AQA GCSE Physics | 8463

SPECIFICATION POINT 4.2.1.1

Standard circuit diagram symbols

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**16**
Available paper years	**2004–2024**

Using this booklet

1. Booklet answer numbers match the question booklet.
2. Use the original question number within marking tables.
3. Examiner comments are included where available.

Name: _____ **Date:** _____

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

4.2.1.1 Standard circuit diagram symbols

Answer 01 · Mark scheme

June 2004 | 3451H | Original Q1 | Legacy

The full source mark scheme begins on page 35. Follow original question 1 in that document.

Answer 02 · Mark scheme

June 2004 | 3451H | Original Q7 | Legacy

The full source mark scheme begins on page 35. Follow original question 7 in that document.

Answer 03 · Mark scheme

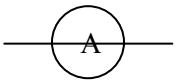
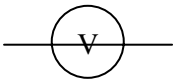
June 2004 | 3462H3 | Original Q1 | Legacy

The full source mark scheme begins on page 56. Follow original question 1 in that document.

4.2.1.1 Standard circuit diagram symbols

Answer 04 · Mark scheme January 2008 | PHY2H | Original Q1 | Legacy

Question 1

question	answers	extra information	mark
(a)(i)	ammeter symbol correct and drawn in series	accept 	1
		do **not** accept lower case a	
	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

4.2.1.1 Standard circuit diagram symbols

PHY2H

Question 1 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	1
total			10

4.2.1.1 Standard circuit diagram symbols

Answer 04 · Mark scheme

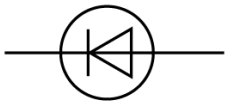
January 2008 | PHY2H | Original Q1 | Legacy

PHY2H

4.2.1.1 Standard circuit diagram symbols

Answer 05 · Mark scheme

Question 5

question	answers	extra information	mark
5(a)	diode	accept LED	1
5(b)	all symbols correct  voltmeter in parallel with component added in series	must include at least voltmeter and diode allow ecf from part (a) if the component is not identified as a diode allow symbol without the line through triangle ignore polarity of diode any additional components must not affect the ability to measure **V** and **I** for the diode / their (a)	1 1
5(c)(i)	0.05	accept 50 mA accept between 0.048 and 0.050 inclusive	1
5(c)(ii)	16	$\frac{0.8}{\text{their (c)(i)}}$ correctly calculated gains both marks allow **1** mark for correct transformation and substitution ie $\frac{0.8}{0.05}$ or $\frac{0.8}{\text{their (c)(i)}}$ allow 17 if using 0.048	2
Total			**6**

4.2.1.1 Standard circuit diagram symbols

Answer 05 · Mark scheme January 2011 | PHY2H | Original Q5 | Legacy

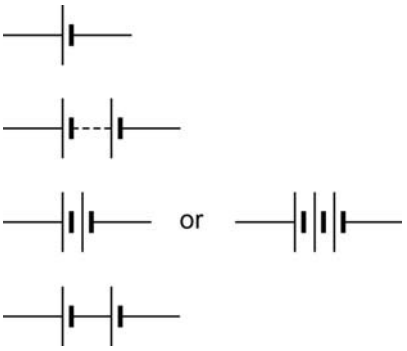
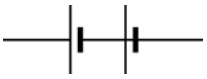
PHY2H

4.2.1.1 Standard circuit diagram symbols

Answer 06 · Mark scheme

June 2011 | PHY2H | Original Q6 | Legacy

Question 6

question	answers	extra information	mark
6(a)(i)	ammeter and battery **in series** with the **gauge**	symbols must be correct ignore a voltmeter drawn in series	1
		accept  **not**  or cells reversed to cancel out	1
	voltmeter in parallel with the gauge	symbol must be correct accept a freestanding circuit diagram provided strain gauge is labelled or a resistor symbol used for the strain gauge	
6(a)(ii)	d.c. flows only in one direction	a.c. changes direction is insufficient	1
6(b)(i)	75	this answer only allow **1** mark for correct substitution **and** transformation, ie resistance = $\frac{3.0}{0.040}$	2

Question 6 continues on the next page

4.2.1.1 Standard circuit diagram symbols

PHY2H

Question 6 continued

question	answers	extra information	mark
6(b)(ii)	increases		1
6(b)(iii)	elastic / strain potential	do **not** accept potential	1
Total			**7**

4.2.1.1 Standard circuit diagram symbols

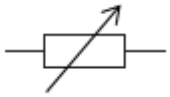
Answer 06 · Mark scheme June 2011 | PHY2H | Original Q6 | Legacy

PHY2H

4.2.1.1 Standard circuit diagram symbols

Answer 07 · Mark scheme

Question 4

question	answers	extra information	mark
4(a)(i)	symbol for a diode 	accept 	1
	symbol for a variable resistor 		1
4(a)(ii)	voltmeter is in series **or** voltmeter is not in parallel		1
	ammeter is in parallel **or** ammeter is not in series	accept an answer in terms of how the circuit should be corrected voltmeter and ammeter are wrong way around is insufficient	1
4(b)(i)	0.2 (V)	accept any value between 0.20 and 0.21 inclusive	1
4(b)(ii)	37.5	allow **1** mark for I = 0.008 **or** allow **2** marks for correct substitution, ie 0.3 = 0.008 × R **or** allow **1** mark for a correct substitution using I = 0.8 **or** I = 0.08 **or** I = 0.009 **or** allow **2** marks for answers of 0.375 **or** 3.75 **or** 33(.3)	3

Question 4 continues on the next page . . .

PH2HP

Question 4 continued . . .

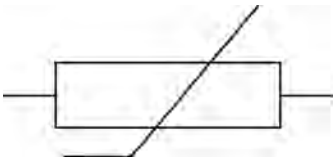
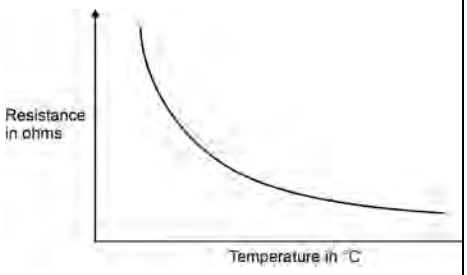
question	answers	extra information	mark
4(c)(i)	25	allow **1** mark for obtaining period = 0.04(s)	2
4(c)(ii)	diode has large resistance in reverse / one direction		1
	so stops current flow in that / one direction	allow diodes only let current flow one way / direction allow **1** mark for the diode has half-rectified the (a.c. power) supply	1
Total			**12**

4.2.1.1 Standard circuit diagram symbols

Answer 07 · Mark scheme January 2013 | PH2HP | Original Q4 | Legacy

PH2HP

Answer 08 · Mark scheme June 2014 | PH2HP | Original Q4 | Legacy

4(a)(i)			1	AO1 2.3.2c
4(a)(ii)	360	allow **1** mark for correct substitution, ie 9 = 0.025 × R	2	AO2 2.3.2h
4(a)(iii)	sketch graph of correct shape, ie 		1	AO1 2.3.2g
4(a)(iv)	An automatic circuit to switch a heating system on and off.		1	AO1 2.3.2c

Question 4 continues on the next page . . .

4.2.1.1 Standard circuit diagram symbols

Question 4 continued . . .

Question	Answers	Extra information	Mark	AO spec ref
4(b)	so ammeter reduces / affects current as little as possible	accept so does not reduce / change the current (it is measuring) accurate reading is insufficient not change the resistance is insufficient	1	AO1 2.3.2c
4(c)	gives a common understanding	accept is easier to share results accept can compare results do not need to be converted is insufficient prevent errors is insufficient	1	AO3 2.3.2k
4(d)	replace Bunsen (and water) with a lamp replace thermometer with light sensor	accept any way of changing light level accept any way of measuring a change in light level datalogger alone is insufficient	1 1	AO2 2.3.2p
Total			**9**	

4.2.1.1 Standard circuit diagram symbols

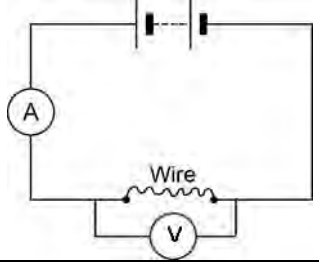
Answer 08 · Mark scheme

June 2014 | PH2HP | Original Q4 | Legacy

Question	Answers	Extra information	Mark	AO spec ref

4.2.1.1 Standard circuit diagram symbols

Answer 09 · Mark scheme June 2015 | PH2HP | Original Q1 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. ref.	ID
1(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**
1(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**
1(b)(i) clip with table in (b)	ohm	accept correct symbol Ω accept an answer written in Table 1 if not given in answer space	1	AO1 2.3.2h	**E**
1(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**
1(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**
1(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**

4.2.1.1 Standard circuit diagram symbols

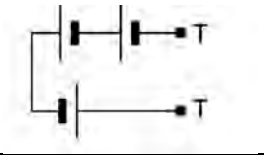
Answer 09 · Mark scheme

June 2015 | PH2HP | Original Q1 | Legacy

1(c)(ii)	correct symbol drawn 	symbol must be rectangular	1	AO1 2.3.2c	**E**
Total			**9**		

4.2.1.1 Standard circuit diagram symbols

Answer 10 · Mark scheme June 2016 | PH2HP | Original Q3 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
3(a)	3rd box from the left ticked 		1	AO2 2.3.2j
3(b)	correct symbol drawn in series with other components	symbol must have upper case A	1	AO1 2.3.2c
3(c)(i)	9 + 3 = 12V pd of battery is shared between the variable resistor and fixed resistor	reason only scores if this mark scored accept $V_1 + V_2$ = pd of the battery accept p.d. is shared in a series circuit accept voltage for p.d.	1 1	AO2 2.3.2k AO1 2.3.2k
3(c)(ii)	600 p.d. of supply shared equally when resistors have the same value **or** ratio of the p.d. is the same as the ratio of the resistance	reason only scores if this mark scored	1 1	AO2 2.3.2k AO1

4.2.1.1 Standard circuit diagram symbols

Answer 10 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
3(c)(iii)	0.015 **or** their (c)(i) ÷ (their (c)(ii) + 200) correctly calculated	allow **2** marks for correct substitution ie 12 = I × 800 **or** their (c)(i) = I × (their (c)(ii) +200) allow **1** mark for total resistance = 800 (Ω) or their (c)(ii) + 200 **or** allow **1** mark for a substitution of 12 = I × 200 **or** their (c)(i) = I × 200 **or** alternative method using the graph V = 3 V (1) 3 = I × 200 (1)	3	AO2 2.3.2k 2.3.2h
Total			**9**	

4.2.1.1 Standard circuit diagram symbols

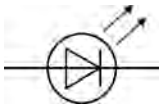
Answer 10 · Mark scheme

June 2016 | PH2HP | Original Q3 | Legacy



4.2.1.1 Standard circuit diagram symbols

Answer 11 · Mark scheme June 2017 | PH2HP | Original Q5 | Legacy

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

4.2.1.1 Standard circuit diagram symbols

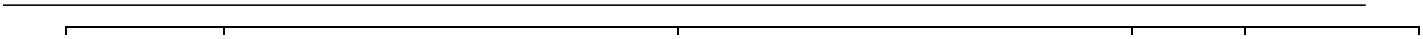
Answer 11 · Mark scheme

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

4.2.1.1 Standard circuit diagram symbols

Answer 11 · Mark scheme

June 2017 | PH2HP | Original Q5 | Legacy



4.2.1.1 Standard circuit diagram symbols

Answer 12 · Mark scheme June 2018 | 8463/1H | Original Q3

Question	Answers	Extra information	Mark	AO/ Spec. Ref
03.1	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
03.2	**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			

4.2.1.1 Standard circuit diagram symbols

Answer 12 · Mark scheme

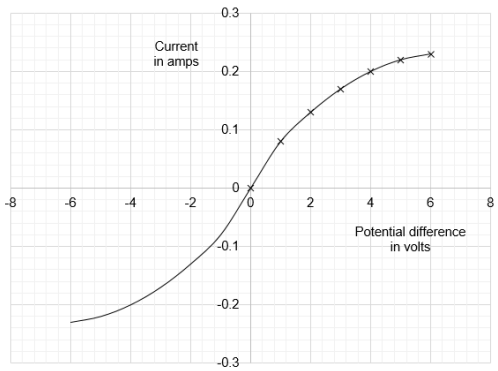
June 2018 | 8463/1H | Original Q3

Question	Answers	Extra information	Mark	AO/ Spec. Ref
03.3	the temperature of the wire would not change		1	AO3 4.2.1.3
03.4	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**	

4.2.1.1 Standard circuit diagram symbols

Answer 13 · Mark scheme November 2020 | 8463/1H | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	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
01.2	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
01.3	potential difference = current × resistance **or** *V = IR*		1	AO1 4.2.1.3 RPA 4
01.4	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

4.2.1.1 Standard circuit diagram symbols

Answer 13 · Mark scheme

November 2020 | 8463/1H | Original Q1

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

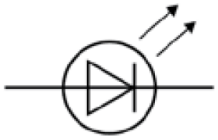
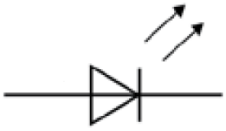
4.2.1.1 Standard circuit diagram symbols

Answer 14 · Mark scheme

June 2022 | 8463/1H | Original Q11

Question 11

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

Question	Answers	Extra information	Mark	AO / Spec. Ref.
11.1		allow: 	1	AO1 4.2.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
11.2	there is a gap in the circuit **or** S_1 needs to be closed to complete the circuit **or** S_1 needs to be closed to turn the hair straighteners on		1	AO1 4.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
11.3	$E = 3600$ (J)		1	AO2 4.2.4.2
	$3600 = 120 \times t$	this mark may score if E is incorrectly / not converted	1	
	$t = \frac{3600}{120}$	this mark may score if E is incorrectly / not converted	1	
	$t = 30$ (s)	allow an answer consistent with their value of E	1	

4.2.1.1 Standard circuit diagram symbols

Answer 14 · Mark scheme June 2022 | 8463/1H | Original Q11

Question	Answers	Extra information	Mark	AO / Spec. Ref.
11.4	the total resistance of the circuit decreases so the current increases which increases the power output		1 1 1	AO1 4.2.4.1 4.2.2

Total Question 11		**9**

4.2.1.1 Standard circuit diagram symbols

Answer 15 · Mark scheme

June 2024 | 8463/1H | Original Q5

Question 5

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

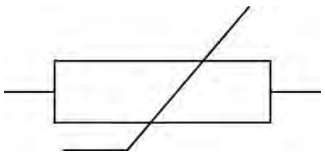
Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	340 mW = 0.34 W		1	AO2 4.2.4.1
	$0.34 = 0.75^2 \times R$	allow a correct substitution of an incorrectly / not converted value of P	1	
	$R = \dfrac{0.34}{0.75^2}$	allow a correct rearrangement of an incorrectly / not converted value of P	1	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

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

4.2.1.1 Standard circuit diagram symbols

Answer 15 · Mark scheme

June 2024 | 8463/1H | Original Q5

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

4.2.1.1 Standard circuit diagram symbols

Answer 15 · Mark scheme

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

Total Question 5	13

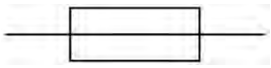
4.2.1.1 Standard circuit diagram symbols

Answer 16 · Mark scheme

June 2024 | 8463/1H | Original Q10

Question 10

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.1	brown		1	AO1 4.2.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.2			1	AO1 4.2.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.3	t = 0.400 (s)		1	AO2 4.2.1.2
	2.0 = I × 0.400	allow a correct substitution of an incorrectly / not converted value of t	1	
	$I = \frac{2.0}{0.400}$	allow a correct rearrangement using an incorrectly / not converted value of t	1	
	I = 5.0 (A)	allow an answer consistent with an incorrectly / not converted value of t	1	

4.2.1.1 Standard circuit diagram symbols

Answer 16 · Mark scheme

June 2024 | 8463/1H | Original Q10

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.4	L = 60 000 (J/kg)	allow full credit for a correct method using E = 0.00102 (kJ)	1	AO2 4.3.2.3
	1.02 = m × 60 000	allow a correct substitution of an incorrectly / not converted value of L	1	
	$m = \frac{1.02}{60\,000}$	allow a correct rearrangement using an incorrectly / not converted value of L	1	
	m = 1.7 × 10^{-5} (kg)	allow an answer consistent with an incorrectly / not converted value of L	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.5	time taken would increase		1	AO3
	more energy would need to be transferred (in total)	MP2 dependent on scoring MP1	1	AO1 4.1.2.1 4.3.2.3

Total Question 10	**12**

GCSE 2004
June Series

ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark Scheme

Physics Specification B
3451/F

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4.2.1.1 Standard circuit diagram symbols

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4.2.1.1 Standard circuit diagram symbols

GCSE PHYSICS

INFORMATION FOR EXAMINERS

1. General

The mark scheme for each question shows:

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

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

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

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

2. Emboldening

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

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

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

3. Marking points

3.1 Marking of Quality of Written Communication

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

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

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

3.2 Marking of lists

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

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4.2.1.1 Standard circuit diagram symbols

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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4.2.1.1 Standard circuit diagram symbols

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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4.2.1.1 Standard circuit diagram symbols

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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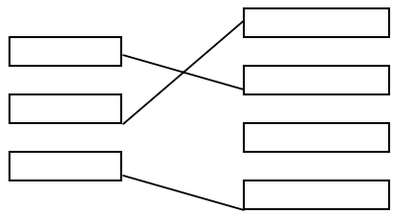
4.2.1.1 Standard circuit diagram symbols

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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4.2.1.1 Standard circuit diagram symbols

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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4.2.1.1 Standard circuit diagram symbols

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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4.2.1.1 Standard circuit diagram symbols

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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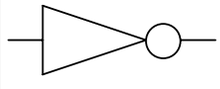
4.2.1.1 Standard circuit diagram symbols

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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4.2.1.1 Standard circuit diagram symbols

3451F Q8

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

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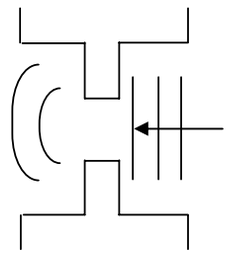
4.2.1.1 Standard circuit diagram symbols

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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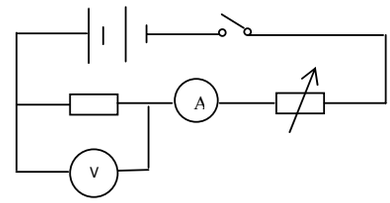
4.2.1.1 Standard circuit diagram symbols

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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4.2.1.1 Standard circuit diagram symbols

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 1.8×30) i.e. adding the correct 2 power values	2
total			9

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4.2.1.1 Standard circuit diagram symbols

3451F Q12

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

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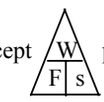
4.2.1.1 Standard circuit diagram symbols

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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4.2.1.1 Standard circuit diagram symbols

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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4.2.1.1 Standard circuit diagram symbols

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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4.2.1.1 Standard circuit diagram symbols

3451F Q16

question	answers	extra information	mark
(a)	**Y** and **Z** 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 1
(b)	**Quality of written communication** 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	for correct use of terms underlined in B **or** C Q ✓ Q X 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	1 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

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4.2.1.1 Standard circuit diagram symbols

SCIENCE: DOUBLE AWARD CO-ORDINATED

INFORMATION FOR EXAMINERS

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- 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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4.2.1.1 Standard circuit diagram symbols

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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4.2.1.1 Standard circuit diagram symbols

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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4.2.1.1 Standard circuit diagram symbols

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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4.2.1.1 Standard circuit diagram symbols

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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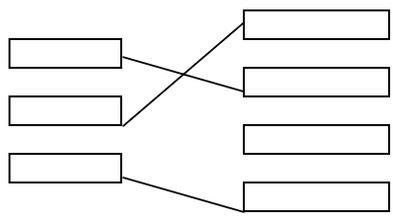
4.2.1.1 Standard circuit diagram symbols

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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4.2.1.1 Standard circuit diagram symbols

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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4.2.1.1 Standard circuit diagram symbols

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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4.2.1.1 Standard circuit diagram symbols

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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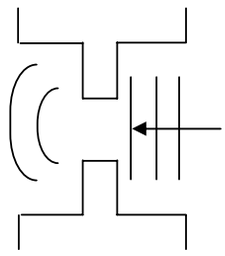
4.2.1.1 Standard circuit diagram symbols

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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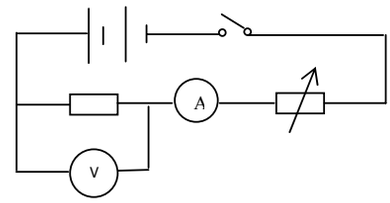
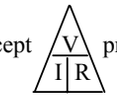
4.2.1.1 Standard circuit diagram symbols

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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4.2.1.1 Standard circuit diagram symbols

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 1.8×30) i.e. adding the correct 2 power values	2
total			9

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4.2.1.1 Standard circuit diagram symbols

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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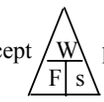
4.2.1.1 Standard circuit diagram symbols

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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4.2.1.1 Standard circuit diagram symbols

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 <u>deflected</u> / <u>repelled</u> / <u>repulsed</u> by the (positive) <u>nucleus</u>	describes 3 tracks correctly for **2** marks describes 2 or 1 track correctly for **1** mark	max 2
	C – alpha particle heading straight for the <u>nucleus</u> is <u>deflected</u> / <u>repelled</u> / <u>repulsed</u> backwards	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	
total			5

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4.2.1.1 Standard circuit diagram symbols

Answer 13 · Examiner comments November 2020 | 8463/1H | Original Q1

Question 1 (Standard demand)

01.1 This question was well answered, 65% of students scored 3 marks. Common mistakes included drawing a line through the circle of the ammeter or the voltmeter.

01.2 51% of students scored 2 marks. Students who chose to use a pen were at a disadvantage, as it made it difficult to determine which attempt to mark. Instructions on the front cover clearly direct students to use pencil for drawing (graphs, diagrams, etc.) Lines that became horizontal would score zero.

01.3 89% of students scored this mark. Most students recalled the equation in the V=IR arrangement. The equation can be recalled in any correct rearrangement, the quantities are listed in alphabetical order in the question.

01.4 A common mistake was to misread the current value as 0.8 A, rather than 0.08 A. Students who misread the graph but used the current correctly in the equation will have scored 3 marks. 59% of students scored 4 marks, while 27% of students scored 3 marks.

01.5 Only 35% of students answered this question correctly. Common incorrect answers included: the ammeter had no error, or the ammeter read zero all the time.

4.2.1.1 Standard circuit diagram symbols

Answer 14 · Examiner comments

June 2022 | 8463/1H | Original Q11

Question 11

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

Levels of demand

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

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

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

4.2.1.1 Standard circuit diagram symbols

Answer 14 · Examiner comments

June 2022 | 8463/1H | Original Q11

Question 1 (Standard demand)

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

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

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

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

Question 2 (Standard demand)

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

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

02.3 About 95% of students answered this question correctly.

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

Question 3 (Standard demand)

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

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

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

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

Question 4 (Standard/High demand)

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

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

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

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

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

Answer 14 · Examiner comments

June 2022 | 8463/1H | Original Q11

Question 5 (Standard/High demand)

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

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

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

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

Question 6 (Standard/High demand)

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

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

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

Question 7 (Standard/High demand)

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

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

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

Question 8 (Standard/High demand)

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

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

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

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

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

4.2.1.1 Standard circuit diagram symbols

Answer 14 · Examiner comments

June 2022 | 8463/1H | Original Q11

Question 9 (High demand)

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

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

09.3 About 75% of students identified the correct conclusion.

Question 10 (High demand)

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

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

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

Question 11 (High demand)

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

4.2.1.1 Standard circuit diagram symbols

Answer 14 · 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.

4.2.1.1 Standard circuit diagram symbols

Answer 15 · Examiner comments June 2024 | 8463/1H | Original Q5

Question 5 (Standard/High Demand)

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

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

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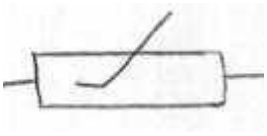
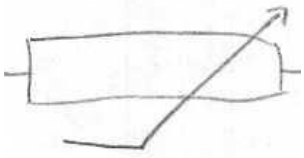
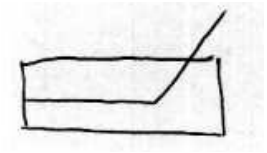
Answer 15 · Examiner comments June 2024 | 8463/1H | Original Q5

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

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

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

4.2.1.1 Standard circuit diagram symbols

Answer 16 · Examiner comments

June 2024 | 8463/1H | Original Q10

Question 10 (Standard/High Demand)

10.1 72% of students correctly identified the colour of the live wire insulation.

10.2 66% of students scored the mark on this question. Students who made the box for the answer into a fuse symbol did not score the mar nor did a fuse symbol added to any side of the box .

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10.3 A grade 6-7 calculation of current. 57% of students scored all 4 marks. 36% of students scored 3 marks, usually for incorrectly converting, or not converting, the unit.

10.4 A grade 6-7 calculation of mass. 61% of students scored 4 marks. 31% of students scored 3 marks for either incorrectly converting, or not converting, the unit.

10.5 40% of students scored 2 marks on this question recognising that the time would be longer because more energy in total would need to be transferred. An answer of 'less energy is melting the wire' was just enough to score the second mark. 15% of students scored zero on this question.

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4.2.1.1 Standard circuit diagram symbols

Mark Ranges and Award of Grades

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

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