GCSE MARKING SCHEME

SUMMER 2023

GCSE
PHYSICS – UNIT 1 (FOUNDATION TIER)
3420U10-1

INTRODUCTION

This marking scheme was used by WJEC for the 2023 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

UNIT 1 – ELECTRICITY, ENERGY AND WAVES

FOUNDATION TIER

SUMMER 2023 MARK SCHEME

GENERAL INSTRUCTIONS

Recording of marks

Examiners must mark in red ink.

One tick must equate to one mark (apart from the questions where a level of response mark scheme is applied).

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.

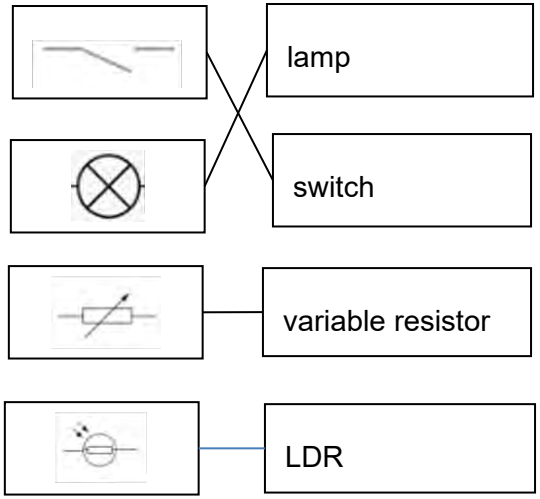
Extended response question

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

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
1	(a)			 4 correct – 3 marks 2 or 3 correct – 2 marks 1 correct – 1 mark	3			3		3
	(b)	(i)		Series (1) The same as (1)	2			2		2
		(ii)	I	Substitution: $P = 3 \times 0.25$ (1) P = 0.75 [W] (1) Accept 0.8 [W]	1	1		2	2	2
			II	Substitution: $R = \frac{3}{0.25}$ (1) R = 12 (1)	1	1		2	2	2

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
			III	Ω	1			1		1
	(c)			Decreases (1) Increases (1)	2			2		2
				Question 1 total	**10**	**2**	**0**	**12**	**4**	**12**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)	(i)		Core	1			1		
		(ii)		Ticks in boxes 2, 3 and 5 i.e. P waves travel faster than S waves (1) S waves cannot travel in a liquid (1) S waves are transverse (1) Deduct 1 mark for each additional tick	3			3		
	(b)	(i)		Substitution: $D = 8000 \times 500$ (1) $D = 4\,000\,000$ [m] (1)	1	1		2	2	
		(ii)		Cross at intersection of the 3 circles		1		1		
				Question 2 total	**5**	**2**	**0**	**7**	**2**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)	(i)		B		1		1		1
		(ii)		C		1		1		1
	(b)			Tick in box 3 i.e. Light must be travelling from a more dense to a less dense material.	1			1		1
	(c)			Optical fibres / endoscopes / periscope / “cats eyes” / telescopes / binoculars / {bike / car} reflectors / remote imaging / automatic windscreen wipers Don’t accept mirrors / communications	1			1		1
				Question 3 total	**2**	**2**	**0**	**4**	**0**	**4**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)			Thumb = force, first finger = [magnetic] field and second finger = current. All 3 correct = 2 marks 1 or 2 correct = 1 mark	2			2		2
	(b)			**Any 2 × (1) from:** • Stronger magnet / Move magnets closer / Increase magnetic field strength • Greater {current / voltage / power} **or** add more batteries • More wire [in the field] / more turns (accept coils). Accept bigger [area] coil Don't accept bigger magnets / increase magnetic field	2			2		2
				Question 4 total	**4**	**0**	**0**	**4**	**0**	**4**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)	(i)		Substitution: power = $P = \frac{2.50}{10}$ (1) Power = 0.25 [kW] (1)	1	1		2	2	
		(ii)	I	75 [p]		1		1		
			II	Substitution: $\frac{75\ \textbf{ecf}}{2.50}$ (1) Cost of 1 unit = 30 [p]	1	1		2	2	
	(b)			To reduce use of fossil fuels / to reduce {greenhouse gas / carbon / CO_2} emissions / to prevent power cuts / to reduce {carbon footprint / climate change / global warming / greenhouse effect} Accept reduce pollution / to help the environment		1		1		
	(c)			**Indicative content:** The earth wire protects users of electricity. The earth wire provides a low resistance path to earth if a fault causes a metal cased appliance to become live. A fuse is used to protect circuits from overheating. If there is a short circuit causing too much current, the fuse melts. The rccb circuit breakers protect users of electricity. The rccb switches off the circuit if there is a difference between the currents in the live and neutral wires.	6			6		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
				5–6 marks Correctly describes the fault that causes all 3 safety features to work and what they are used to protect. *There is a sustained line of reasoning which is coherent, relevant, substantiated and logically structured. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.* **3–4 marks** Correctly describes the fault that causes 2 safety features to work and what they are used to protect **OR** limited attempt at all 3. *There is a line of reasoning which is partially coherent, largely relevant, supported by some evidence and with some structure. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.* **1–2 marks** Correctly describes the fault that causes 1 safety feature to work and what it is used to protect **OR** limited attempt at 1 or 2. *There is a basic line of reasoning which is not coherent, largely irrelevant, supported by limited evidence and with very little structure. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.* **0 marks** *No attempt made or no response worthy of credit.*						
				Question 5 total	**8**	**4**	**0**	**12**	**4**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
6	(a)	(i)		Black **and** [experiment] 2 (1) because it shows the higher temperature [so is emitting more IR] **or** correct numerical comparison i.e. 90 is bigger than 65 (1) Allow **ecf** on the experiment number provided black is chosen Award 0 marks if silver is chosen			2	2		2
		(ii)		Black **and** [experiment] 1 (1) because it shows the higher temperature [so is absorbing more IR] **or** correct numerical comparison i.e. 46 is bigger than 32 (1) Allow **ecf** on the experiment number provided black is chosen Award 0 marks if silver is chosen			2	2		2
	(b)			Silver surface is a poor emitter [of infra-red] / reflects the [radiated] heat back in		1		1		
	(c)	(i)		Payback time = $\frac{500}{25}$ (1) Payback time = 20 [years] (1)	1	1		2	2	
		(ii)		Loft insulation is cheaper than cavity wall insulation (1) but savings are the same (1) so disagree. Accept reverse argument **OR** The payback time for loft insulation is 3 years (1) compared to the 4 years for cavity wall insulation (1) so disagree **OR** Loft insulation is cheaper than cavity wall insulation (1) payback time for loft insulation is shorter (1) so disagree Conclusion needed to award 2 marks			2	2		
				Question 6 total	**1**	**2**	**6**	**9**	**2**	**4**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7	(a)			Temperature	1			1		1
	(b)	(i)		All 5 points correctly plotted to <1 small square tolerance (2) 4 points correctly plotted to <1 small square tolerance (1) 3 or less points correctly plotted to <1 small square tolerance (0) Straight line of best fit between 0 – 80 °C (1) **ecf**		3		3	3	3
		(ii)		As temperature increases, pressure increases (1) at a constant rate / uniformly (1) Don't accept positive correlation / proportional		2		2		2
		(iii)	I	$\frac{6}{2}$ or any equivalent ratios (1) = 3 [units] (1)		2		2	2	2
			II	94 - 3 (**ecf**) = 91 [units]		1		1	1	1
		(iv)		- 273 [°C]	1			1		1
	(c)			(60 - 20) **or** 40 (1) So Q = 0.05 × 720 × (60 - 20) = 1 440 [J] (1)		2		2	2	
				Question 7 total	**2**	**10**	**0**	**12**	**8**	**10**

<table>
<tr><th colspan="4" rowspan="2">Question</th><th rowspan="2">Marking details</th><th colspan="6">Marks available</th></tr>
<tr><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th><th>Maths</th><th>Prac</th></tr>
<tr><td>8</td><td>(a)</td><td>(i)</td><td></td><td>Total of rank orders = 3 (1)
Which is the lowest total (1) [so agree]
OR
[Type B power stations] are ranked number 1 (1)
for all features (1) [and so agree]

Award 2 marks for all 3 named features:
[Type B power stations] have no emissions and the running cost is {nearly 0 / lowest} and the efficiency {is the best / rank number 1}
Award 1 mark for 2 named features e.g.
[Type B power stations] have no emissions and the running cost is {nearly 0 / lowest}
Don’t accept running cost is low or emissions are low</td><td></td><td></td><td>2</td><td>2</td><td></td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td></td><td><table><tr><th>Type A, B, C or D</th><th>Energy source</th></tr><tr><td>A</td><td>Fossil</td></tr><tr><td>B</td><td>Hydroelectric</td></tr><tr><td>C</td><td>Fossil</td></tr><tr><td>D</td><td>Nuclear</td></tr></table>
4 correct award 3 marks
2 or 3 correct award 2 marks
1 correct award 1 mark</td><td></td><td></td><td>3</td><td>3</td><td></td><td></td></tr>
<tr><td></td><td>(b)</td><td></td><td></td><td>Selection and substitution: $\frac{170\,000}{200\,000}$ [$\times$ 100] (1)
= 85 (1)
Answer of 0.85 award 1 mark only</td><td></td><td>2</td><td></td><td>2</td><td>2</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td>Question 8 total</td><td>0</td><td>2</td><td>5</td><td>7</td><td>2</td><td>0</td></tr>
</table>

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
9	(a)			At least 1 wave in shallow water joining correctly to a deep water wave (1) A minimum of 3 wavefronts shown perpendicular to wave direction by eye (1) Smaller wavelength in shallow water must be consistent and a minimum of 3 wavefronts shown (1)		3		3		3
	(b)	(i)	I	1.5		1		1		1
			II	10 [cm] **ecf**		1		1	1	1
		(ii)		Wavelength is less in region B (1) [Frequency is constant] so wave speed is also less in region B, so disagree (1) **Alternative:** {The waves are closer / there are more waves} in region B (1) because the waves have slowed down in the shallow water, so disagree (1)			2	2		2
	(c)	(i)		6 [cm]		1		1		1
		(ii)		Selection and substitution: $\frac{75}{50}$ (1) = 1.5 [cm] (1)		2		2	2	2

		(iii)		A quarter of 60 is 15 (1) so increases to 75 [cm/s] (1) A quarter of 75 is 18.75 so should increase to 93.75 cm/s [but it increases to 82 cm/s] (1) [so the rule is not generally true and Janet is not correct] **Alternative:** Increase = 75 - 60 = 15 [cm/s] (1) So $\frac{15}{60} = \frac{1}{4}$ (1) Increase = 82 – 75 = 7 [cm/s], so $\frac{7}{75}\left[\neq \frac{1}{4}\right]$ (1) [so the rule is not generally true and Janet is not correct] **Alternative:** 60×1.25 (1) = 75 [cm/s] (1) $75 \times 1.25 = 93.75$ [cm/s] (1) [so the rule is not generally true and Janet is not correct] N.B. 2 marks can be awarded for the first calculation comparison of wave speeds at 8 and 6 [cm] or at 6 and 4 [cm] and then 1 mark for a second calculation comparison.			3	3	3	3
				Question 9 total	**0**	**8**	**5**	**13**	**6**	**13**

FOUNDATION TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	Total	Maths	Prac
1	10	2	0	**12**	4	12
2	5	2	0	**7**	2	0
3	2	2	0	**4**	0	4
5	4	0	0	**4**	0	0
5	8	4	0	**12**	4	0
6	1	2	6	**9**	2	4
7	2	10	0	**12**	8	12
8	0	2	5	**7**	2	0
9	0	8	5	**13**	6	13
Total	**32**	**32**	**16**	**80**	**28**	**45**