GCE A LEVEL MARKING SCHEME

SUMMER 2024

A LEVEL
PHYSICS – UNIT 5
1420U50-1

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 GCE A LEVEL PHYSICS

UNIT 5 – PRACTICAL EXAMINATION

SUMMER 2024 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

EXPERIMENTAL TASK MARK SCHEME

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
1	(a)	(i)	Correct log conversion i.e. $\ln R = n\ln l + \ln k$ (1) **Teacher assessed** - graph to be plotted of $\ln R$ against $\ln l$ (1) Accept $\log R$ against $\log l$ Trial readings taken (min of 2) and recorded in the plan section (1) Sample size to give a minimum of 5 readings over a minimum range of 50 [cm] (1) Zero error considered correctly (1) accept reference to length and / or resistance Repeat readings of resistance taken (1)	1	1 1 1	1 1	6	2	6
		(ii)	**Teacher assessed** – No significant risk	1			1		1
	(b)		Clear headings and units for all columns (1) Minimum of 5 sets of readings to resolution of ohmmeter (1) Mean values correct to consistent sig figs with resolution of the ohmmeter (1) $\ln R$ and $\ln l$ calculated correctly **with** ln values consistent to 2 or 3 sig figs (1) Resolution of ruler ± 0.001 m **and** ohmmeter ± 0.1 Ω (1) Accept ± 0.01 Ω	1 1	 1 1 1		5	3	5
	(c)	(i)	Titles and no units (or $\ln(R/\Omega)$ and $\ln(l/\text{cm})$) on the axes all correct allow **ecf** from (b) (1) Suitable scales that occupy at least ½ of the graph paper with no awkward multiples e.g. 3, 6 (1) All points plotted correctly to within ± ½ small square division **ecf** (1) Line of best fit drawn correctly (1)	1	 1 1 1		4	3	4

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
		(ii)	Large triangles used (should be close to the extremities of the lines) or two suitable points clearly shown on each graph (1) Gradient [= n] correct i.e. should be 1.0 (Theoretical) accept 1.0 – 0.5 (ignore units and s.f.) (1) Point taken from the graph i.e. on the line (1) $y = mx + c$ used where $c = \ln k$ **ecf** gradient and data point **and** k calculated correctly (ignore units) (1)	1		1 1 1	4	3	4
	(d)	(i)	Diameter of wire measured correctly to the resolution of the callipers i.e. (0.23 ± 0.02 mm) (1) Area calculated correctly using $A = \pi r^2$ or $\frac{\pi d^2}{4}$ (1) **ecf**		2		2	1	2
		(ii)	$\rho = kA$ (rearrangement) (1) ρ calculated correctly with units consistent with values used e.g. Ωm **or** Ωcm **or** Ωmm (1) **ecf** on A		2		2	2	2
	(e)		Gradient stays the same **and** intercept changes		1		1		1
			Question total	**6**	**14**	**5**	**25**	**14**	**25**

PRACTICAL ANALYSIS TASK MARK SCHEME

<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>1</td><td>(a)</td><td>(i)</td><td>All values for mean deflection correct to 1 d.p. i.e. 3.2, 9.0, 13.3
N.B. consistent sig figs with the raw data</td><td></td><td>1</td><td></td><td>1</td><td>1</td><td>1</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Using method based on $S = kL^3$ (1)
Determining constant k for all 3 values (1)
Correct conclusion S is proportional to L^3 i.e. constant is the same for all values (1)</td><td></td><td></td><td>3</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td></td><td></td><td>(iii)</td><td>Increase range of values for overhang length / improve intervals of overhang length / compare with someone else's results can be implied by using a 2nd beam
Accept use callipers to measure deflection / improve resolution of measuring instrument / method to check original length of beam / take readings at eye level</td><td></td><td></td><td>1</td><td>1</td><td></td><td>1</td></tr>
<tr><td>2</td><td>(a)</td><td></td><td>All values for fringe separation correct (1)
All values correct to 1 d.p. and consistent in the column
N.B. consistent sig figs with the raw data (1)

<table>
<tr><th>Distance, D / ± 0.005 m</th><th>$6\Delta y$ / mm</th><th>Δy / ± 0.4 mm</th></tr>
<tr><td>0.500</td><td>13</td><td>2.2</td></tr>
<tr><td>1.000</td><td>24</td><td>4.0</td></tr>
<tr><td>1.500</td><td>39</td><td>6.5</td></tr>
<tr><td>2.000</td><td>50</td><td>8.3</td></tr>
<tr><td>2.500</td><td>65</td><td>10.8 / 11</td></tr>
<tr><td>3.000</td><td>75</td><td>12.5 / 13</td></tr>
<tr><td>3.500</td><td>90</td><td>15.0 / 15</td></tr>
</table>
</td><td></td><td>2</td><td></td><td>2</td><td>2</td><td>2</td></tr>
</table>

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
	(b)		Both axes labelled and units included (1) Suitable scales chosen so that data points occupy at least ½ of the vertical axis and not involving awkward factors e.g. 3 for both axes (1) All points plotted correctly to within ± ½ small square division **ecf** (1) All vertical error bars plotted correctly to within ± ½ small square division **ecf** (1) ignore horizontal error bars Correct lines of maximum and minimum gradient consistent with the error bars **ecf** (1)	1	1 1 1 1		5	4	5
	(c)	(i)	Data is consistent as <u>straight line</u> graph can be drawn (1) Lines appear to straddle the origin **or** mean intercept corresponds to origin (1) Lines pass through error bars (1)			3	3		3
		(ii)	Large triangles used (should be close to the extremities of the lines) or two suitable points clearly shown on each graph or clearly implied by calculation [see below] (1) Minimum gradient correctly calculated **ecf** (3.9 – 4.2) [$\times 10^{-3}$] (1) Maximum gradient correctly calculated **ecf** (4.3 – 4.6) [$\times 10^{-3}$] (1) Note – ignore units and number of sig figs in this part of the question.	1	1 1		3	2	3
		(iii)	Mean gradient correct **ecf** (1) Percentage uncertainty correct **ecf** [= 4 – 6 %] (no unit or sig figs penalty) (1)		2		2	2	2

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
	(d)	(i)	Wavelength = gradient $\times$ a (1) % unc(λ) = %unc(a) + %unc(gradient) (1) [expect $\approx$12 %] λ = (6.4 ± 0.7) **ecf** $\times$ 10^{-7} m **with unit** and absolute uncertainty expressed to max of 2 sig figs (1) Range of wavelength values to be accepted: 6.30 - 6.50 $\times$ 10^{-7} m			3	3	3	3
		(ii)	$6\Delta y = \frac{6\lambda D}{a}$ **or** gradient = $\frac{6\lambda}{a}$ **or** by implication (1) $\lambda = \frac{a \text{ x gradient}}{6}$ (1) **Alternative:** Gradient is 6 times greater (1) Divide the gradient by 6 and multiply by a (1)			2	2	1	2
			Question totals	**2**	**11**	**12**	**25**	**18**	**25**

GCE A LEVEL UNIT 5: PRACTICAL EXAMINATION

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
Practical Analysis Task	2	11	12	25	18	25
Experimental Task	6	14	5	25	14	25
TOTAL	**8**	**25**	**17**	**50**	**32**	**50**