive side of the supply B's cathode is connected to the negative terminal	N.B. the candidate's answer to part (b)(iii) may include this mark but do **not** credit if the response to part (b)(iii) is incorrect or there is any other contradiction if (iv) is completely consistent with (iii) which is wrong, allow **1** mark	1
(c)(i)	first input / second input / output 0 / 0 / **0** 1 / 0 / **0** 0 / 1 / **0** 1 / 1 / **1**	**all** correct allow: OFF NO OFF NO OFF NO ON YES	1
(ii)	truth (table)		1

cont…

4.2.1.3 Current, resistance and potential difference

3451/F Q9 cont…

(iii)		a Roman upper case D in any orientation without contacts is acceptable but if contacts are shown do **not** give the mark if there is any ambiguity or contradiction allow  	1
(d)	light sensor	**or** light dependent resistor **or** LDR accept 'ldr', Ldr' etc allow solar cell, photo cell	1
	NOT gate	accept 'Not gate' **or** 'not gate' if both correct but in the wrong order credit with **1** mark	1
total			12

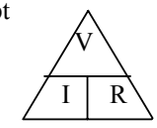
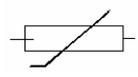
4.2.1.3 Current, resistance and potential difference

3451/F Q10

question	answers	extra information	mark
(a)(i)	rays continued to meet on the right hand side of the lens and beyond	must be straight lines from the right hand side of the lens ignore details through the lens allow if no arrows	1
	meet exactly on the axis	negate mark if contradictory arrow(s) added do not need to go beyond the focus for this mark	1
(ii)	(principal) focus	**or** focal (point)	1
(iii)	converging	**or** convex	1
(b)(i)	**A**		1
(ii)	rays seem to come from this point	**or** words to this effect **or** shows this on the diagram	1
(iii)	diverging	**or** concave	1
(c)	film	accept any unambiguous method of showing the correct response	1
	smaller than		1
	further away from		1
(d)	any **three** from: • real image can be put on a screen • virtual image cannot be put on a screen / film • virtual image is imaginary • real image is formed where (real) rays cross / converge • virtual image is where virtual / imaginary rays (seem to) come from • virtual image formed where virtual rays intersect / cross	 allow film allow real image has light travelling through it **or** virtual image is where rays seem to come from	3
total			13

4.2.1.3 Current, resistance and potential difference

3451/F Q11

question	answers	extra information	mark
(a)(i)	$A_1 = 0.5$	ignore any units	1
	$A_4 = 0.5$	allow **1** mark for $A_1 = A_4 \neq 0.5$	1
(ii)	the resistance of **P** is more than 20 Ω		1
	a smaller current goes through P / A_2 (than 20 Ω)	dependent on getting 1st mark correct accept converse	1
(b)(i)	potential difference = current × resistance	accept pd / voltage for potential difference accept V = I × R, correct symbols and correct case only accept volts = amps × ohms accept  provided subsequent method is correct allow combination of physical quantities and named units allow voltage = I × R	1
(ii)	6	allow **1** mark for correct substitution	2
(iii)	6	accept their (b)(ii)	1
(c)	thermistor or 	accept correct circuit symbol allow phonetic spelling	1
	resistance goes down (as temperature of thermistor goes up)	do **not** accept changes for goes down do **not** accept an answer in terms of current only answers in terms of other components are incorrect	1
total			10

4.2.1.3 Current, resistance and potential difference

3451/F Q12

question	answers	extra information	mark
(a)(i)	larger the distance, greater the time	accept 'they are proportional' accept converse	1
(ii)	any value between 6 and 9 years inclusive		1
(b)(i)	carbon dioxide		1
(ii)	(Venus) has high**er** temperature (than Mercury)	accept has the high**est** temperature accept Venus is hotter / hottest do **not** accept has a high / very high temperature	1
	(Venus) further from the Sun than Mercury	accept 'Venus is not the closest planet to the Sun' answer in terms of greenhouse effect only, scores **0** marks	1
total			5

4.2.1.3 Current, resistance and potential difference

3451/F Q13

question	answers	extra information	mark
(a)(i)	20		1
(ii)	convection		1
(iii)	fit draughtproof strips	accept lay carpet accept fit curtains accept close doors / windows / curtains accept any reasonable suggestion for reducing a draught 'double glazing' alone is insufficient	1
(b)	air is (a good) insulator **or** air is a poor conductor	accept air cavity / 'it' for air	1
	reducing heat transfer by <u>conduction</u>	accept stops for reduces ignore convection do **not** accept radiation do **not** accept answers in terms of heat being trapped	1
(c)(i)	most cost effective	accept it is cheaper or low<u>est</u> cost accept shortest payback time accept in terms of reducing heat loss by the largest amount do **not** accept it is easier ignore most heat is lost through the roof	1
(ii)	4		1
total			7

4.2.1.3 Current, resistance and potential difference

3451/F Q14

question	answers	extra information	mark
(a)(i)	constant speed	do **not** accept normal speed do **not** accept it is stopped / stationary	1
	in a straight line	accept any appropriate reference to a direction constant velocity gains **2** marks 'not accelerating' gains **2** marks terminal velocity alone gets **1** mark	1
(ii)	goes down owtte	accept motorbike (it) slows down	1
(b)(i)	20 (m/s)	ignore incorrect units	1
(ii)	acceleration = change in velocity / time (taken)	do **not** accept velocity for change in velocity accept change in speed accept $a = \frac{v-u}{t}$ **or** $a = \frac{v_1 - v_2}{t}$ **or** $a = \frac{\Delta v}{t}$ do **not** accept $a = \frac{v}{t}$	1
(iii)	4 **or** their (b)(i) ÷ 5	allow **1** mark for correct substitution	2
	m/s^2	m/s/s **or** ms^{-2} **or** metres per second squared **or** metres per second per second	1
(c)	vehicle may skid / slide	loss of control / brakes lock / wheels lock accept greater stopping distance **or** difficult to stop	1
	due to reduced friction (between tyre(s) and road)	accept due to less grip do **not** accept no friction	1

cont…

3451/F Q14 cont…

(d)	any **three** from: • <u>increased</u> speed • <u>reduced</u> braking force • <u>slower</u> (driver) reactions • <u>poor</u> vehicle maintenance • <u>increased</u> mass / weight of vehicle • <u>poor</u> road surface • <u>more</u> streamlined	do **not** accept night time / poor vision N.B. specific answers may **each** gain credit eg tiredness (1), drinking alcohol (1), using drugs (1), driver distracted (1) etc specific examples may **each** gain credit eg worn brakes or worn tyres etc accept large mass / weight of vehicle if candidates give three answers that affect stopping distance but not specific to <u>increase</u> award **1** mark only	3
total			13

4.2.1.3 Current, resistance and potential difference

3451/F Q15

question	answers	extra information	mark
(a)(i)	arrow from centre of the ball **and** at right angles to the string **and** in the correct direction	arrow should point to the student's belt accept free-hand 'straight' line do **not** accept curved line	1
(ii)	increase increase increase	accept 'be stronger / bigger' accept 'be stronger / bigger' accept 'be stronger / bigger'	1 1 1
(b)	speed velocity direction	all **three** correct any two correct for **1** mark otherwise **0** marks	2
(c)(i)	centripetal	accept 'centripedal' and other minor misspellings do **not** accept anything which could be 'centrifugal'	1
(ii)	gravity	accept 'weight' accept 'force of attraction due to mass(es) (of the Moon and the Earth)'	1
(iii)	electron(s)		1
(iv)	electrostatic	accept 'electrical' do **not** accept just 'centripetal'	1
total			10

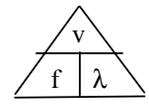
4.2.1.3 Current, resistance and potential difference

3451/F Q16

question	answers	extra information	mark
(a)(i)	**X** at the centre of the lifebelt	measuring from the centre of **X**, allow 2 mm tolerance in any direction	1
(ii)	any **two** from: below the point of suspension at the centre (of the lifebelt) (because) the lifebelt / it is symmetrical	if X is on vertical line below the hanger (but not at centre) can gain the first point only accept '(vertically) below **Y**' accept 'in the middle' **or** (because) the mass / weight is evenly distributed	2
(b)	Nm **or** newton metre(s) 750	accept Newton metre(s) do **not** accept any ambiguity in the symbol ie NM, nM or nm (moment) = force × (perpendicular) distance (between line of action and pivot) **or** (moment) = 500 × 1.5 gains **1** mark	1 2
(c)	**Quality of written communication**: any **three** connected points from: low(er) <u>centre of mass / gravity</u> (more) <u>stable</u> less likely to fall over the <u>turning effect / moment</u> (of the weight of case) is less so the pull on her arm is less	for **2** of the underlined terms used in the correct context **or** <u>centre of mass / gravity</u> will be close(r) to the wheels / axle / ground **or** less <u>unstable</u> accept 'less likely to overturn' do **not** accept 'will not fall over' **or** so less effort is needed to hold the case ignore references to pulling the case	1 3
total			10

4.2.1.3 Current, resistance and potential difference

3451/F Q17

question	answers	extra information	mark
(a)	any **two** from: • **amplitude** decreasing • **wavelength** increasing • **frequency** decreasing **Quality of written communication**	accept siren / sound getting quieter do **not** accept sound decreases accept pitch decreasing ignore reference to transverse wave ignore reference to speed contradictory statements within each point lose the mark all emboldened terms in candidate's answer used correctly	2 1
(b)(i)	ultrasound **or** ultrasonic		1
(ii)	wave speed = frequency × wavelength	accept speed / velocity for wave speed accept $v = f \times \lambda$ do **not** accept w for λ do **not** accept s for v accept  provided subsequent calculation shows a correct method	1
(iii)	339.2 **or** 340 **or** 339	allow **1** mark for using 212 000 allow **1** mark for correct substitution an answer of 0.3392 **or** 0.34 **or** 0.339 gains **1** mark only award full credit for a correct numerical answer with the unit changed to km/s	3
total			8

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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Science: Double Award 3462/3F
Specification B (Co-ordinated)

Mark Scheme

2005 examination - June series

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.

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Double Award
Foundation Tier 3462/3F

3462/3F Q1

question	answers	extra information	mark
(a)(i)	less than	accept any correct indication	1
(ii)	more than	accept any correct indication	1
(b)	any **two** from: stays above the same place above the equator one orbit takes 24 hours	 do **not** accept stays in the same place do **not** accept goes around equator unless qualified do **not** accept orbit at same speed as Earth do **not** accept orbit at a constant speed accept has same angular speed / velocity as Earth	2
total			4

3462/ 3F Q2

question	answers	extra information	mark
(a)	comet		1
(b)	large group / number / collection of stars	ignore reference to planets accept millions of stars do **not** accept thousands of stars do **not** accept loads of stars	1
(c)	giant supernova neutron		1 1 1
total			5

4.2.1.3 Current, resistance and potential difference

3462/3F Q3

question	answers	extra information	mark
(a)(i)	radio		1
(ii)	gamma	accept microwave accept infrared	1
(iii)	ultra violet		1
(iv)	microwaves		1
(b)	the same as		1
(c)	**Quality of written communication**	award for a sensible sequence of **two** points	1
	X-rays do not go through lead	accept lead protects them from the X-rays accept not exposed to X-rays	1
	lead stops / reduces risk of X-rays harming / damaging / killing (persons) <u>cells</u>	accept X-rays (may) cause cancer accept organs for cell do **not** accept references to electric shock do **not** accept stops bones of people showing on X-ray answers involving the horse wearing an apron are incorrect references to gamma rays are incorrect	1
total			8

4.2.1.3 Current, resistance and potential difference

Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2005 June series

3462/3F Q4

question	answers	extra information	mark
(a)	light electrical		1 1
(b)	15% **or** 0.15	correct substitution gains **1** mark only an answer of 15 with no unit **or** an incorrect unit gains **1** mark an answer of 0.15 given with a unit gains **1** mark	2
(c)	the ticket machine is a long way from other electricity supplies		1
(d)	any figure between 5 and 10 inclusive	unit not required but if given must match numerical answer	1
total			6

4.2.1.3 Current, resistance and potential difference

3462/3F Q5

question	answers	extra information	mark
(a)(i)	radon (gas)	do **not** accept gas	1
(ii)	background		1
(b)	bigger	accept any word which means bigger	1
(c)	**Z** alpha will not pass through aluminium or lead	if Z is not given, the reason does not score accept alpha cannot go through metals / dense material accept there is nothing to stop the radiation accept alpha will not pass through aluminium do **not** accept alpha will not pass through lead do **not** accept alpha stopped by air	1 1
total			5

4.2.1.3 Current, resistance and potential difference

Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2005 June series

3462/3F Q6

question	answers	extra information	mark
(a)	loses negative charge / electrons	do **not** accept positive charge transfers to the comb do **not** accept friction	1
(b)	**A** attract		1
	B repel		1
	C attract		1
(c)	**F A D E**	allow **2** marks for 2 letters in the correct place allow **1** mark for 1 letter in the correct place	3
total			7

4.2.1.3 Current, resistance and potential difference

3462/3F Q7

question	answers	extra information	mark
(a)	all points correctly plotted	tolerance ± $\frac{1}{2}$ square on y axis only allow **1** mark for 3 correctly plotted points	2
	attempt made to draw a smooth curve	do **not** accept dot-to-dot line	1
(b)(i)	3 days ± 0.2 **or** any value correctly obtained using their graph line	if no line drawn in (a), answer must be exactly 3	1
(ii)	3 days or their (b)(i)		1
(c)	radon-222	accept radon **or** 222 accept alpha or 3.8 correct isotope required for reason to score	1
	has the shortest <u>half-life</u>	accept the others have longer <u>half-lives</u>	1
total			7

4.2.1.3 Current, resistance and potential difference

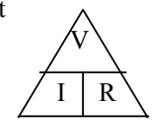
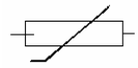
Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2005 June series

3462/3F Q8

question	answers	extra information	mark
(a)	fossils of Cynognathus are found in Africa and South America		1
	the shapes ……. almost fit together	only two boxes should be ticked deduct **1** mark for each additional box to a minimum mark of **0**	1
(b)	continental		1
	crust		1
	tectonic		1
total			5

4.2.1.3 Current, resistance and potential difference

3462/3F Q9

question	answers	extra information	mark
(a)(i)	$A_1 = 0.5$ $A_4 = 0.5$	ignore any units allow **1** mark for $A_1 = A_4 \neq 0.5$	1 1
(ii)	the resistance of **P** is more than 20 Ω a smaller current goes through P / A_2 (than 20 Ω)	 dependent on getting 1st mark correct accept converse	1 1
(b)(i)	potential difference = current × resistance	accept pd / voltage for potential difference accept V = I × R, correct symbols and correct case only accept volts = amps × ohms accept  provided subsequent method is correct allow combination of physical quantities and named units allow voltage = I × R	1
(ii)	6	allow **1** mark for correct substitution	2
(iii)	6	accept their (b)(ii)	1
(c)	thermistor or  resistance goes down (as temperature of thermistor goes up)	accept correct circuit symbol allow phonetic spelling do **not** accept changes for goes down do **not** accept an answer in terms of current only answers in terms of other components are incorrect	1 1
total			10

4.2.1.3 Current, resistance and potential difference

Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2005 June series

3462/3F Q10

question	answers	extra information	mark
(a)(i)	larger the distance, greater the time	accept 'they are proportional' accept converse	1
(ii)	any value between 6 and 9 years inclusive		1
(b)(i)	carbon dioxide		1
(ii)	(Venus) has high**er** temperature (than Mercury)	accept has the high**est** temperature accept Venus is hotter / hottest do **not** accept has a high / very high temperature	1
	(Venus) further from the Sun than Mercury	accept 'Venus is not the closest planet to the Sun' answer in terms of greenhouse effect only, scores **0** marks	1
total			5

4.2.1.3 Current, resistance and potential difference

3462/3F Q11

question	answers	extra information	mark
(a)(i)	20		1
(ii)	convection		1
(iii)	fit draughtproof strips	accept lay carpet accept fit curtains accept close doors / windows / curtains accept any reasonable suggestion for reducing a draught 'double glazing' alone is insufficient	1
(b)	air is (a good) insulator **or** air is a poor conductor	accept air cavity / 'it' for air	1
	reducing heat transfer by <u>conduction</u>	accept stops for reduces ignore convection do **not** accept radiation do **not** accept answers in terms of heat being trapped	1
(c)(i)	most cost effective	accept it is cheaper or lowest cost accept shortest payback time accept in terms of reducing heat loss by the largest amount do **not** accept it is easier ignore most heat is lost through the roof	1
(ii)	4		1
total			7

4.2.1.3 Current, resistance and potential difference

Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2005 June series

3462/3F Q12

question	answers	extra information	mark
(a)(i)	constant speed	do **not** accept normal speed do **not** accept it is stopped / stationary	1
	in a straight line	accept any appropriate reference to a direction constant velocity gains **2** marks 'not accelerating' gains **2** marks terminal velocity alone gets **1** mark	1
(ii)	goes down owtte	accept motorbike (it) slows down	1
(b)(i)	20 (m/s)	ignore incorrect units	1
(ii)	acceleration = change in velocity / time (taken)	do **not** accept velocity for change in velocity accept change in speed accept $a = \frac{v-u}{t}$ **or** $a = \frac{v_1 - v_2}{t}$ **or** $a = \frac{\Delta v}{t}$ do **not** accept $a = \frac{v}{t}$	1
(iii)	4 **or** their (b)(i) ÷ 5	allow **1** mark for correct substitution	2
	m/s^2	m/s/s **or** ms^{-2} **or** metres per second squared **or** metres per second per second	1
(c)	vehicle may skid / slide	loss of control / brakes lock / wheels lock accept greater stopping distance **or** difficult to stop	1
	due to reduced friction (between tyre(s) and road)	accept due to less grip do **not** accept no friction	1

cont…

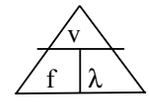
3462/3F Q12 cont…

(d)	any **three** from: • increased speed • reduced braking force • slower (driver) reactions • poor vehicle maintenance • increased mass / weight of vehicle • poor road surface • more streamlined	do **not** accept night time / poor vision NB specific answers may **each** gain credit eg tiredness (1), drinking alcohol (1), using drugs (1), driver distracted (1) etc specific examples may **each** gain credit eg worn brakes or worn tyres etc accept large mass / weight of vehicle if candidates give three answers that affect stopping distance but not specific to increase award **1** mark only	3
total			13

4.2.1.3 Current, resistance and potential difference

Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2005 June series

3462/3F Q13

question	answers	extra information	mark
(a)	**Quality of written communication**	all emboldened terms in candidate's answer used correctly	1
	any **two** from: • **amplitude** decreasing • **wavelength** increasing • **frequency** decreasing	accept siren / sound getting quieter do **not** accept sound decreases accept pitch decreasing ignore reference to transverse wave ignore reference to speed contradictory statements within each point lose the mark	2
(b)(i)	ultrasound **or** ultrasonic		1
(ii)	wave speed = frequency × wavelength	accept speed / velocity for wave speed accept $v = f \times \lambda$ do **not** accept w for λ do **not** accept s for v accept  provided subsequent calculation shows a correct method	1
(iii)	339.2 **or** 340 **or** 339	allow **1** mark for using 212 000 allow **1** mark for correct substitution an answer of 0.3392 **or** 0.34 **or** 0.339 gains **1** mark only award full credit for a correct numerical answer with the unit changed to km/s	3
total			8

Version 1.0: 0906

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Physics 3451/F
Specification B

Mark Scheme

2006 examination - June series

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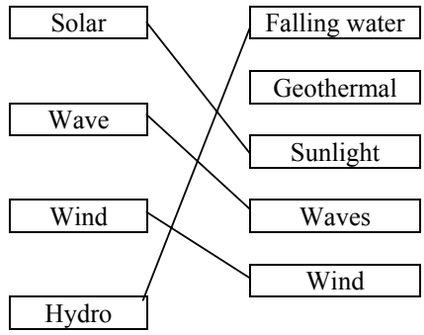
4.2.1.3 Current, resistance and potential difference

Physics (Specification B)
Foundation Tier 3451/F

3451/F Q1

question	answers	extra information	mark
(a)	4 correct lines drawn  	**1** mark for each correct line if more than 4 lines are drawn mark incorrect ones first. Mark only 4 lines	4
(b)	4		1
(c)(i)	nuclear		1
(ii)	(natural) gas	do **not** accept natural	1
total			7

4.2.1.3 Current, resistance and potential difference

3451/F Q2

question	answers	extra information	mark
(a)(i)	ultra violet		1
(ii)	kill the cells	accept destroys the cells accept makes cells cancerous accept damage cells accept harms cells accept changes DNA accept cause cells to mutate accept skin cells for cells accept cause cancer do **not** accept skin for cells do **not** accept burns the cells	1
(b)(i)	the sunbed uses an alternating current (a.c.) supply		1
(ii)	10.8	accept **1** mark for correct substitution of power in W or kW and time in hours or seconds	2
total			5

4.2.1.3 Current, resistance and potential difference

3451/F Q3

question	answers	extra information	mark
(a)(i)	M		1
(ii)	K		1
(iii)	J		1
(iv)	O		1
(b)(i)	billions of years		1
(ii)	red giant	any answer in terms of explosion or supernova is **incorrect**	1
	contracts / shrinks to	incorrect reference to black hole negates **1** mark	1
	white dwarf		1
total			8

4.2.1.3 Current, resistance and potential difference

3451/F Q4

question	answers	extra information	mark
(a)(i)	A and C	**both** answers must be correct in either order	1
(ii)	A and B	**both** answers must be correct in either order	1
(iii)	same number of protons plus neutrons **or** same number of nucleons	accept number of particles in nucleus the same do **not** accept they add up to 6 unless qualified	1
(b)(i)	any **two** from: • boron - 12 • carbon - 14 • oxygen - 15 • lead - 209	**both** required both name **and** number must be given	1
(ii)	any **two** from: • boron - 11 • carbon - 12 • oxygen - 16 • lead - 207	**both** required both name **and** number must be given	1
(c)	alpha		1
total			6

4.2.1.3 Current, resistance and potential difference

3451/F Q5

question	answers	extra information	mark
(a)	(good) insulator	accept does not conduct (electricity) accept does not conduct heat or electricity do **not** accept does not conduct heat outside is tough is insufficient	1
(b)	fuse		1
(c)	connect the green and yellow / earth wire	accept wires must be connected to screws	1
	swap the brown and blue wires round		1
total			4

3451/F Q6

question	answers	extra information	mark
(a)	fossils	answers can be in either order	1
	water		1
(b)	increased		1
(c)	radio telescope		1
total			4

4.2.1.3 Current, resistance and potential difference

3451/F Q7

question	answers	extra information	mark
(a)(i)	electrical		1
	kinetic	accept movement	1
(ii)	heat	answers can be in either order	1
	sound		1
(b)(i)	360	accept **1** mark for correct substitution	2
(ii)	watt		1
(c)	the stairlift is not moving the stairlift is moving at constant speed	**both** answers are required for the mark	1
total			8

3451/F Q8

question	answers	extra information	mark
(a)(i)	(up) further **or** (up) faster	any reference to downwards movement loses credit accept <u>with</u> more force accept motion would increase	1
(ii)	down	accept the opposite way accept drop	1
(b)(i)	direct current		1
(ii)	Z		1
total			4

4.2.1.3 Current, resistance and potential difference

3451/F Q9

question	answers	extra information	mark
(a)	level of radiation (detected) will not change	ignore reference to particles	1
	if thickness of aluminium changes	accept for **both** marks a specific example eg if the aluminium gets thicker the level of radiation detected stays the same. accept for **1** mark gamma will pass through aluminium	1
	QoWC for 2 points in a sensible sequence		1
(b)	S W T V	all in correct order accept **2** marks for 2 correct accept **1** mark for 1 correct	3
total			6

4.2.1.3 Current, resistance and potential difference

3451/F Q10

<table>
<tr><th>question</th><th>answers</th><th>extra information</th><th>mark</th></tr>
<tr><td>(a)</td><td>thermistor(s)
LDR(s)
switch(es)
LED(s)
buzzer(s)
motor(s)</td><td>1 mark each
or light dependent resistor(s)
or light emitting diode(s)</td><td>6</td></tr>
<tr><td>(b)(i)</td><td><table><tr><th>1st input</th><th>2nd input</th><th>Output</th></tr><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>1</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>0</td></tr><tr><td>1</td><td>1</td><td>1</td></tr></table></td><td>all correct</td><td>1</td></tr>
<tr><td>(ii)</td><td><table><tr><th>Input</th><th>Output</th></tr><tr><td>0</td><td>1</td></tr><tr><td>1</td><td>0</td></tr></table></td><td>both correct</td><td>1</td></tr>
<tr><td>(iii)</td><td><table><tr><th>1st input</th><th>2nd input</th><th>Output</th></tr><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>1</td><td>0</td><td>1</td></tr><tr><td>0</td><td>1</td><td>1</td></tr><tr><td>1</td><td>1</td><td>1</td></tr></table></td><td>all correct</td><td>1</td></tr>
<tr><td>(c)(i)</td><td></td><td>do not credit any attempt which could equally well be a poorly drawn attempt at the symbol for a cell</td><td>1</td></tr>
<tr><td>(ii)</td><td>charge

increases</td><td>accept ‘electrons’
accept ‘energy
or gets bigger/larger</td><td>1

1</td></tr>
<tr><td>total</td><td></td><td></td><td>12</td></tr>
</table>

4.2.1.3 Current, resistance and potential difference

3451/F Q11

question	answers	extra information	mark
(a)(i)	A		1
(ii)	B		1
(iii)	mass is larger	credit if the response is clear by some other means e.g. it is ringed	1
	wire is shorter	credit if the response is clear by some other means e.g. it is ringed	1
(b)	moment		1
	distance		1
(c)(i)	1		1
(ii)	5		1
(iii)	any **two** from • remove slotted mass(es) • slide (slotted) masses / weights nearer pivot • slide forcemeter away from the pivot • slide rod to the left	 **or** ….. to the left **or** ….. to the right **or** …. so that the slotted masses side is shorter **or** …. so that the forcemeter side is longer	2
(d)	centre of the rectangle	accept *2*mm tolerance any direction	1
	centre of the circle	accept *2*mm tolerance any direction	1
	on centre line and 10mm above base	accept *2*mm tolerance any direction	1
total			13

4.2.1.3 Current, resistance and potential difference

3451/F Q12

question	answers	extra information	mark
(a)	0.05 (A)	ignore incorrect units if given accept 'the same' / 'the same as K' / 'the same as the other ammeter' do **not** accept 'same as the other meter'	1
(b)(i)	any **two** from: • two cells are joined + to +	answers in terms of current gain no marks accept one cell in the wrong way accept two cells are joined back-to-back accept two cells are joined – to – accept battery for cell do **not** accept answers in terms of all the cells or in terms of energy only	2
	• some of the cells potential difference is across the diode / ammeters / wires **or** the pd of the cells is shared by all components	accept voltage for pd do **not** accept using up pd	
	• the other components have a resistance	accept a named component / components / wire has a resistance	
	• cells not fully charged **or** cells partially run down	do **not** accept voltage of cells is less than 1.5 unless explained do **not** accept cells are not as powerful unless explained	
	• cells have an internal resistance		
(ii)	the diode has a (very) high resistance (in the reverse direction)		1
	a diode only conducts / allows current to flow in one direction	accept little / no current flows do **not** accept blocks / cuts flow	1

Continued

4.2.1.3 Current, resistance and potential difference

3451/F Q12

question	answers	extra information	mark
(c)	**QoWC** for the use of the word resistance	annotate Q✓ Q✗ accept resistant	1
	accept increase / change / decrease throughout question but a contradiction loses **one** mark with change as neutral		
	as the pd / current increases / changes	accept voltage for pd must be correctly linked to at least one of the following points accept	1
	the temperature of the filament increases / changes	lamp / bulb for filament accept filament becomes hotter	1
	increasing / changing the **resistance** of the lamp		1
		accept for **1** mark only the filament lamp does not obey Ohm's law	
total			9

4.2.1.3 Current, resistance and potential difference

3451/F Q13

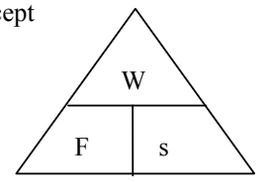
question	answers	extra information	mark
(a)	0.5		1
	hertz	accept Hz but **not** HZ / hz / hZ accept (waves) per second **or** / sec **or** / s **or** s^{-1} **or** sec^{-1}	1
(b)	any **one** from: • any named part of the electromagnetic spectrum • S – waves / secondary waves • wave on a rope	 do **not** accept seismic waves / earthquake do **not** accept slinky unless clearly described	1
(c)	transverse – disturbance / vibration is perpendicular to the direction of energy transfer / wave travel	accept a correctly labelled diagram	1
	longitudinal – disturbance / vibration is parallel to the direction of energy transfer / wave travel	accept a correctly labelled diagram part explanation of the difference between transverse **and** longitudinal gains **1** mark	1
(d)(i)	TIR shown	needs to stay inside water jet ignore number of reflections **or** arrow heads lines straight by eye	1
(ii)	bigger than	any indication of correct answer	1
total			7

4.2.1.3 Current, resistance and potential difference

3451/F Q14

question	answers	extra information	mark
(a)	W		1
	has only two states **or** is either on or off	accept discrete values only do **not** credit answer purely in terms of shape	1
(b)	any **one** from:		1
	• higher quality	accept clearer do **not** accept easier to read ignore faster accept <u>less</u> distortion **or** <u>less</u> weakening of signal strength do **not** accept no distortion / weakening on its own	
	• increased carrying capacity	accept more information can be sent **or** more channels	
	• errors can be rectified		
total			3

3451/F Q15

question	answers	extra information	mark
(a)(i)	all points plotted accurately	accept **1** mark for 5 correct plots ± ½ small square on stopping distance	2
	line of best fit must be continuous	accept attempt at a reasonable curve does not need to go through 0 0 do **not** accept a straight line do **not** accept dot-to-dot	1
(ii)	4 to 6 (metres)	accept ecf from (a)(i) accept **1** mark for value taken correctly from graph at 25mph **or** correct method shown	2
(b)(i)	0.7 (s)	incorrect unit = 0 marks	1
(ii)	constant speed / velocity	accept (continued as) 30mph accept did not change / stayed the same accept no acceleration	1
(iii)	3.3(s)	penalise incorrect unit once only	1
(iv)	reaction time increases / is longer **or** thinking distance increases	do **not** accept reaction time slower **or** reactions are slower	1
	stopping distance / it increases	do **not** accept travels at constant speed for longer	1
(c)(i)	work done = force (applied) × distance (moved)	accept W = F × s or W = F × d accept  provided subsequent method is correct	1

Continued

4.2.1.3 Current, resistance and potential difference

3451/F Q15

question	answers	extra information	mark
(ii) **E**	2100	accept 2.1 kilo accept **1** mark for using 7000 N	2
(iii)	2100 (joules)	accept their (c)(ii)	1
total			14

4.2.1.3 Current, resistance and potential difference

3451/F Q16

question	answers	extra information	mark
(a)(i)	refraction		1
(ii)	it changes speed **or** change in density	accept it speeds up do **not** accept it slows down do **not** accept air is more dense than glass	1
(b)(i)	sound / waves <u>diffract</u> through the gap (in the wall) **or** over the wall **or** because the gate is open	do **not** accept reflection this only scores if first marking point is given accept for **1** mark only sound / waves go through the gap and <u>spread out</u> **or** diagram showing wave fronts spreading out from open gates if diagram is labelled as diffraction both marks can be scored	1 1
(ii)	less diffraction	accept no diffraction accept gates <u>absorb</u> sound / noise / waves accept gates <u>reflect</u> sound / noise / waves do **not** accept rebounds / stops / blocks out	1
total			5

4.2.1.3 Current, resistance and potential difference

3451/F Q17

question	answers	extra information	mark
(a)	both rays brought to a focus at F on the right	do **not** have to be continued beyond F	1
	lines have been drawn **accurately** with a ruler	only credit if 1st mark credited do **not** credit if contradictory arrow(s) added	1
(b)	rays seem to come from a focus at G on the left and continued to the right of the lens	this mark is for the current idea of divergence	1
	lines have been drawn **accurately** with a ruler	only credit if 1st mark credited do **not** credit if contradictory arrow(s) added	1
(c)	…lens… …image… …object… …image… ...object… …lens…	lens as 1st and 6th words (1) image and object in the correct order 2nd and 3rd words (1) image and object in correct order 4th and 5th words (1)	max 3
(d)(i)	correct statement about real image real rays intersect / cross to form a real image **or** a real image can be formed on a screen **or** real image is (always) on the opposite side (of the lens) **or** real image is (always) upside down (to the object)	may be credited from a correct diagram	1
	correct statement about virtual / imaginary image virtual / imaginary rays intersect / cross to form a virtual image **or** a virtual / imaginary image cannot **or** virtual / imaginary image is (always) on the same side (of the lens) **or** virtual / imaginary image is (always) same way up (as the object)	may be credited from a correct diagram	1

Continued

4.2.1.3 Current, resistance and potential difference

3451/F Q17

question	answers	extra information	mark
(ii)	**either** image needs to fall on / affect the film **or** image needs to fall on / affect the light sensors / charged coupled devices (CCDs) (in a digital camera / mobile phone) **or** image needs to cause a chemical reaction (in / on the film)		1
total			10

4.2.1.3 Current, resistance and potential difference

3451/F Q18

<table>
<tr><th>question</th><th>answers</th><th>extra information</th><th>mark</th></tr>
<tr><td>(a)</td><td>AND (gate)

OR (gate)

NOT (gate)

LED or light emitting diode</td><td>accept ‘and’

accept ‘or’

accept ‘not’ or invert gate

accept ‘led’</td><td>1

1

1

1</td></tr>
<tr><td>(b)(i)</td><td>NOT (gate) and AND (gate)</td><td>both in either order or ‘(the) gates’

any additions lose the mark</td><td>1</td></tr>
<tr><td>(ii)</td><td><table><tr><th>Switch for fire</th><th>Tilt switch</th><th>Signal to relay</th></tr><tr><td>0</td><td>0</td><td>…0…</td></tr><tr><td>0</td><td>1</td><td>…0…</td></tr><tr><td>1</td><td>0</td><td>…1…</td></tr><tr><td>1</td><td>1</td><td>…0…</td></tr></table></td><td>all correct

allow off or no
off no
on yes
off no</td><td>1</td></tr>
<tr><td>(iii)</td><td>(relay) acts as / is a switch

either
small current from the electronic / control circuit / system (1)

large current through the output / (electric) fire (1)

or

full current through electronic control system (1)

may damage components / lead to overheating / electric shock (1)

QoWC for correct use of the scientific term ‘current’</td><td>accept implication that it works as a switch e.g. ‘turns on fire’

or ‘small current through the coil (of the relay)’

do not accept small current is turned into a large current

annotate Q✓ Q×

if answer in terms of voltage isolation / voltage/ p.d. accept QoWC mark for correct use</td><td>1

1

1

1</td></tr>
<tr><td>total</td><td></td><td></td><td>10</td></tr>
</table>

Version 1.0: 0906

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Science: Double Award 3462/3F
Specification B

Mark Scheme

2006 examination - June series

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.

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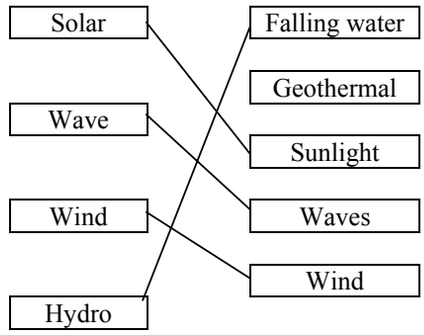
Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2006 June series

Double Award (Co-ordinated)
Foundation Tier 3462/3F

3462/3F Q1

question	answers	extra information	mark
(a)	4 correct lines drawn  	**1** mark for each correct line if more than 4 lines are drawn mark incorrect ones first. Mark only 4 lines	4
(b)	4		1
(c)(i)	nuclear		1
(ii)	(natural) gas	do **not** accept natural	1
total			7

4.2.1.3 Current, resistance and potential difference

3462/3F Q2

question	answers	extra information	mark
(a)(i)	ultra violet		1
(ii)	kill the cells	accept destroys the cells accept makes cells cancerous accept damage cells accept harms cells accept changes DNA accept cause cells to mutate accept skin cells for cells accept cause cancer do **not** accept skin for cells do **not** accept burns the cells	1
(b)(i)	the sunbed uses an alternating current (a.c.) supply		1
(ii)	10.8	accept **1** mark for correct substitution of power in W or kW and time in hours or seconds	2
total			5

4.2.1.3 Current, resistance and potential difference

Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2006 June series

3462/3F Q3

question	answers	extra information	mark
(a)(i)	M		1
(ii)	K		1
(iii)	J		1
(iv)	O		1
(b)(i)	billions of years		1
(ii)	red giant	any answer in terms of explosion or supernova is **incorrect**	1
	contracts / shrinks to	incorrect reference to black hole negates **1** mark	1
	white dwarf		1
total			8

4.2.1.3 Current, resistance and potential difference

3462/3F Q4

question	answers	extra information	mark
(a)(i)	A and C	**both** answers must be correct in either order	1
(ii)	A and B	**both** answers must be correct in either order	1
(iii)	same number of protons plus neutrons **or** same number of nucleons	accept number of particles in nucleus the same do **not** accept they add up to 6 unless qualified	1
(b)(i)	any **two** from: • boron - 12 • carbon - 14 • oxygen - 15 • lead - 209	**both** required both name **and** number must be given	1
(ii)	any **two** from: • boron - 11 • carbon - 12 • oxygen - 16 • lead - 207	**both** required both name **and** number must be given	1
(c)	alpha		1
total			6

4.2.1.3 Current, resistance and potential difference

Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2006 June series

3462/3F Q5

question	answers	extra information	mark
(a)	(good) insulator	accept does not conduct (electricity) accept does not conduct heat or electricity do **not** accept does not conduct heat outside is tough is insufficient	1
(b)	fuse		1
(c)	connect the green and yellow / earth wire	accept wires must be connected to screws	1
	swap the brown and blue wires round		1
total			4

3462/3F Q6

question	answers	extra information	mark
(a)	fossils	answers can be in either order	1
	water		1
(b)	increased		1
(c)	radio telescope		1
total			4

4.2.1.3 Current, resistance and potential difference

3462/3F Q7

question	answers	extra information	mark
(a)(i)	electrical		1
	kinetic	accept movement	1
(ii)	heat	answers can be in either order	1
	sound		1
(b)(i)	360	accept **1** mark for correct substitution	2
(ii)	watt		1
(c)	the stairlift is not moving the stairlift is moving at constant speed	**both** answers are required for the mark	1
total			8

3462/3F Q8

question	answers	extra information	mark
(a)(i)	(up) further **or** (up) faster	any reference to downwards movement loses credit accept <u>with</u> more force accept motion would increase	1
(ii)	down	accept the opposite way accept drop	1
(b)(i)	direct current		1
(ii)	Z		1
total			4

4.2.1.3 Current, resistance and potential difference

Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2006 June series

3462/3F Q9

question	answers	extra information	mark
(a)	level of radiation (detected) will not change	ignore reference to particles	1
	if thickness of aluminium changes	accept for **both** marks a specific example eg if the aluminium gets thicker the level of radiation detected stays the same. accept for **1** mark gamma will pass through aluminium	1
	QoWC for 2 points in a sensible sequence		1
(b)	S W T V	all in correct order accept **2** marks for 2 correct accept **1** mark for 1 correct	3
total			6

4.2.1.3 Current, resistance and potential difference

3462/3F Q10

question	answers	extra information	mark
(a)	0.05 (A)	ignore incorrect units if given accept 'the same' / 'the same as K' / 'the same as the other ammeter' do **not** accept 'same as the other meter'	1
(b)(i)	any **two** from: • two cells are joined + to +	answers in terms of current gain no marks accept one cell in the wrong way accept two cells are joined back-to-back accept two cells are joined – to – accept battery for cell do **not** accept answers in terms of all the cells or in terms of energy only	2
	• some of the cells potential difference is across the diode / ammeters / wires **or** the pd of the cells is shared by all components	accept voltage for pd do **not** accept using up pd	
	• the other components have a resistance	accept a named component / components / wire has a resistance	
	• cells not fully charged **or** cells partially run down	do **not** accept voltage of cells is less than 1.5 unless explained do **not** accept cells are not as powerful unless explained	
	• cells have an internal resistance		
(ii)	the diode has a (very) high resistance (in the reverse direction)		1
	a diode only conducts / allows current to flow in one direction	accept little / no current flows do **not** accept blocks / cuts flow	1

Continued

4.2.1.3 Current, resistance and potential difference

Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2006 June series

3462/3F Q10

question	answers	extra information	mark
(c)	**QoWC** for the use of the word resistance	annotate Q✓ Q✗ accept resistant	1
	accept increase / change / decrease throughout question but a contradiction loses **one** mark with change as neutral		
	as the pd / current increases / changes	accept voltage for pd must be correctly linked to at least one of the following points accept	1
	the temperature of the filament increases / changes	lamp / bulb for filament accept filament becomes hotter	1
	increasing / changing the **resistance** of the lamp	accept for **1** mark only the filament lamp does not obey Ohm's law	1
total			9

4.2.1.3 Current, resistance and potential difference

3462/3F Q11

question	answers	extra information	mark
(a)	0.5		1
	hertz	accept Hz but **not** HZ / hz / hZ accept (waves) per second **or** / sec **or** / s **or** s^{-1} **or** sec^{-1}	1
(b)	any **one** from: • any named part of the electromagnetic spectrum • S – waves / secondary waves • wave on a rope	 do **not** accept seismic waves / earthquake do **not** accept slinky unless clearly described	1
(c)	transverse – disturbance / vibration is perpendicular to the direction of energy transfer / wave travel	accept a correctly labelled diagram	1
	longitudinal – disturbance / vibration is parallel to the direction of energy transfer / wave travel	accept a correctly labelled diagram part explanation of the difference between transverse **and** longitudinal gains **1** mark	1
(d)(i)	TIR shown	needs to stay inside water jet ignore number of reflections **or** arrow heads lines straight by eye	1
(ii)	bigger than	any indication of correct answer	1
total			7

4.2.1.3 Current, resistance and potential difference

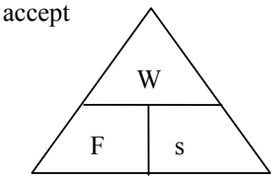
Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2006 June series

3462/3F Q12

question	answers	extra information	mark
(a)	W		1
	has only two states **or** is either on or off	accept discrete values only do **not** credit answer purely in terms of shape	1
(b)	any **one** from:		1
	• higher quality	accept clearer do **not** accept easier to read ignore faster accept <u>less</u> distortion **or** <u>less</u> weakening of signal strength do **not** accept no distortion / weakening on its own	
	• increased carrying capacity	accept more information can be sent **or** more channels	
	• errors can be rectified		
total			3

4.2.1.3 Current, resistance and potential difference

3462/3F Q13

question	answers	extra information	mark
(a)(i)	all points plotted accurately	accept **1** mark for 5 correct plots ± ½ small square on stopping distance	2
	line of best fit must be continuous	accept attempt at a reasonable curve does not need to go through 0 0 do **not** accept a straight line do **not** accept dot-to-dot	1
(ii)	4 to 6 (metres)	accept ecf from (a)(i) accept **1** mark for value taken correctly from graph at 25mph **or** correct method shown	2
(b)(i)	0.7 (s)	incorrect unit = 0 marks	1
(ii)	constant speed / velocity	accept (continued as) 30mph accept did not change / stayed the same accept no acceleration	1
(iii)	3.3(s)	penalise incorrect unit once only	1
(iv)	reaction time <u>increases</u> / is <u>longer</u> **or** thinking distance <u>increases</u>	do **not** accept reaction time slower **or** reactions are slower	1
	stopping distance / it <u>increases</u>	do **not** accept travels at constant speed for longer	1
(c)(i)	work done = force (applied) × distance (moved)	accept W = F × s or W = F × d accept  provided subsequent method is correct	1
(ii)	2100	accept 2.1 kilo accept **1** mark for using 7000 N	2
(iii)	2100 (joules)	accept their (c)(ii)	1
total			14

4.2.1.3 Current, resistance and potential difference

Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2006 June series

3462/3F Q14

question	answers	extra information	mark
(a)(i)	refraction		1
(ii)	it changes speed **or** change in density	accept it speeds up do **not** accept it slows down do **not** accept air is more dense than glass	1
(b)(i)	sound / waves <u>diffract</u> through the gap (in the wall) **or** over the wall **or** because the gate is open	do **not** accept reflection this only scores if first marking point is given accept for **1** mark only sound / waves go through the gap and <u>spread out</u> **or** diagram showing wave fronts spreading out from open gates if diagram is labelled as diffraction both marks can be scored	1 1
(ii)	less diffraction	accept no diffraction accept gates <u>absorb</u> sound / noise / waves accept gates <u>reflect</u> sound / noise / waves do **not** accept rebounds / stops / blocks out	1
total			5

4.2.1.3 Current, resistance and potential difference

GCSE
PHYSICS
PH3FP
Mark scheme

4403
June 2014

Version: 1.0 Final

4.2.1.3 Current, resistance and potential difference

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Information to 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 Assessment Objectives and specification content that each question is intended to cover.

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 bullet points 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 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	green, 5	0
2	red*, 5	1
3	red*, 8	0

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

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

3.2 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.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, 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 or by each stage of a longer calculation.

3.4 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.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

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.

3.6 Phonetic spelling

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

3.7 Brackets

(…..) are 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.

3.8 Ignore / Insufficient / Do <u>not</u> allow

Ignore or insufficient is used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

Do **not** allow means that this is a wrong answer which, even if the correct answer is given, will still mean that the mark is not awarded.

Quality of Written Communication and levels marking

In Question 9(a) candidates are required to produce extended written material in English, and will be assessed on the quality of their written communication as well as the standard of the scientific response.

Candidates will be required to:

- use good English
- organise information clearly
- use specialist vocabulary where appropriate.

The following general criteria should be used to assign marks to a level:

Level 1: basic

- Knowledge of basic information
- Simple understanding
- The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail
- The spelling, punctuation and grammar are very weak.

Level 2: clear

- Knowledge of accurate information
- Clear understanding
- The answer has some structure and organisation, use of specialist terms has been attempted but not always accurately, some detail is given
- There is reasonable accuracy in spelling, punctuation and grammar, although there may still be some errors.

Level 3: detailed

- Knowledge of accurate information appropriately contextualised
- Detailed understanding, supported by relevant evidence and examples
- Answer is coherent and in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately.
- The answer shows almost faultless spelling, punctuation and grammar.

4.2.1.3 Current, resistance and potential difference

Question	Answers	Extra information	Mark	AO spec ref
1(a)	transmits absorbs	correct order	1 1	AO1 3.1.1b
1(b)	light	allow ultra violet **or** UV **or** infrared **or** IR **or** gamma	1	AO1 3.1.1b
1(c)	20	allow **1** mark for correct working, ie $\frac{60}{3}$ provided no subsequent step	2	AO2 3.1.1b
1(d)	Killing cancer cells		1	AO1 3.1.1b
Total			**6**	

4.2.1.3 Current, resistance and potential difference

Question	Answers	Extra information	Mark	AO spec ref
2(a)	3000	allow **1** mark for correct substitution, ie 600 × 5 provided no subsequent step	2	AO2 3.2.2b
2(b)	anticlockwise moment	must be both words	1	AO1 3.2.2c
2(c)(i)	3400	allow 3.4 kilo (newtons)	1	AO2 3.2.2c
2(c)(ii)	as the distance (of the girl from point A) increases, force F increases	allow gets bigger for increases force is (directly) proportional to distance will negate any correct response	1	AO3 4.5.3
Total			**5**	

Question	Answers	Extra information	Mark	AO spec ref
3(a)	<table><tr><th></th><th>Digital Camera</th><th>Eye</th></tr><tr><td>Cornea</td><td></td><td>✓</td></tr><tr><td>Lens</td><td>✓</td><td>✓</td></tr><tr><td>Pupil</td><td></td><td>✓</td></tr><tr><td>CCD</td><td>✓</td><td></td></tr></table>	ignore shaded row each correct row = **1** mark	3	AO1 3.1.4a, d
3(b)	long		1	AO1 3.1.4b
3(c)	lens A it is a concave / diverging lens	 this mark is only gained if lens A is stated any reference to lens material or mass of lens negates this mark allow it will focus light onto the retina	1 1	AO1 3.1, 3.1.4b
3(d)	The refractive index of the lens material		1	AO1 3.1.4f
3(e)	4	ignore any signs allow **1** mark for correct substitution, ie $\frac{1}{0.25}$ provided no subsequent step	2	AO2 3.1.4e

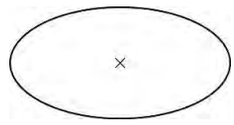
Question 3 continues on the next page . . .

4.2.1.3 Current, resistance and potential difference

Question 3 continued . . .

Question	Answers	Extra information	Mark	AO spec ref
3(f)	Cauterising open blood vessels		1	AO1 3.1.5f
3(g)	5	allow **1** mark for correct substitution, ie $\frac{70}{14}$ provided no subsequent step	2	AO2 3.1.3i
Total			**12**	

4.2.1.3 Current, resistance and potential difference

Question	Answers	Extra information	Mark	AO spec ref
4(a)	concentrated		1	AO1 3.2.1a
4(b)		judge by eye	1	AO2 3.2.1c
4(c)	C A D	3 correct = **2** marks 1 or 2 correct = **1** mark	2	AO1 3.2.1a
4(d)	Lower the athlete's seating position Move the wheels further apart		1 1	AO2 3.2
Total			**6**	

4.2.1.3 Current, resistance and potential difference

Question	Answers	Extra information	Mark	AO spec ref
5(a)	hydraulic		1	AO1 3.2.3
5(b)	9	allow **1** mark for a correct substitution, ie $\frac{1800}{200}$ provided no subsequent step	2	AO2 3.2.3c
5(c)	an environmental		1	AO3 SALoSE
Total			**4**	

4.2.1.3 Current, resistance and potential difference

Question	Answers	Extra information	Mark	AO spec ref
6(a)(i)	increase		1	AO3 3.3.1a, 4.5.4
6(a)(ii)	A and B and B and C	both required for the mark either order	1	AO3 3.3.1a, 4.5.4
6(a)(iii)	any **two** from: • size of nail **or** nail material • current • (size of) paper clip • length of wire	 allow (same) nail allow (same) cell allow p.d. same amount of electricity is insufficient accept type/thickness of wire	2	AO3 4.1b
6(b)	4 B picks up the same number as C, so this electromagnet would pick up the same number as A **or** direction of current does not affect the strength of the electromagnet	 allow it has got the same number of turns as A	1 1	AO3 3.3.1a, 4.5.4
6(c)	2	allow 1 or 3	1	AO3 3.3.1a, 4.5.4
Total			**7**	

Question	Answers	Extra information	Mark	AO spec ref
7(a)	(sound waves) which have a frequency higher than the upper limit of hearing for humans **or** a (sound) wave (of frequency) above 20 000 Hz	sound waves that cannot be heard is insufficient a wave of frequency 20 000 Hz is insufficient	1	AO1 3.1.2a
7(b)	640	an answer of 1280 gains **2** marks allow **2** marks for the correct substitution ie 1600 × 0.40 provided no subsequent step allow **2** marks for the substitution $\frac{1600 \times 0.80}{2}$ provided no subsequent step allow **1** mark for the substitution 1600 × 0.80 provided no subsequent step allow **1** mark for the identification that time (boat to bed) is 0.4	3	AO2 3.1.2c
7(c)	any **one** from: • pre-natal scanning / imaging • imaging of a named organ (that is not surrounded by bone), eg stomach, bladder, testicles • Doppler scanning blood flow	accept heart do **not** allow brain **or** lungs (either of these negates a correct answer)	1	AO1 3.1.2d

Question 7 continues on the next page . . .

Question 7 continued . . .

Question	Answers	Extra information	Mark	AO spec ref
7(d)	advantage any **one** from: • (images are) high quality or detailed or high resolution • (scan) produces a slice through the body • image can be viewed from any direction • an image can be made of <u>any</u> part (inside the body) • easier to diagnose **or** see a problem (on the image) disadvantage any **one** from: • (the X-rays used **or** scans) are <u>ionising</u> • mutate cells **or** cause mutations **or** increase chances of mutations • turn cells cancerous **or** produce abnormal growths **or** produce rapidly growing cells • kill cells • shielding is needed	clearer / better image is sufficient allow images are (always) 3D / 360° allow whole body can be scanned allow a description of what ionising is allow for cells: DNA / genes / chromosomes / nucleus / tissue damage cells is insufficient can be dangerous (to human health) unqualified, is insufficient	1 1	AO1 3.1
Total			**7**	

4.2.1.3 Current, resistance and potential difference

Question	Answers	Extra information	Mark	AO spec ref
8(a)	gravitational attraction (between the satellite and the Earth)	allow gravity allow weight of the satellite	1	AO1 3.2.4b
8(b)	any **two** from: • mass of satellite • speed / velocity (of satellite) • radius of orbit / circle	allow height above the Earth radius / height alone is insufficient	2	AO1 3.2.4c
8(c)(i)	increasing the height (above the Earth's surface) increases the time (for one orbit)	allow a positive correlation allow as one gets bigger, the other gets bigger, or vice versa ignore they are directly proportional	1	AO3 4.5.3
8(c)(ii)	there is no relationship / correlation		1	AO3 4.5.3
8(d)	Isaac Newton was a respected scientist who had made new discoveries before		1	AO3 3.2.4, SALoSE
Total			**6**	

Question	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.		Mark	AO spec ref
9(a)			6	
0 marks	**Level 1 (1–2 marks)**	**Level 2 (3–4 marks)**	**Level 3 (5–6 marks)**	AO1 3.3.2
No relevant / correct content.	**Either** there is an attempt at a description of the construction of a transformer **or** a correct statement of the effect of one type of transformer on the input p.d.	There is a description of the construction of a transformer **and** a correct statement of the effect of one type of transformer on the input p.d.	There is a clear description of the construction of a transformer **and** there is a correct description of how transformers affect the input p.d.	

details of construction:	extra information
a (laminated) core	
core is made from a magnetic material / iron	
2 coils	
the coils are made from an electrical conductor / copper	
the coils are covered in plastic / insulation	
the coils are (usually) on opposite sides	
step-up transformer has more turns on secondary coil than (its) primary (or vice versa)	
step-down transformer has less turns on secondary coil than (its) primary (or vice versa)	
effect on input p.d. :	
step-up transformer, the output p.d. is greater (than the input p.d.)	accept voltage for p.d.
step-down transformer, the output p.d. is lower (than the input p.d.)	

Question 9 continues on the next page . . .

Question 9 continued . . .

Question	Answers	Extra information	Mark	AO spec ref
9(b)	switch mode (transformer)		1	AO1 3.3.2j
Total			**7**	

4.2.1.3 Current, resistance and potential difference

AQA

GCSE
Additional Science / Physics

PH2FP
Mark scheme

4408/4403
June 2015

Version/Stage: 1.0: Final

4.2.1.3 Current, resistance and potential difference

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' 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.

Further copies of this mark scheme are available from aqa.org.uk

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Mark Scheme

Information to 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 Assessment Objectives and specification content that each question is intended to cover.

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 bullet points 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 / ; eg allow smooth / free movement.

2.4 Any wording that is underlined is essential for the marking point to be awarded.

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students 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 errors / 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)

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

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

Student	Response	Marks awarded
1	Neptune, Mars, Moon	1
2	Neptune, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a student 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.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, 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 or by each stage of a longer calculation.

3.4 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.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward is 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.

3.6 Phonetic spelling

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

3.7 Brackets

(.....) are 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.

3.8 Accept / allow

Accept is used to indicate an equivalent answer to that given on the left-hand side of the mark scheme. Allow is used to denote lower-level responses that just gain credit.

3.9 Ignore / Insufficient / Do not allow

Ignore of insufficient is used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

Do **not** allow means that this is a wrong answer which, even if the correct answer is given, will still mean that the mark is not awarded.

4. Quality of Communication and levels marking

In Question **8c** students are required to produce extended written material in English, and will be assessed on the quality of their communication as well as the standard of the scientific response.

Students will be required to:
- use good English
- organise information clearly
- use specialist vocabulary where appropriate.

The following general criteria should be used to assign marks to a level:

Level 1: basic
- Knowledge of basic information
- Simple understanding
- The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail
- The spelling, punctuation and grammar are very weak.

Level 2: clear
- Knowledge of accurate information
- Clear understanding
- The answer has some structure and organisation, use of specialist terms has been attempted but not always accurately, some detail is given
- There is reasonable accuracy in spelling, punctuation and grammar, although there may still be some errors.

Level 3: detailed
- Knowledge of accurate information appropriately contextualised
- Detailed understanding, supported by relevant evidence and examples
- Answer is coherent and in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately.
- The answer shows almost faultless spelling, punctuation and grammar.

4.2.1.3 Current, resistance and potential difference

MARK SCHEME – GCSE ADDITIONAL SCIENCE / PHYSICS – PH2FP– JUNE 2015

Question	Answers	Extra information	Mark	AO / Spec. ref.	ID
1(a)	increases	accept reaches highest value do **not** accept increases and decreases	1	AO2 2.3.2	E
1(b)(i)	increases		1	AO1 2.3.2m	A
1(b)(ii)	increases		1	AO1 2.3.2m	A
1(c)	18 watt	allow **1** mark for correct substitution i.e. 12 x 1.5 provided no subsequent step accept W answer may be indicated in the list	2 1	AO2 2.4.2c AO1 2.4.2c	E
Total			**6**		

4.2.1.3 Current, resistance and potential difference

Question	Answers	Extra information	Mark	AO / Spec. ref.	ID
2(a)	inside the Sun		1	AO1 2.6.2b	**A**
2(b)	fusion		1	AO1 2.6.2a	**G**
2(c)	energy		1	AO1 2.6.2f	**A**
Total			**3**		

4.2.1.3 Current, resistance and potential difference

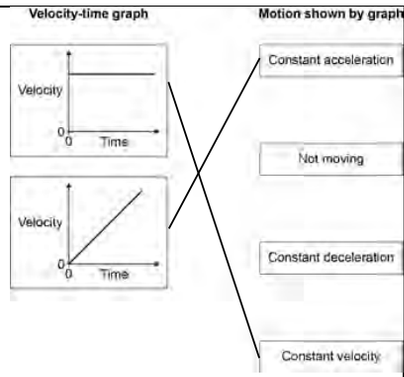
Question	Answers	Extra information	Mark	AO / Spec. ref.	ID
3(a)	3 (.0)	allow **1** mark for correct substitution i.e. 25 x 0.12 provided no subsequent step	2	AO2 2.1.5d	**E**
3(b)(i)	elastic potential kinetic	correct order only	1 1	AO1 2.1.5c 2.2	**G**
3(b)(ii)	increases to 80(mm) (or more)	 accept any number greater than 75 an answer 'it (more than) doubles' gains both marks	1 1	AO3 2.1.5a	**E**
3(c)(i)	weight		1	AO1 2.1	**A**
3(c)(ii)	Downward speed increases		1	AO1 2.1.1e	**A**
Total			**8**		

4.2.1.3 Current, resistance and potential difference

Question	Answers	Extra information	Mark	AO / Spec. ref.	ID
4(a)(i)	(3-pin) plug	do **not** accept plug socket	1	AO1 2.4.1d	**E**
4(a)(ii)	live and neutral		1	AO1 2.4.1e	**A**
4(a)(iii)	double		1	AO1 2.4.1j	**G**
4(b)	Direct current (d.c.) only		1	AO1 2.4.1a	**A**
4(c)(i)	live		1	AO1 2.4.1g	**G**
4(c)(ii)	too great a current flows	accept a surge of current accept too great a power accept an electrical fault do **not** accept voltage / energy / electricity too high	1	AO1 2.4.1g	**E**
4(c)(iii)	can be reset (disconnects circuit) faster	accept does not need replacing cheaper is insufficient does not melt is insufficient quicker to fix / replace is insufficient	1 1	AO2 2.4	**E**
Total			**8**		

4.2.1.3 Current, resistance and potential difference

MARK SCHEME – GCSE ADDITIONAL SCIENCE / PHYSICS – PH2FP– JUNE 2015

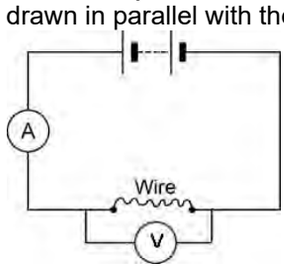
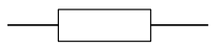
Question	Answers	Extra information	Mark	AO / Spec. ref.	ID
5(a)		if more than one line is drawn from a graph then all those lines are wrong allow **1** mark for 1 correct line	2	AO1 2.1.2f	**G**
5(b)	speed		1	AO1 2.1.2d	**G**
5(c)(i)	2.25	allow **1** mark for correct substitution i.e. $a = \frac{9 - 0}{4}$ or $a = \frac{9}{4}$ provided no subsequent step	2	AO2 2.1.2e	**E**
5(c)(ii)	The air resistance increases		1	AO1 2.1.4a	**A**
5(d)	2000 J mass is half **or** kinetic energy depends on mass	 do **not** accept weight for mass	1 1	AO2 2.2.1g	**E**
Total			**8**		

Question	Answers	Extra information	Mark	AO / Spec. ref.	ID
6(a)	cell damage *or* cancer	accept kills/mutates cells radiation poisoning is insufficient ionising is insufficient	1	AO3 2.5.2g	**E**
6(b)(i)	any **one** from: • use tongs to pick up source • wear gloves • use (lead) shielding • minimise time (of exposure) • maximise distance (between source and teacher)	accept any other sensible and practical suggestion ignore reference to increasing / decreasing the number / thickness of lead sheets	1	AO3 2.5	**E**
6(b)(ii)	<u>background</u>		1	AO1 2.5.2b	**E**
6(c)(i)	curve drawn *from point 2,160*	do **not** accept straight lines drawn from dot to dot	1	AO2 2.5	**E**
6(c)(ii)	(also) increases	less radiation passes through is insufficient	1	AO3 2.5	**E**
6(c)(iii)	50	accept any value from 40 to 56 inclusive	1	AO3 2.5	**E**
6(d)	gamma only gamma (radiation) can pass through lead	 accept alpha **and** beta cannot pass through lead a general property of gamma radiation is insufficient	1 1	AO2 2.5.2e	**E**
Total			**8**		

4.2.1.3 Current, resistance and potential difference

MARK SCHEME – GCSE ADDITIONAL SCIENCE / PHYSICS – PH2FP– JUNE 2015

Question	Answers	Extra information	Mark	AO / Spec. ref.	ID
7(a)(i)	p.d. is (directly) proportional to current **or** gradient/slope is constant ***or*** the lines show constant resistance	accept lines are straight / diagonal	1	AO2 2.3.2d/e/g	**E**
7(a)(ii)	C for the same p.d. the current is the smallest	reason only scores if C is chosen accept lowest gradient **and** the gradient = 1/R	1 1	AO2 2.3.2i	**E**
7(b)(i) clip with table 1	ohm	accept correct symbol Ω accept an answer written in Table 1 if not given in answer space	1	AO1 2.3.2h	**E**
7(b)(ii)	K and L only length varies	reason only scores if both K and L are chosen accept type of metal and the diameter are the same	1 1	AO3 2.3.2	**E**
7(b)(iii)	measure the resistance of more wires made from different metals	accept test more (types of) metals measure the resistance of more wires is insufficient they only use two metals is insufficient	1	AO3 2.3.2	**E**

7(c)(i)	voltmeter symbol correct and drawn in parallel with the wire 	accept voltmeter symbol correct and drawn in parallel with the battery	1	AO1 2.3.2c/f	**E**
7(c)(ii)	correct symbol drawn 	symbol must be rectangular	1	AO1 2.3.2c	**E**
Total			**9**		

Question	**Answers**	**Extra information**	**Mark**	**AO / Spec. ref.**	**ID**
8(a)	(an equal amount of) positive charge	do **not** accept charge on the atom / nucleus is positive	1	AO3 2.5.1	**E**
8(b)(i)	a (significant) number of alpha particles were scattered by more than 4° **or** alpha particles deflected backwards measurements / results could not be explained by 'plum pudding' model **or** measurements / results did not support predictions	accept (some) measurements / results were unexpected can be explained by the nuclear model is insufficient accept measurements / results did not support hypothesis	1 1	AO1 2.5 AO1	**E**
8(b)(ii)	many/(over)100 000 measurements / results taken	accept Rutherford(and Marsden) were respected scientists **or** scientists were respected accept measurements / results taken over several months the experiment was repeated many times is insufficient	1	AO3 2.5	**E**

4.2.1.3 Current, resistance and potential difference

Question 8 continues on the next page . . .

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
8(c)			6	AO1 2.5.1a/b/c	**E**

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.

0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)
no relevant content	A brief description is given with some particles correctly named	A description is given with all three particles named **plus either** the polarity of charge associated with the three particles **or** the relative mass of the three particles **or** the relative mass for one particle and the relative charge for one particle given	A more detailed description is given, naming the particles and polarity of charge **and either** the relative mass is given for at least two particles **or** the relative charge is given for at least two particles

examples of the points made in the response	extra information		
brief description contains protons, neutrons and electrons protons are positive electrons are negative neutrons are uncharged has a nucleus **relative charge** proton +1 electron – 1 neutron 0 **relative mass** proton 1 neutron 1 electron (about) 1/2000 **more detailed description** protons and neutrons make up the nucleus electrons orbit the nucleus electrons are in shells most of the atom is empty space nucleus occupies a very small fraction of the volume of the atom electrons orbit at a relatively large distance from the nucleus most of the mass of the atom is contained in the nucleus the nucleus as a whole is positively charged total number of protons in the nucleus equals the total number of electrons orbiting it in an atom	accept protons and neutrons have the same mass accept electrons have tiny / negligible mass zero mass is neutral		

Total		**10**

4.2.1.3 Current, resistance and potential difference

Answer 52 · Examiner comments — June 2018 | 8463/2F | Original Q4

Question 4 (Low demand)

04.1 Just over 60% of the students correctly indicated the north and south ends of both paper clips. Most of the other students indicated only a north pole on the top paper clip and a south pole at the lower end of the second paper clip.

04.2 Many of the students stated that keeping all of the paper clips the same size would make it a 'fair test'. Fewer suggested that the paper clips should all have the same weight or mass to allow for a fair comparison of the results. Common incorrect answers referred to current travelling in the paper clips or implied that larger paper clips would take more of a share of the magnetic field.

04.3 92% of the students scored at least one mark. Few of the students failed to recognise that the number of paper clips increased as the number of turns of wire increased. Many scored two marks by stating that the relationship was directly proportional or described the number of paper clips held increasing by three for every ten extra turns of wire on the electromagnet.

04.4 Just over 80% of the students scored this mark.

04.5 78% of students scored one mark for this question. Few of the students picked up on 18 paper clips being an anomalous result and as such should be disregarded as the three remaining results were similar. A mean of the three similar results could then be found and used in the table. Students scoring one mark calculated the mean of all four results but did not gain a second mark for rounding down to the nearest whole paper clip.

04.6 Most of the students appreciated that the current would need to be changed, with many specifying how. Fewer students explicitly stated that the number of turns needed to be kept constant. Only a minority explained that the number of paper clips held could be used to show the strength of the electromagnet.

Answer 63 · Examiner comments — June 2022 | 8463/1F | Original Q7

Question 7 (Low and standard demand)

07.1 Approximately 50% of students scored both marks. Many students stated nuclear was renewable. Many students stated biofuel was non-renewable.
Students who guessed often scored zero as 2 correct ticks were not enough to score a mark.

07.2 Less than 3% of students scored full marks. Students who scored 1 mark usually scored the 3rd marking point for 'energy'. The 4th marking point scored more often than the 1st or 2nd marking points.

07.3 95% of students answered correctly as they had all the Physics equations on the Equations Sheet for the 2022 series.

07.4 Few students attempted to convert the time into seconds, so arrived at an answer of 650 000, scoring 2 marks. Few students chose the correct unit, watts being a common incorrect response. 15% of students scored all 4 marks.

Answer 64 · Examiner comments

June 2022 | 8463/1F | Original Q11

Question 11 (Standard demand)

11.1 About 90% of students answered this question correctly as they had all the Physics equations on the Equations Sheet for the 2022 series.

11.2 Many students could not rearrange the given equation. 48% of students scored 0 marks. 51% of students scored 3 marks.

11.3 About 90% of students answered this question correctly as they had all the Physics equations on the Equations Sheet for the 2022 series.

11.4 Despite being another equation that needed rearranging, students were more successful at answering this question, compared with question **11.2**. About 75% of students scored 3 marks, whereas approximately 20% of students scored 0 marks. ‘Saves money’ did not score unless it was linked to a bill or the amount of electricity used, as the cost of a new energy efficient appliance may be considerably more expensive than the cost to run an inefficient appliance.

4.2.1.3 Current, resistance and potential difference

Answer 64 · Examiner comments

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.

4.2.1.3 Current, resistance and potential difference

Answer 65 · Examiner comments

June 2023 | 8463/1F | Original Q1

Question 1 (Low Demand)

01.1 Students were very successful with 91 % of students scoring a mark. Common incorrect answers were ‘open circuit’. The state of the switch (open / closed) was ignored in this question.

01.2 34% of students scored 1 mark, while 39 % scored 2 marks.
Current was a more common correct answer than potential difference.

01.3 Only 5% of students scored 3 marks for identifying the effect of increasing the resistance, , with 47% of students scoring 2 marks and 34 % of students scoring 1 mark.

01.4 90% of students answered this calculation correctly, scoring 2 marks.

01.5 87% of students answered this calculation correctly, scoring 2 marks.

01.6 16% of students scored 2 marks, while 51 % of students scored 1 mark.
Most students answers appeared to be based on guesswork rather than recognising the general trend for each graph.

01.7 42% of students correctly identified the type of error.

Answer 66 · Examiner comments

June 2023 | 8463/1F | Original Q8

Question 8 (Standard Demand)

08.1 32% of students scored 2 marks, while 17% scored 1 mark. Some students hedged their bets by writing either ‘increase’ or ‘decrease’ for both gaps.

08.2 9% of students scored this mark. The equations sheet was provided for this exam series.

08.3 42% of students scored 3 marks. The most common mistake was to forget to square the current when substituting. For 3 mark calculations, these general principles apply:
The 1st mark is for the substitution.
The 2nd mark is for the rearrangement.
The 3rd mark is for the answer.
In straightforward calculations, the correct final answer is sufficient to score all marks.
For this question a negative sign before the numerical answer was ignored.

08.4 Only 64% of students scored this mark. The equations sheet was provided for this exam series. The equation with efficiency related to power was not creditworthy.

08.5 76% of students scored 3 marks for this calculation question.

Answer 67 · Examiner comments

June 2023 | 8463/1F | Original Q10

Question 10 (Standard Demand)

10.1 Very few correct answers, only 2% of students scored a mark. Many students gave answers in terms of charge flow and current which were insufficient. The specification does not mention alternating or direct current, only alternating or direct p.d. Answers like ‘ the potential difference flows in one direction’ were insufficient to score.
. Saying the potential difference only travels/goes in one direction was insufficient, as this suggested charge flow. Saying that ‘the potential difference is always positive’ or ‘the potential difference doesn’t go negative’ were creditworthy. ‘The potential difference is in one direction’ was creditworthy. ‘The potential difference isn’t alternating’ was insufficient.

10.2 95% of students scored this mark. The equations sheet was provided for this exam series.

10.3 74% of students scored 3 marks. The most common mistake was to multiply the energy and the pd, which scored zero.

10.4 64% of students scored 3 marks. Students should appreciate that the first mark in a calculation is for the substitution, not the rearrangement. The substitution into an incorrectly rearranged equation scores zero. A substitution into an equation could score one mark even if the next step was an incorrect rearrangement.

10.5 Students made simple statements about the particle movement or particle arrangement, but usually made mistakes which stopped them scoring marks in Level 2. To score in Level 2, students needed to make comparisons of the movement and arrangement of particles in ice and liquid water. In addition to this, for students to score in Level 3, they needed to discuss either the change of state at constant temperature increasing the potential energy of the particles or how the warming of liquid water increased the kinetic energy of the particles. For 6 marks, both these aspects needed discussion. Students found this question difficult with less than 1% scoring 5 or 6 marks and14% scoring 3 or 4 marks.

Mark Ranges and Award of Grades

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

4.2.1.3 Current, resistance and potential difference

Answer 68 · Examiner comments — June 2024 | 8463/1F | Original Q1

Question 1 (Low Demand)

01.1 Only 38% of students scored a mark for knowing that when a person touches a negatively charged metal dome they also become negatively charged.

01.2 55% of students scored a mark for this question about the force of repulsion between like charges.

01.3 Only 29% of students scored a mark for this question. The majority of wrong answers chose the diagram for the electric field around a positively charged dome.

01.4 62% of students chose the correct answer, knowing that an insulator has a high resistance. The most common incorrect answer was temperature.

01.5 67% of students answered this question correctly, knowing that a spark jumps when the air is ionised.

01.6 78% of students answered this question correctly, identifying electrons as the particle transferred when a spark jumps between two objects.

01.7 93% of students calculated the energy transferred correctly.

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Answer 69 · Examiner comments — June 2024 | 8463/1F | Original Q2

Question 2 (Low demand)

02.1 48% of students were able to recall the frequency of the UK mains electricity supply.

02.2 75% of students were able to recall the potential difference of the UK mains electricity supply.

02.3 94% of students scored 2 marks for this calculation question. For low demand calculations the equation is provided in the rearrangement needed to answer the question.

02.4 91% of students correctly identified the circuit symbol for a thermistor.

02.5 Only 24% of students chose the correct answer for this question, which tested how the potential difference is shared between components in a series circuit.

02.6 The question discriminated well between students. 12% of students scored 2 marks, while 33% scored 1 mark. The question tested whether students knew how the potential difference was shared between components with equal resistance. 'Because it's a series circuit' was insufficient to score the 2nd marking point.

02.7 80% of students scored 2 marks for this question, by calculating the change in resistance between two values of temperature.

Answer 70 · Examiner comments

June 2024 | 8463/1F | Original Q8

Question 8 (Low / Standard demand)

08.1 A small number of students added 6 to the values of current and calculated the mean of all 4 numbers, scoring zero. Some students thought the value of 0.21 was an anomaly and omitted it from the calculation, these were still able to score 2 marks for correct evaluation of the mean. However, this wasn't the intention with this third value. 81% of students scored 2 marks for the question.

08.2 The question discriminated well with 81% of students scoring 3 marks and 6% of students scoring 2 marks, while 10% of students scored no marks. Students who misread the value of current were allowed to score the 2nd and 3rd mark provided it was within a generous range. Students who ignored the scale and thought 17 units of current should be multiplied by 3 and arrived at an answer of 51 also scored 2 marks.

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Answer 70 · Examiner comments

June 2024 | 8463/1F | Original Q8

08.3 Students found this question difficult, with only 23% of students scoring the mark for identifying how the gradient changed as the potential difference increased.

08.4 33% of students correctly identified the filament lamp as the component.

Answer 71 · Examiner comments

June 2024 | 8463/1F | Original Q11

Question 11 (Standard demand)

11.1 Students struggled to answer this question, and many failed to say how the resistance should be measured despite the apparatus set-up being shown in a photo. Students made statements like 'measure the resistance' without saying how, taking measurements from the ammeter and voltmeter were exceptions rather than the norm. Most students scored marks in Level 1 and e 17%did not attempt the question Only 3% of students scored in Level 3, while 16% of students scored in Level 2.

11.2 64% of students identified the graph showing the relationship between length of wire and resistance.

11.3 Many students said 'low potential difference (or pd)' or 'low voltage' scoring a mark. Lots said so 'no risk', without clarifying so didn't score the second mark. 7% scored 2 marks, while 45% scored 1 mark. 9% of students did not attempt this question part.

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4.2.1.3 Current, resistance and potential difference

Answer 71 · Examiner comments

Mark Ranges and Award of Grades

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4.2.1.3 Current, resistance and potential difference

Answer 72 · Examiner comments

June 2025 | 8463/1F | Original Q5

05.1

This question discriminated well with 44% of the students scoring 3 marks, 10 % of the students scoring 2 marks and 28 % of the students scoring 1 mark.

05.2

Nearly 70 % of the students scored the mark for identifying the circuit symbol for a fuse.

05.3

Most of the students scored 2 marks on this grade 1-3 calculation.

05.4

About 94 % of the students scored both marks on this calculation of resistance. Students who scored 0 marks usually rearranged the equation and multiplied the current^2 by the power. When students are provided with the equation at the point they need it in the exam, there is no need to rearrange the equation before using it as it is a grade 1-3 question.

05.5

Just over 60 % of the students scored 2 marks for correct comparisons between kettle A and kettle B. Many students did not read the instructions for the question and only ticked one box.

4.2.1.3 Current, resistance and potential difference

Answer 73 · Examiner comments June 2025 | 8463/1F | Original Q7

07.1

This was a grade 1-3 calculation of current with just over 90 % of the students scoring 2 marks.

07.2

A grade 1-3 calculation of energy transferred with 95 % of the students scoring 2 marks.

07.3

About 94 % of the students identified the correct equation for efficiency.

07.4

Just over half of the students scored 3 marks on this calculation using the efficiency equation. Many students struggled to rearrange the equation correctly scoring just one mark for the substitution. Students should be encouraged to substitute first then rearrange, as many students did both actions in one go using an incorrect rearrangement and so scored no marks.

07.5

Nearly 60 % of the students scored 1 mark for predicting the efficiency of the motor.

07.6

Just fewer than 50 % of the students scored this mark. Students who tried to describe the relationship were less successful than students who just described the shape of the line. Students who stated that the gradient changes also scored the mark, as a better description than the line is curved.

4.2.1.3 Current, resistance and potential difference

Answer 74 · Examiner comments

June 2025 | 8463/1F | Original Q10

10.1

Just fewer than 20 % of the students scored this mark. Some students wrote 'Increase the resistance' without specifying how, so did not score the mark. 'Closing the switch' was another common incorrect answer. A common answer was 'reversing the connections to the power supply', copying the stem of 10.4 and not understanding that the two phrases were not related to each other.

10.2

Just over 90 % of the students chose the correct equation linking V, I and R.

10.3

About half of the students scored 4 marks, while almost 10 % of the students scored 3 marks. Reading the correct value of current from the graph proved difficult for some the students, so a large tolerance was allowed for mark points 2, 3 and 4.

10.4

Many of the students thought the ammeter was broken, or the switch was open, or misread the question and thought the ammeter was being used to measure potential difference. Very few of the students scored 2 marks, while only about 3 % of the students scored 1 mark.

Answer 74 · Examiner comments

Mark Ranges and Award of Grades

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

4.2.1.3 Current, resistance and potential difference

AQA

GCSE
PHYSICS

8463/1F: Paper 1
Report on the Examination

8463
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4.2.1.3 Current, resistance and potential difference

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4.2.1.3 Current, resistance and potential difference

General

Grade 1-3 calculation questions were well answered, where the equation is always given and students will not be required to rearrange the equation. Grade 4-5 calculation questions involving equation recall were answered better this year than in 2018 and students are scoring many of their marks on the paper by answering the subsequent calculation questions correctly. At grade 4-5 students are expected to be able to either rearrange an equation or convert a unit, so it is beneficial for students to be able to quickly identify if the units given in a question are correct for the use in the equation. Question 10.1 was generally well attempted and students who had carried out Required Practical Activity 2 would have had a material advantage over those who hadn't.

Handwriting sometimes makes 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.

Levels of demand

Questions are set at two levels of demand on this paper:

- low demand questions are targeted at students working at grades 1–3
- standard demand questions are targeted at students working at grades 4–5.

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.

Question 1 (Low demand)

01.1 Around 77% of students scored 2 marks. Around 16% of students scored 1 mark.

01.2 Only around 8% of students scored 2 marks. Both evaporation and change of state were common, insufficient answers for the first marking point. Less than half of the students scored 1 mark. The marking points were independent, so if the change of state was incorrect eg melting, the student could still score the second marking point.

01.3 Around 91% of students scored 2 marks. In calculations where students are provided with the equation (grades 1-3) students are not expected to rearrange the equation. Some students incorrectly tried to convert the kg into g and scored 0 marks.

01.4 Approximately 82% of students scored 3 marks. In calculations where students are provided with the equation (grades 1-3) students are not expected to rearrange the equation. Some students incorrectly tried to convert the kg into g and scored 0 marks for the calculation. Some students set out their calculation, but then multiplied the two values rather than dividing.

Question 2 (Low demand)

02.1 About 67% of students identified the correct decay equation.

02.2 More than three quarters of the students identified why alpha radiation is dangerous inside the human body.

02.3 Just below three quarters of students scored 2 marks. Most correct answers read the values from the graph as intended (460, 280) and students didn't need the tolerance given in the mark scheme.

02.4 About 60% of students correctly estimated the mass remaining.

02.5 Students found this question difficult, with around 55% of students scoring 2 marks and around 27% of students scoring 1 mark.

Question 3 (Low demand)

03.1 Approximately 45% of students scored 1 mark for identifying a measuring instrument that could be used. About 9% of students scored 2 marks for describing an appropriate way to use it. Pythagoras was insufficient as the triangle described would not give the height of the zip wire.

03.2 Students were often very successful in calculation, with around 91% scoring 2 marks.

03.3 This question gave a good spread of marks. Over a fifth scored 3 marks, almost two fifths scored 2 marks and slightly below a quarter scored 1 mark. Gravitational potential energy or gravitational field strength were insufficient to score a mark.

Question 4 (Low demand)

04.1 Over a third of students answered this question correctly.

04.2 About 14% of students answered this question correctly.

04.3 This question about the alpha particle scattering experiment discriminated well between students. Around 16% of students scored 3 marks, around 45% of students scored 2 marks and around 30% of students scored 1 mark.

04.4 About 77% of students correctly identified what reproducible means. .

Question 5 (Low demand)

05.1 The most common correct answers linked CO_2 to global warming. Around 38% of students scored 2 marks and around 35% scored 1 mark. Common incorrect answers were usually vague and mentioned air pollution without being specific. There were many students who incorrectly linked CO_2 with the ozone layer.

05.2 Over half of the students scored 2 marks and over a third scored 1 mark. Insufficient answers included hydro and water. Answers using specification wording eg the tides were acceptable, as were terms like tidal, etc. Oil was insufficient as this was assumed to be non-renewable oil as opposed to palm oil or other biofuel oils.

05.3 Around 83% of students scored 2 marks for this percentage calculation. An answer of 78 scored 1 mark even if spurious calculations followed.

05.4 About 67% of students scored 2 marks. Quite a large number of misreads from the graph resulting in 0 marks and around 29% of students scored 0 marks.

4.2.1.3 Current, resistance and potential difference

05.5 Only around 5% of students scored 2 marks whilst half of the students scored 1 mark. Some students failed to make the connection between the time of day and sunrise. Some students talked vaguely about the energy stored by solar panels, confusing them with solar heating panels rather than solar photovoltaic panels.

Question 6 (Low and Standard demand)

06.1 More than half of the students scored 2 marks. To score a mark a comparative statement was needed eg lower, not low mass of power source. A statement using the word 'better' would be insufficient.

06.2 Around 64% of students scored 2 marks. Many students scored 1 mark for truncating and not rounding their answers, an answer of 26.08 would score only 1 mark for the substitution.

06.3 This question discriminated well, with about 16% scoring 2 marks and more than half scoring 1 mark. 'Increases the battery's power output' was insufficient to score a mark. 'Battery lasts longer' was insufficient to score a mark.

06.4 The quantities in the question are given in alphabetical order; there is no need for students to recall the equation in this order. Any correct rearrangement of the equation or use of the correct symbols for quantities was allowed. A mixture of symbols and words would also score the mark. Approximately 70% of students answered this question correctly.

06.5 It was encouraging to see many Foundation tier students successfully rearranging the equation. Around 77% of students scored 3 marks.

Question 7 (Low and Standard demand)

07.1 About 86% of students answered this question correctly.

07.2 Approximately 83% of students answered this question correctly. Students should refer to the Physics specification for the accepted symbols for circuit components. Textbooks and revision guides do not necessarily use the specification symbols. The circles in the component symbol scored a mark even if shown as blobs rather than circles.

07.3 Around 93% of students scored 2 marks. At grade 1-3, the equation is given and no rearrangement of the equation is needed. Students need to simply substitute and calculate the answer.

07.4 Around 93% of students scored 2 marks. At grade 1-3, the equation is given and no rearrangement of the equation is needed. Students need to simply substitute and calculate the answer.

07.5 About 23% of students answered this question correctly.

07.6 About 38% of students answered this question correctly.

07.7 Students can recall the equation in any correct rearrangement. The stem of the question lists the quantities in alphabetical order, so that there is no suggestion of the correct order.

Correct letters for quantities are acceptable in place of the quantity names. Voltage or p.d. were acceptable for potential difference. Approximately 57% of students answered this question correctly.

07.8 The first mark is for the substitution into the correct equation. The second mark is for the correct rearrangement of the correct equation. The third mark is for the correct final answer. About 58% of students scored 3 marks for this question. Grade 4-5 calculation questions require either a unit change or a rearrangement of the equation.

Question 8 (Low and Standard demand)

08.1 Around 63% of students answered this question correctly.

08.2 Around 86% of students answered this question correctly. Some students gave a precaution instead of a risk, which was insufficient.

08.3 Around 62% of students answered this question correctly, demonstrating that students still confuse the terms resolution and range.

08.4 Around 96% of students answered this question correctly.

08.5 Many students failed to substitute correctly into the equation that was printed on the Physics Equations Sheet. Many students multiplied the 3 values given in the question, which scored zero marks. The unit mark was independent, but a large number of students failed to recognise the correct unit from the box. More than a third of students scored 4 marks and around 16% of students scored 3 marks. A quarter of students scored 1 mark for either the correct unit or the correct substitution.

Question 9 (Standard demand)

09.1 About 45% of students correctly identified the meaning of power input.

09.2 Only a quarter of students scored this mark. Students can recall the equation in any correct rearrangement. The stem of the question lists the quantities in alphabetical order, so that there is no suggestion of the correct order. Correct letters for quantities are acceptable in place of the quantity names. Voltage or p.d. were acceptable for potential difference.

09.3 Around 13% of students scored 3 marks and about 81% scored zero. Students found this question difficult to answer, presumably due to their inability to recall the correct equation in the preceding question.

09.4 More than half of students answered this correctly. Some students failed to score the mark by writing input for both the denominator and the numerator.

09.5 Students who successfully recalled the equation in **09.4** were likely to score all 3 marks for this question. Only around 15% of students scored zero.

09.6 Many students restated the stem, rather than going the extra stage in the reasoning and linking to efficiency because thermal energy is also transferred by the light bulb. A number of students believed that knowing the rate at which the bulbs emitted visible light was a

safety concern related to the household electrics. Only around 1% of students scored 2 marks, about 16% of students scored 1 mark and around 73% of students scored zero marks.

Question 10 (Standard demand)

10.1 This question produced a good spread of marks. A mean score of 2.1 was achieved by students on the Foundation tier. Students who had experience of a similar practical benefitted from this as they were able to describe a method in sufficient detail to achieve Level 2. To achieve Level 3, a student needed to indicate that several values of number of layers were used, referring to the interval of 8 layers (as the graph showed) or that the experiment should be done with no layers. A control variable was also needed, either the initial temperature of the water, or the volume of water in each experiment. Some students gained no credit by describing different required practical methods. Around 2% of students scored 6 marks, around 15% of students scored 4 marks and about a fifth of students scored 2 marks. Around 10% of students didn't attempt the question.

10.2 Many students stated that it wasn't necessary to use both as it would be confusing. The datalogger would produce too much data was a common insufficient answer. A number of students stated that using a normal thermometer would be more appropriate, scoring zero marks. Less than 1% of students scored 2 marks and less than a fifth of students scored 1 mark.

Question 11 (Standard demand)

11.1 Over two-fifths of students scored 3 marks for this question. It wasn't necessary to give the answer to an appropriate number of significant figures, so answers of 0.502, 0.50 and 0.5 were all creditworthy. Some students calculated the jump height to be unlikely values; students should be encouraged to consider whether it is likely that someone can jump a height of 4.92 m, a commonly seen answer achieved by multiplying the 2 values given (41 × 0.12). Less than half of the students scored zero marks.

11.2 A common incorrect answer was E_k = mass × speed, since these were the quantities given in the question. A number of students also left out the 0.5 value even if they remembered that speed should be squared. Velocity was allowed instead of speed in the equation. Correct symbols were acceptable for the quantities in the equation. About 30% of students answered this question correctly.

11.3 Despite being asked to recall the equation in 11.2, most students simply multiplied or divided the 2 values given in the question (3.0 and 270), scoring 0 marks. Only around 19% of students scored 3 marks.

11.4 Some students commented on muscle mass and strength which were insufficient to score marks. Clear comparisons, including at least one difference and one similarity, were needed to score 4 marks. This question discriminated well between students; around 6% of students scored 4 marks, around 29% of students scored 2 marks and around 13% of students scored zero.

4.2.1.3 Current, resistance and potential difference

11.5 Some students failed to score a mark because they simply restated the question, 'the scientist wanted the highest muscle power reading' without adding any value. The answer either needed to refer to the effect of repetition on performance (improvement or worsening) or that it was the maximum (or peak) muscle power that the scientist was investigating. A fifth of students answered this question correctly.

4.2.1.3 Current, resistance and potential difference

Use of statistics

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Mark Ranges and Award of Grades

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