A-level

Physics

PHY6T/Q14

Final Marking Guidelines

2450/2455
June 2014

Version/Stage: 1.0 Final Marking Guidelines

Guidance for teachers marking Physics ISAs

These are the **Stage 1 Marking Guidelines,** which provide guidance on the marking of Stage 1 of the ISA. The full **Marking Guidelines** will be published on eAQA in March 2014.

The marking guidelines have been devised by a team of experienced examiners. They have tried to anticipate all possible responses worthy of credit. In order to establish consistency it is essential that all centres mark exactly to this scheme.

For ease of use the mark scheme has been presented in tabular form. Concise answers are given in the left-hand column. More detailed explanatory notes for some questions are included in the right-hand column.

Marking of Stage 1 of the ISA – student data and graph – should ideally be completed before the ISA written test to ensure that candidates do not change any data. (Alternatively, centres should take other steps to ensure that candidates do not change any information on their data script/graph). The marking of this section should be annotated with a red tick at the point where the mark has been awarded together with the letter referring to this mark scheme, eg '✓b'. **No other comments or feedback should be written on the candidates' scripts**. The total mark for this section should be written at the top of the paper. This will be transferred to the grid on the front page of the ISA test booklet.

Marking of the ISA test should be done using a red tick to represent each mark awarded. Further annotated comments **can** be added where necessary as an explanation as to why a particular point has been awarded which will greatly aid the moderation process. The total mark for each question should be entered on the grid on the front cover of the ISA booklet and the total mark calculated.

Assessment Advisers are allocated to each centre and they can advise on the marking process. You should receive the contact details for the Assessment Advisor through the post. If you have not received them, please contact the AQA subject team.

Stage 1		Mark	Additional guidance notes
(a)	Suitable circuit diagram with circuit correctly set up.✓	**1**	This mark cannot be awarded if any help has been given in setting up the circuit unless this was because of faulty apparatus.
(b)	Recorded values for V and I at room temperature quoted to noted precision and with correct unit. At least **two** values each for V and I at room temperature are required✓	**1**	This mark is only available to candidates who have recorded the instrument precisions as directed on the task sheet. The values for V are expected to be similar if not identical. If values of V are the same this value need only be recorded only once.
(c)	Single table with column headings including appropriate units showing all raw data (θ, I, V) **and** Recorded data for a minimum of seven different temperatures with a range of at least 30 ^{o}C✓ *A suitable set of temperatures would be 60, 55, 50, 45, 40, 35 and 30 ^{o}C.*	**1**	Column headings can be either in words or standard symbols. Units can be in words or the correct abbreviation. eg current/A. Alternative acceptable labelling includes current (A). *This mark cannot be awarded if units are included in the body of the table.*
(d)	Thermistor resistance correctly calculated and recorded to the nearest ohm with correct unit in all cases✓	**1**	Check only the **second and fifth rows of the table** for the calculation of the resistance. Should a value of R be greater than 1 kΩ accept 3 sf.
(e)	A graph of R against θ, with R on the y-axis. Suitably large graph scale (do not award if scale on either axis could have been doubled). Scale must have 'sensible' divisions which can be easily read e.g. scales in multiples of 3,6,7,9 etc are not acceptable: both axes must be labelled with quantity and unit. ✓	**1**	The plotted points should occupy over half of each axis so neither scale is likely to start at zero. For axes labels, the same convention as for table headings is required. Allow ecf from (c) for incorrect unit but do not award the mark if either unit is missing. A scale division in 4's might sometime be acceptable. Examples of acceptable and unacceptable scales in 4's are given in the teachers support section of the website.

(f)	Points accurately plotted to within 1 mm ✓ *Markers should check the second and fifth plotted points*	**1**	This mark is independent of mark (e). i.e. if candidates have used an unsuitable scale they can still achieve marks for accurately plotting the points.
(g)	Best-fit curve well drawn. ✓	**1**	A single smooth, continuous exponential-like decrease curve is expected with the points evenly scattered about the line of best fit. Point to point straight lines are not acceptable.
	Section Total	**7**	

Stage 2	Section A	Mark	Additional guidance notes
1(a)	(±) (precision ÷ pd) x 100% for pd ✓ (±) (½ range of repeats ÷ mean value) × 100% for current✓	**2**	If zero spread of repeats, then precision of ammeter must be used.
1(b)(i)	δR% = % uncertainty in pd + % uncertainty in current ✓ (±) (δR% x R)/100 Ω ✓	**2**	**1 or 2sf and unit** is required for the **final answer**.
1(b)(ii)	Systematic error in <u>ammeter and/or voltmeter</u> readings ✓	**1**	*The answer must mention the measuring instrument* Accept "zero error in <u>ammeter and/or voltmeter</u> readings" Also can accept " contact resistance"
1 (c)	Stir water Position thermometer near thermistor Avoid parallax in reading thermometer Read thermometer both before and after taking meter readings and average if necessary ✓✓	**2**	**Any 2 from 4 for 1 mark each** **Do not accept "take repeat readings".**
1 (d)	A large current will produce a heating effect ✓ This would mean that the temperature of the thermistor was not the same as the measured temperature (of the water) ✓	**2**	Do not accept "this would be dangerous" "Thermistor would overheat/be damaged" is worth 1 mark.

Stage 2	Section A	Mark	Additional guidance notes
1 (e)	Take temperature readings from the graph ✓ To check if the temperature increase required to halve the resistance is always the same ✓ **OR** Take resistance readings from the graph ✓ To check for a constant ratio with equal temperature changes ✓ **OR** Take readings and plot a graph of ln$R$ against θ ✓ Expect a straight line with a negative gradient ✓ **OR** Take two sets of values from the curve and use a logarithmic equation to find R_0 and a ✓ Check that a third point is consistent on the curve with these values ✓ **OR** Take more than two sets of values from the curve and use a logarithmic equation to find R_0 and a ✓ Check for consistency in these values✓	**2**	"take readings to check for constant half-life" is worth 1 mark
	Question Total	**11**	

Stage 2	Section B	Mark	Additional guidance notes
2(a)	<table><tr><td>318</td><td>3.145</td><td>3.43</td></tr><tr><td>333</td><td>3.003</td><td>3.18</td></tr></table> ✓	**1**	Exact answers only
2(b)	Both plotted correctly within ± 1 mm ✓ Best fit straight line drawn ✓	**2**	Allow ecf if values in 2(a) incorrect. The line should be a straight line that accurately reflects the trend and has an approximately equal number of points on either side.
2(c)	Large gradient triangle with points accurately <u>read</u> from the line ✓ Gradient in range (2.00 to 2.16) $\times 10^3$ (K) ✓	**2**	Smallest side of triangle at least 8 cm in length. 2 or 3 sf, but unit not required.
2(d)(i)	B = value from 2(c) ✓ K ✓	**2**	Same numerical value as in 2(c) with no sf penalty Independent mark for correct unit.
2(d)(ii)	Values for ln$R$ and 1/T taken from <u>a point on the line of best fit</u> and B from 2(d)(i) ✓ Substitution into $\ln R = B/T + \ln A$ ✓ Correct value for A with unit ✓	**3**	Expected amswer approximately 0.046 Ω No sf penalty but unit required.
2(d)(iii)	<u>Equation written</u> in the required form with p = candidate's value for A and q = candidate's value for B ✓	**1**	Ignore unit and sf
	Question Total	**11**	

Stage 2	Section B	Mark	Additional guidance notes
3(a)	ln*R* for $1/T = 3.69 \times 10^{-3}\ K^{-1}$ and for $1/T = 3.64 \times 10^{-3}\ K^{-1}$ read correctly from best-fit line ✓ Either value of *R* found correctly using the e^x function ✓ A resistance range found and divided by 4 ✓ Answer in the range 2.5 to 4.0 $\Omega\ K^{-1}$ ✓	**4**	No sf or unit penalty in the final answer. Allow ecf from ln*R* values in second and third marking points
3(b)	Comparison between 1.2 $\Omega\ K^{-1}$ and the candidate's answer to 3(a) ✓ Thermometer would be more sensitive to temperature changes at low temperatures ✓ Therefore better in winter than summer ✓	**3**	Allow ecf from 3(a) for second and third marking points
	Question Total	**7**	

Stage 2	Section B	Mark	Additional guidance notes
4(a)	Connect the leads from the thermistor to an ohm-meter ***OR*** Connect the thermistor in series with a power supply and an ammeter and in parallel with a voltmeter ✓ Find the resistance of the thermistor at the initial temperature, the final temperature and at least five more temperatures in between ✓ For each value of the resistance, read off the corresponding temperature from the calibration graph and record this together with the internal pressure ✓	**3**	The first mark can be awarded for a correct circuit diagram
4 (b)	Plot a graph of pressure on *y*-axis against temperature on *x*-axis. ✓ The intercept on the temperature axis will be absolute zero ✓	**2**	Either or both marks can be awarded for a clearly labelled sketch graph
	Question Total	**5**	