GCSE MARKING SCHEME

SUMMER 2024

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

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About this marking scheme

The purpose of this marking scheme is to provide teachers, learners, and other interested parties, with an understanding of the assessment criteria used to assess this specific assessment.

This marking scheme reflects the criteria by which this assessment was marked in a live series and was finalised following detailed discussion at an examiners' conference. A team of qualified examiners were trained specifically in the application of this marking scheme. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners. It may not be possible, or appropriate, to capture every variation that a candidate may present in their responses within this marking scheme. However, during the training conference, examiners were guided in using their professional judgement to credit alternative valid responses as instructed by the document, and through reviewing exemplar responses.

Without the benefit of participation in the examiners' conference, teachers, learners and other users, may have different views on certain matters of detail or interpretation. Therefore, it is strongly recommended that this marking scheme is used alongside other guidance, such as published exemplar materials or Guidance for Teaching. This marking scheme is final and will not be changed, unless in the event that a clear error is identified, as it reflects the criteria used to assess candidate responses during the live series.

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GCSE PHYSICS

UNIT 1 – ELECTRICITY, ENERGY AND WAVES

FOUNDATION TIER

SUMMER 2024 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.

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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

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<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>1</td><td></td><td></td><td></td><td>
<table>
<tr><th>Property</th><th>P waves</th><th>S waves</th><th>Surface waves</th></tr>
<tr><td>These waves travel the fastest</td><td>✓</td><td></td><td></td></tr>
<tr><td>These waves are longitudinal</td><td>✓</td><td></td><td>Accept ✓</td></tr>
<tr><td>These waves cannot travel through liquids</td><td></td><td>✓</td><td></td></tr>
</table>
One mark for each correct row
</td><td>3</td><td></td><td></td><td>3</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td>Question 1 total</td><td>3</td><td>0</td><td>0</td><td>3</td><td>0</td><td>0</td></tr>
</table>

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)	(i)		Substitution: units used = 30×700 (1) = 21 000 [kWh] (1)	1	1		2	2	
		(ii)		Substitution: cost = 21 000 (**ecf**) $\times$ 0.12 (1) = £2520 (1) Award 1 mark for an answer of £84 or £3.60	1	1		2	2	
		(iii)		£3.60 **or** $\frac{\text{answer from (a)(ii)}}{700}$		1		1	1	
	(b)	(i)		£180 **or** 50 $\times$ answer from (a)(iii)		1		1	1	
		(ii)		Payback time = $\frac{3600}{180\ \textbf{ecf}}$ = 20 [years]		1		1	1	
				Question 2 total	**2**	**5**	**0**	**7**	**7**	**0**

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)	(i)		24 [Ω]		1		1		
		(ii)		Substitution: current = $\frac{12}{24\ \textbf{ecf}}$ (1) = 0.5 [A] (1)	1	1		2	2	
		(iii)		Substitution: power = 0.5 **ecf** × 12 (1) = 6 [W] (1)	1	1		2	2	
	(b)	(i)		LED selected so tick in box 2	1			1		
		(ii)	I	8 [mA]		1		1		
			II	16 [mA] **ecf** i.e. 8 + answer from the previous part		1		1		
		(iii)	I	L_2 and L_3	1			1		
			II	L_1 and L_2 **or** L_1 and L_3	1			1		
				Question 3 total	**5**	**5**	**0**	**10**	**4**	**0**

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)	(i)		Substitution: energy transferred = 50 × 150 (1) = 7500 [J] (1)	1	1		2	2	2
		(ii)		Change in temperature = 15 [^{o}C]		1		1		1
		(iii)		Substitution: $\frac{7500\ \textbf{ecf}}{[1\,x]\,15\ \textbf{ecf}}$ (1) c = 500 [J/kg ^{o}C] (1)	1	1		2	2	2
		(iv)	I	Difference = 70 [J/kg ^{o}C]		1		1	1	1
			II	Substitution: $\frac{70\ \textbf{ecf}}{385} \times 100$ (1) % difference = 18.2 **or** 18 **or** $18.\dot{1}\dot{8}$ (1) Award 1 mark only for 18.1 **or** 0.18	1	1		2	2	2
	(b)			Ticks in boxes 3 and 4: Wrap block in insulating material (1) push heater fully into block (1) Deduct 1 mark for any additional tick			2	2		2
				Question 4 total	**3**	**5**	**2**	**10**	**7**	**10**

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<tr><td>5</td><td>(a)</td><td>(i)</td><td></td><td>D</td><td>1</td><td></td><td></td><td>1</td><td></td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td></td><td>B</td><td>1</td><td></td><td></td><td>1</td><td></td><td></td></tr>
<tr><td></td><td></td><td>(iii)</td><td></td><td>E</td><td></td><td>1</td><td></td><td>1</td><td></td><td></td></tr>
<tr><td></td><td></td><td>(iv)</td><td>I</td><td>8 [V]</td><td></td><td>1</td><td></td><td>1</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td></td><td>II</td><td>0.02 [s]</td><td></td><td>1</td><td></td><td>1</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td></td><td>III</td><td>
<table>
<tr><th>Change</th><th>Effect on maximum voltage</th><th>Effect on time for 1 rotation (spin)</th></tr>
<tr><td>Stronger magnets</td><td>increases</td><td>no change</td></tr>
<tr><td>More turns on the coil</td><td>increases (1)</td><td>no change</td></tr>
<tr><td>Coil spins slower</td><td>decreases (1)</td><td>increases (1)</td></tr>
</table>
</td><td></td><td>3</td><td></td><td>3</td><td></td><td></td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td></td><td>Ticks in boxes 3, 5 and 6 i.e.
The core is made from iron
The primary coil creates an alternating magnetic field
Transformers can increase or decrease voltages
Deduct 1 mark for any additional tick</td><td>3</td><td></td><td></td><td>3</td><td></td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td></td><td>Substitution: $20 \times \frac{36}{12}$ (1)
N_2 = 60 (1)</td><td>1</td><td>1</td><td></td><td>2</td><td>2</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td>Question 5 total</td><td>6</td><td>7</td><td>0</td><td>13</td><td>4</td><td>0</td></tr>
</table>

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
6				**Indicative content** **Regions:** The other regions are microwaves, infra-red, visible light, ultraviolet, X-rays and gamma rays. **Similarities:** They all travel at the same speed in a vacuum and can travel through space. All regions of the electromagnetic spectrum transfer energy. They are all transverse waves. They can be reflected or refracted. **Differences:** They have different wavelengths. They have different frequencies. Some are ionising other are not or radiations named. They have different energies. **5 – 6 marks** Comprehensive description of the regions and similarities and differences. *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.*	6			6		6

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
				3 – 4 marks Partial description of the regions and similarities and differences **or** comprehensive description of two out of regions, similarities and differences. *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** Limited description of any of the regions, similarities and differences. *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 6 total	**6**	**0**	**0**	**6**	**0**	**6**

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7	(a)			5 points plotted correctly < 1 small square tolerance (2) 4 points plotted correctly < 1 small square tolerance (1) 3 points or fewer plotted correctly < 1 small square tolerance award 0 marks Straight line of best fit through all the plotted points (origin not needed) < 1 small square tolerance (1)		3		3	3	
	(b)			Time [to travel 9000 km from graph] = 0.045 ± 0.001 [s] **or** 10 000 = 0.05 [s] (1) Which is less than 0.24 so {quicker by cable / disagree} (1) Second mark can only be awarded if the first mark is awarded **Alternative:** $\frac{0.24}{0.01}$ = 24 so 24 × 2000 = 48 000 [km] (1) but only has to travel 9000 [km] so {quicker by cable / disagree} (1) Second mark can only be awarded if the first mark is awarded			2	2	1	
				Question 7 total	**0**	**3**	**2**	**5**	**4**	**0**

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
8	(a)			Substitution: $\frac{25}{10}$ (1) = 2.5 [N/cm^2] (1)	1	1		2	2	
	(b)			Substitution: 2.5 (**ecf**) $\times$ 4000 (1) = 10 000 [N] (1)	1	1		2	2	
	(c)			[More] space between molecules (1) **For the 2nd mark: (1)** - Air can be compressed / air molecules can be pushed together - Lower {pressure / force} [at A_2] Don't accept no pressure		2		2		
				Question 8 total	**2**	**4**	**0**	**6**	**4**	**0**

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
9	(a)	(i)		5 [cm^3]		1		1	1	1
		(ii)		Substitution: $\frac{15}{5\ \mathbf{ecf}}$ (1) = 3 [g/cm^3] (1)	1	1		2	2	2
		(iii)		Selection of 2.7 (1) 3 is closest to 2.7 / only 0.3 difference / this is the closest value (1) so agree with Ffion N.B. Award 2 marks for Ffion is correct, it is closest to aluminium because there is only a 0.3 difference. Conclusion must be present to award both marks **Alternative: when applying ecf from (a)(ii)** Naming the material with the closest density to their calculated value (1) Comment that their value is closest to this stated density value (1) so disagree with Ffion Conclusion must be present to award both marks **Alternative: when applying ecf from (a)(ii)** Selection of 2.7 (1) Comment comparing their value to 2.7 e.g. it is not the closest to 2.7 (1) so disagree with Ffion Conclusion must be present to award both marks			2	2	2	2

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(b)			Method of submerging object [e.g. use a sinker or pencil point] (1) Reference to measuring volume in appropriate context (1) Account for the volume of the submerging object [e.g. subtracting volume of sinker / just submerging by pencil point] (1) e.g. Submerge the object with just the pencil point – award 2 marks Don't accept any reference to the use of a displacement can			3	3		3
				Question 9 total	**1**	**2**	**5**	**8**	**5**	**8**

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
10	(a)	(i)		Fuel is burnt in the boiler **or** water is heated in the boiler (1) Steam {drives / turns} a turbine (1) Turbine {drives / turns} a generator (1) accept spins	3			3		
		(ii)		Electrical energy = 70 [J] (1) $\frac{70}{200} \times 100$ (1) = 35[%] (1) [so agree with Neve] **Alternative:** Energy loss = 130 [J] (1) $\frac{130}{200} \times 100$ (1) = 65[%] so 100 – 65 = 35[%] (1) [so agree with Neve] Award 2 marks for an answer of 65[%] **or** 0.35 Award 1 mark for an answer of 0.65			3	3	3	
	(b)	(i)		{Minimum / lowest / smallest} {output / power / supplied / demand / on the graph} accept energy	1			1		
		(ii)		40 [GW]		1		1	1	
		(iii)		Maximum output from Dinorwig = 1.8 GW (1) Peak demand is {4 h / from 16:00 to 20:00} (1) don't accept 2 different time periods N.B. 7.2 GWh seen award the 1st two marks Extra demand [above 35 GW] is 5 GW (1) 3.2 GW is required from overseas (1) [so agree with Rowan] N.B. numbers have to be used in the correct context			4	4	4	
				Question 10 total	**4**	**1**	**7**	**12**	**8**	**0**

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FOUNDATION TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	Total	Maths	Prac
1	3	0	0	3	0	0
2	2	5	0	7	7	0
3	5	5	0	10	4	0
4	3	5	2	10	7	10
5	6	7	0	13	4	0
6	6	0	0	6	0	0
7	0	3	2	5	4	0
8	2	4	0	6	4	0
9	1	2	5	8	5	8
10	4	1	7	12	8	0
Total	**32**	**32**	**16**	**80**	**43**	**18**

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