GCSE MARKING SCHEME

SUMMER 2024

GCSE
PHYSICS – UNIT 1 (HIGHER TIER)
3420UA0-1

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.

WJEC GCSE PHYSICS

UNIT 1 – ELECTRICITY, ENERGY AND WAVES

HIGHER 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.

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)	(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

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 1 total	**1**	**2**	**5**	**8**	**5**	**8**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(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 2 total	**4**	**1**	**7**	**12**	**8**	**0**

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
3	(a)		P waves are longitudinal (1) S waves are transverse (1) Accept correct reference to vibrations	2			2		
	(b)		P waves travel faster [than S waves] **or** reverse argument	1			1		
	(c)		P waves travel through <u>solids</u> and <u>liquids</u> while S waves [only] travel through <u>solids</u> Treat gases as neutral	1			1		
			Question 3 total	**4**	**0**	**0**	**4**	**0**	**0**

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
4	(a)	(i)	Temperature change = 22.5 [^{o}C] (1) Substitution: 5400 = 0.5 × c × 22.5 (1) **ecf** on attempted temp change subtraction shown c = 480 [J/kg ^{o}C] (1)	1	1 1		3	2	3
		(ii)	Difference of {95 / around 100} (1) **ecf** {Not close / 25%} so not accurate (1) **ecf**			2	2	1	2
		(iii)	Make sure all of the heater is inside the block (1) OWTTE Wrap block in insulating material (1) Accept: use a more powerful heater use a balance with a better resolution add oil to the hole for the thermometer Don't accept use a thermometer with a better resolution			2	2		2
	(b)		[Atoms] gain [kinetic] energy (1) Vibrate faster (1) accept more Don't accept start to vibrate Treat reference to electrons as neutral	2			2		2
			Question 4 total	**3**	**2**	**4**	**9**	**3**	**9**

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
5	(a)		Substitution: $22\,000 = 30 \times$ time (1) Time = $\frac{22000}{30}$ (1) = 733.33 [h per year] (1) = $\frac{733.33\ \textbf{ecf}}{365}$ = 2 [h] (1) accept 2.01 or 2.009 [h] **Alternative:** $\frac{22000}{365}$ = 60.27 (1) Substitution: 60.27 **ecf** = $30 \times$ time (1) Time = $\frac{60.27}{30}$ (1) Time = 2 [h] (1)	1	1 1 1		4	4	
	(b)		Energy saved = $22\,000 - 20\,500 = 1500$ [kWh] (1) Cost savings = $1500 \times 12 = 18\,000$ [p] (1) **ecf** on attempted energy saved subtraction shown Conversion to £180 **ecf** (1) Payback time = $\frac{3600}{180\ \textbf{ecf}}$ = 20 [years] (1) Award 3 marks for an answer of 0.2 [years] Award 2 marks for an answer of 1.46 [years] **or** 1.36 [years]		4		4	4	
			Question 5 total	**1**	**7**	**0**	**8**	**8**	**0**

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
6			**Indicative content** 1. Adjust the variable resistor. 2. Use the ammeter to measure the current. 3. Use the voltmeter to measure the voltage. 4. Record the readings of voltage and current. 5. Repeat steps 1 to 4 {for the full range of the variable resistor / to give several pairs of readings}. 6. Plot a graph of current (y-axis) against voltage (x-axis). **5 – 6 marks** Detailed account of method. *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** Partial account of method. *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.*	6			6		6

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
			1–2 marks Limited account of method. Some points made from any parts of the indicative content. *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**

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
7	(a)		450 [Ω]		1		1	1	
	(b)		Substitution: $\frac{1}{300}+\frac{1}{450}$ **ecf** (1) $\frac{1}{R}=\frac{5}{900}$ (1) = 180 [Ω] (1) Award 2 marks for 0.0055556 **or** 0.006 [Ω] Award 1 mark for 0.005 [Ω]	1	2		3	3	
	(c)		140 +180 **ecf** = 320 [Ω]		1		1	1	
			Question 7 total	**1**	**4**	**0**	**5**	**5**	**0**

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
8	(a)		Speed of infra-red = $[(7.5 \times 10^{-7}) \times (4 \times 10^{14})] = 3 \times 10^{8}$ (1) Speed of microwaves = 3×10^{8} (1) **ecf** Wavelength of microwaves = $\frac{3 \times 10^{8}\ \textbf{ecf}}{3 \times 10^{10}}$ (1) $= 1 \times 10^{-2}$ [m] (1) Award 1 mark for answer of 1×10^{n} where $n \neq -2$	1	1 1 1		4	4	
	(b)	(i)	Speed of infra-red waves in glass = $\frac{3 \times 10^{8}\ \textbf{ecf}}{1.5}$ = 2×10^{8} m/s (1) **ecf** Calculation of the time delays as 0.24 [s] [by satellite] **and** 0.045 [s] [by cable] (1) **Alternative:** $\frac{72\,000}{9000} = 8$ (1) So the time delay is $\frac{8}{1.5}$ = 5.3 times longer [by satellite] (1) accept the inverse argument		2		2	1	
		(ii)	**Any 2 × (1) from:** - Less time delay - More security - Very low error rate / less data loss - Greater data transfer rates (10 Gb/s) compared to satellites (50 Mb/s) / higher bandwidth - Less interference Accept less power loss	2			2		
		(iii)	Orbit above equator (1) [of Earth] Orbit period of 24 hour **OR** has to be 36 000 km above the Earth (1)	2			2		
			Question 8 total	**5**	**5**	**0**	**10**	**5**	**0**

<table>
<tr><th colspan="3" 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>9</td><td>(a)</td><td>(i)</td><td>First (pointing) finger points from {N → S / left to right / direction of the field} (1)
Thumb points {in direction of motion [of AB] / up} (1)
Second (middle) finger gives [induced] current which is <u>A to B</u> (1)</td><td>1
1</td><td>1</td><td></td><td>3</td><td></td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>
<table>
<tr><th rowspan="2">Change</th><th colspan="3">Effect on voltage</th><th colspan="3">Effect on time for 1 cycle</th></tr>
<tr><th>Decreases</th><th>Stays the same</th><th>Increases</th><th>Decreases</th><th>Stays the same</th><th>Increases</th></tr>
<tr><td>Weaker magnets</td><td>✓</td><td></td><td></td><td></td><td>✓</td><td></td></tr>
<tr><td>Coil spins faster</td><td></td><td></td><td>✓</td><td>✓</td><td></td><td></td></tr>
<tr><td>More turns in the coil</td><td></td><td></td><td>✓</td><td></td><td>✓</td><td></td></tr>
</table>
1 mark for each correct row</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>An <u>alternating</u> magnetic field (1)
is linked to the secondary coil by the iron core (1) OWTTE</td><td>2</td><td></td><td></td><td>2</td><td></td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Substitution: $\frac{25\,000}{400\,000} = \frac{600}{N_2}$ (1)
Rearrange equation (1)
So secondary turns = 16 × 600 = 9600 (1)
Award 1 mark for answer of 16 or 0.0625</td><td>1</td><td>1
1</td><td></td><td>3</td><td>3</td><td></td></tr>
<tr><td></td><td></td><td></td><td>Question 9 total</td><td>5</td><td>6</td><td>0</td><td>11</td><td>3</td><td>0</td></tr>
</table>

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
10	(a)		Substitution: $\frac{250}{25}$ (1) = 10 [N/cm^2] (1)	1	1		2	1	
	(b)	(i)	288 [K]		1		1		
		(ii)	Selection and substitution: $\frac{10\ \textbf{ecf} \times 125}{288\ \textbf{ecf}}$(1) = $\frac{p \times 75}{298}$(1) Rearrangement: $\frac{10 \times 125 \times 298}{288 \times 75}$(1) = $\frac{372\,500}{21600}$ = 17.2 **or** 17.25 **or** 17 [N/cm^2] (1) Award 2 marks for an answer of 4.34 Deduct 1 mark for incorrect rounding of the final answer	1	1 1 1		4	3	
			Question 10 total	**2**	**5**	**0**	**7**	**4**	**0**

HIGHER TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	Total	Maths	Prac
1	1	2	5	8	5	8
2	4	1	7	12	8	0
3	4	0	0	4	0	0
4	3	2	4	9	3	9
5	1	7	0	8	8	0
6	6	0	0	6	0	6
7	1	4	0	5	4	0
8	5	5	0	10	5	0
9	5	6	0	11	3	0
10	2	5	0	7	4	0
Total	**32**	**32**	**16**	**80**	**42**	**23**