



GCSE MARKING SCHEME

SUMMER 2019

**PHYSICS COMPONENT 2 – HIGHER TIER
C420UB0-1**

INTRODUCTION

This marking scheme was used by WJEC for the 2019 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conference, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about this marking scheme.

GCSE PHYSICS
COMPONENT 2 – Applications in Physics
HIGHER TIER
MARK SCHEME
GENERAL INSTRUCTIONS

Recording of marks

Examiners must mark in red ink.

One tick must equate to one mark (except for the extended response question).

Question totals should be written in the box at the end of the question.

Question totals should be entered onto the grid on the front cover and these should be added to give the script total for each candidate.

Marking rules

All work should be seen to have been marked.

Marking schemes will indicate when explicit working is deemed to be a necessary part of a correct answer.

Crossed out responses not replaced should be marked.

Credit will be given for correct and relevant alternative responses which are not recorded in the mark scheme.

Extended response question

A level of response mark scheme is used. Before applying the mark scheme please read through the whole answer from start to finish. Firstly, decide which level descriptor matches best with the candidate's response: remember that you should be considering the overall quality of the response. Then decide which mark to award within the level. Award the higher mark in the level if there is a good match with both the content statements and the communication statement.

Marking abbreviations

The following may be used in marking schemes or in the marking of scripts to indicate reasons for the marks awarded.

cao = correct answer only
ecf = error carried forward
bod = benefit of doubt

SECTION A

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
1	(a)		Fossil fuel use dropped from 71 % to 52 % / coal use dropped 7 % <u>and</u> gas dropped 12 % (1) Less greenhouse gases added to the atmosphere / so less CO ₂ adding to greenhouse effect or global warming or climate change (1)	1	1		2		
	(b)		26 [GW]		1		1		
	(c)	(i)	5 000 [km ²]		1		1	1	
		(ii)	1 045 000 [units]		1		1	1	
	(d)		Smaller (1) Larger power output (1) More reliable (1) Don't accept they don't spoil the view	1		1 1	3		
	(e)	(i)	Efficiency = $\frac{220}{1000}$ (1) subs = 0.22 (1) [accept 22 %]	1	1		2	1	
		(ii)	Power from 4 m ² = 220 × 4 = 880 [W] (1) Current = $\frac{880}{230}$ (ecf) (1) subs = 3.8 [A] (1) Answer = 0.956 [A] award 2 marks	1	1 1		3	2	

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iii)		Energy = 880 ecf × 6 (1) = 5 280 = 5 000 [Wh] (1) or 5 kWh answer must be to 1 sig fig		2		2	2	
				Question 1 total	4	9	2	15	7	0

SECTION B

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)			Keep a safe distance between source and body / limit exposure time / protective screen	1			1		1
	(b)			${}_{-1}^0\beta$ or ${}_{-1}^0e$ (1) ${}_{92}^{234}\text{U}$ (1)	2			2		2
	(c)	(i)		5 [counts per second]	1			1		1
		(ii)		$\frac{480}{320} = 1.5$ (1) accept alternative pairs to get ratio of 1.5 $\frac{63}{1.5} = 42$ (1)		2		2	2	2
		(iii)		All points correctly plotted (1) (ecf on final point) Smooth best fit curve (1)		2		2	2	2
		(iv)		Time for more than 1 half-life e.g. 480 cps to 60 cps is 210 s (1) Time represents 3 half-lives, so mean half-life is $\frac{210}{3} = 70$ [s] ± 1 (1) Alternative: Time to decay from 480 cps to 240 cps is 70 s (1) An additional pair of activities to verify that half-life is constant so the mean value is 70 s (1)		2		2	2	2

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
		(v)	Each big square = $50 \times 40 = 2\,000$ (1) [Ignoring squares $< \frac{1}{2}$ big square] total squares is 13 (1) $13 \times 2\,000 = 26\,000$ (1) [accept answer within range $\pm 2\,000$] Alternative Area = $0.5 \times (480 + 210) \times 80$ (2) = $27\,600$ (1) [accept answer within range $\pm 2\,500$]		3		3	3	3
			Question 2 total	4	9	0	13	9	13

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)			Ohms or ohm or ohm symbol Ω	1			1		
	(b)	(i)		Same power supply / same source p.d. / constant 20 V / identical resistors R	1			1		1
		(ii)		At least 2 pairs of points selected $1 \times 20 = 2 \times 10 = 5 \times 4$ (1) $= 20$ so Mary is correct (1) when rounded to 1 dp			2	2	2	2
	(c)	(i)		$\frac{0.5}{10} = 0.05$	1			1	1	1
		(ii)		$\frac{1}{\text{p.d.}} = 0.05N + 0$ (1) for identifying x and y variables (1) for substitution of gradient (ecf) for m [and $c = 0$ or inferred]	2			2	2	2

Question		Marking details	Marks available					
			AO1	AO2	AO3	Total	Maths	Prac
	(iii)	<p>Prediction made from graph, 15 resistors $\rightarrow \frac{1}{\text{p.d.}}$ or $y = 0.75$ (1)</p> <p>$V = \frac{1}{0.75} = 1.33\text{V}$ so friend is not correct (1)</p> <p>Alternative: Using equation(b)(ii) $15 \times 0.75 = 11.25\text{V}$ (1) 11.25V is not equal to constant of 20V so friend not correct (1)</p> <p>Alternative: From equation $\frac{1}{V} = 0.05 \times 15 + 0 = 0.75$ (1)</p> <p>$V = \frac{1}{0.75} = 1.33\text{V}$ so friend is not correct (1)</p> <p>Alternative: Using equation (b)(ii) $\frac{\text{constant}}{15} = \text{p.d.} = \frac{20}{15} = 1.33\text{V}$ (1) 1.33V is not equal to 0.75V, so friend not correct (1)</p>			2	2	1	2
		Question 3 total	5	0	4	9	6	8

Question		Marking details	Marks available					
			AO1	AO2	AO3	Total	Maths	Prac
4	(a)	<p>SET UP: The risks and hazards are considered. The apparatus is set up as shown. The original temperature of the aluminium block is measured using the thermometer. The immersion heater is turned on for a designated [sensible] time, such as 5 minutes (300s). After 300s the heater is turned off but the temperature of the block still increases. The maximum temperature reached by the block is noted.</p> <p>ANALYSIS: The change in temperature $\Delta\theta$ is calculated by subtracting the maximum temperature from the original temperature of the block. The energy from the immersion heater is calculated using: $\Delta Q = E = P \times t = 50 \times 300$. The equation $\Delta Q = mc\Delta\theta$ is rearranged. Values for ΔQ, $\Delta\theta$ and m are substituted into the equation and c is calculated.</p> <p>5-6 marks Detailed description of how the experiment is set up with consideration of hazards/risks and how to analyse the results to obtain a value for shc. <i>There is a sustained line of reasoning which is coherent, relevant, substantiated and logically structured. The information included in the response is relevant to the argument.</i></p> <p>3-4 marks Either a detailed description of how the experiment is set up with consideration of hazards/risks or how to analyse the results to obtain a value for shc OR a limited description of both the set up and the analysis. <i>There is a line of reasoning which is partially coherent, largely relevant, supported by some evidence and with some structure. Mainly relevant information is included in the response but there may be some minor errors or the inclusion of some information not relevant to the argument.</i></p>	6			6		6

Question				Marking details	Marks available						
					AO1	AO2	AO3	Total	Maths	Prac	
				<p>1-2 marks A limited description of how the experiment is set up with consideration of hazards/risks or how to analyse the results to obtain a value for shc. <i>There is a basic line of reasoning which is not coherent, supported by limited evidence and with very little structure. There may be significant errors or the inclusion of information not relevant to the argument.</i></p> <p>0 marks No attempt made or no response worthy of credit.</p>							
(b)	(i)			$\frac{1520 + 1500 + 1480 + 1500 + 1530 + 1470}{6} = \frac{9\,000}{6} = 1\,500 \text{ (1) [J/kg } ^\circ\text{C]}$	1			1			1
		(ii)		<p>Range in data = 1530 – 1470 = 60 (1) [J/kg °C]</p> $\frac{0.5 \times 60 \text{ (ecf)}}{1500 \text{ (ecf)}} \times 100\% = 2 \text{ [%] (1)}$	1			2	1		2
		(iii)		<p>Data is reproducible as different groups get similar shc data using the same technique / small range (1) Accurate when measured value close to published value (1) There is a difference of 598 J/kg °C so it is not accurate (1)</p>	1		1	3			3
		(iv)		<p>Heat is lost from the block [as it is not insulated] (1) This gives a lower temperature change/rise of the block or resulting in a higher specific heat capacity value / needing more energy to heat the block (1)</p>			2	2			2
				Question 4 total	9	1	4	14	1		14

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)	(i)		$f = \frac{c}{\lambda} = \frac{3 \times 10^8}{600} \text{ (1 manipulation + sub)}$ $= \frac{3 \times 10^8}{600 \times 10^{-9}} \text{ (1 conversion)}$ $= 5.0 \times 10^{14} \text{ (1) [Hz] (tolerance accept down to } 4.9 \times 10^{14}\text{)}$ <p>N.B. Any wavelength values selected between 610 nm and 650 nm award maximum of 2 marks.</p>		3		3	3	3
		(ii)		Lamp appears red (1) Because the red filter absorbs all wavelengths/colours apart from red or transmits only red (1)	2			2		2
	(b)		Only one peak drawn at 445 ± 5 nm (1) Start at 420 nm and end at 470 nm (1) If more than one peak drawn award no marks			2		2		2
	(c)		Tie = black Castle = red Sun = red Any two correct (1) Third correct (1)		2		2		2	
			Question 5 total	2	5	2	9	3	9	

HIGHER TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

	Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
SECTION A	1	4	9	2	15	7	0
SECTION B	2	4	9	0	13	9	13
	3	5	0	4	9	6	8
	4	9	1	4	14	1	14
	5	2	5	2	9	3	9
	TOTALS	24	24	12	60	26	44