Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2011

Physics

Assessment Unit AS 3

Practical Techniques (Internal Assessment)

Session 1

[AY131]

THURSDAY 12 MAY, MORNING

MARK SCHEME

General Instructions for Internal Assessment

1 **Mark strictly according to this mark scheme.** Do not agonise over awarding "charity" or "benefit of doubt" marks. Give credit for numerical answers only if they are within the ranges indicated in this mark scheme. Remember, every script will be checked later to ensure that candidates are not disadvantaged.

2 Mark in **red** ball-point pen. For each correct point in the scheme you are rewarding, place a tick in the text of the script; for each incorrect point, place a cross. Then add up the ticks for each part of a question for which there is a sub-total in square brackets, and write this total in the "Teacher Mark" column to the right of the text. When you have finished marking a question, write the total for the question as a ringed mark at the beginning of the question and in the appropriate box on the front of the script.

3 In marking graphs you will have to exercise some professional judgment, but other features must be marked strictly according to the scheme. In labelling the axes, candidates should give the label/unit. The mark for "Scales" is normally awarded only if the plotted points occupy at least half of the printed graph along each axis. In addition, the scale must be to an easily manageable factor, such as 1:2, 1:4, 1:5, 1:10, 1:20. A factor of, for example, 10 mm to represent 30 cm does not score because of the difficulty of accurately plotting or reading off values.

The credit for plotting the points is, following the normal tariff, 2 marks for plotting 5 points correctly and 1 mark for plotting 4. "Correctly" means to within ± one small square (± 2 mm) on the printed grid in either *x*- or *y*-direction. The marker's professional judgment comes in here. One tick is to be awarded for drawing the best straight line through the points. Do not agonise over scoring (or not) this mark; your professional judgment will allow you to come to a decision very quickly.

In measuring the gradient, one mark is reserved for a "large triangle". This means that either rise or run (or both) must be at least 5 cm on the printed graph grid. Some candidates do not draw their triangle, but use points read off from the line. Provided the rise and/or run in this virtual triangle meet the 5 cm criterion, the mark is scored. Beware of candidates who read off their gradient points directly from a table. The marker must check that the points used actually **lie on the line** and meet the 5 cm test.

4 When you have finished marking the paper, add up the marks for the questions in the "Teacher Mark" column in the box on the front page of the booklet and enter the total. Check this total by adding up all the sub-total marks for parts of questions throughout the script (**not** the ringed total question marks). The totals arrived at in these two different ways should agree. If you cannot get agreement after a re-count, go back to counting the individual ticks throughout the text of the script.

Section A

			AVAILABLE MARKS
1	**(a)**	Heading + units [1] (must have timed *five* or more oscillations) Repeat [1] 10^n errors: Penalty [−1]; *T* values not increasing with *N*: Penalty [−1] *T* [1] (consistent with candidate's results) [3]	
	(b)	Eqn **(i)** [1] must be consistent with candidate's results As *N* increases, *T* increases [1] or appropriate calculations [2]	5
2	**(a)**	Three image distances decreasing in size ($u + v$ value given – 0 marks) Check at $u = 30\,\text{mm}$, $v \approx 30\,\text{mm}$ [1]	
	(b)	**(i)** Subs into Equation 2.1 [1] Value for *f* consistent with their *v* [1] [2]	
		(ii) Calculate *f* from each pair and average or graph *u* against *v* and *f* is (intercept)$^{-1}$ [1]	
		(iii) Judgement of sharpest image position [1]	5
3	**(a)**	micrometer + More accurate or precise for this measurement [1] Uncertainty = ±0.01 mm, consistent with instrument [1]	
	(b)	Thickness = supervisor's value ±0.05 mm (to 2 d.p.) d.p. consistent with instrument [1]	
	(c)	Diameter = supervisor's value ±0.3 mm (to 1 d.p.) [1]	
	(d)	Ratio = consistent calculation with candidate's values [1]	5
4	**(a)**	3 sets of *V* and *I* readings [1] *I* readings in sequence "middle", "lowest", "highest" [1] [2]	
	(b)	Values of R – consistent with candidates *V*, *I* values [1]	
	(c)	10 cm wire connected to Z Consistent with candidate's 15 cm wire connected to X R values 20 cm wire connected to Y [1]	
		Explanation: Resistance proportional to length **or** Longer wire greater resistance [1]	5

Section B

AVAILABLE MARKS

5 **(a)** Quotes $y = mx + c$ [1]
maps Equation 5.1 to $y = mx + c$ [1] [2]

(b)

$1/V_{out}/V^{-1}$	$1/R_1/\Omega^{-1}$
0.26	20×10^{-3}
0.17	10×10^{-3}
0.14	6.7×10^{-3}
0.13	5.0×10^{-3}
0.11	4.0×10^{-3}

(i) Headings + units [1]

(ii) I/V_{out} values [1]
$1/R_1$ values [1]
all to 2 sig. fig [1] [3]

(iii) Axes labelled [1] Penalise for wrong plots
Scales [1]
Points plotted [2]
([−1] each error, to a maximum of [−2])
Straight line [1] [5]

(c) **(i)** correct value of intercept [1]
Value of V_{in} between 11 and 14 V [1] [2]

(ii) Extreme fit line drawn [1]
New V_{in} value [1]
Difference in V_{in} values [1] [3]

(iii) Large triangle or values for gradient [1]
Consistent value for gradient [1]
Consistent R_2 value [1] from candidate's gradient
R_2 quality 100 Ω ± 30 Ω [1] [4]
R_2 evaluation using equation, penalty of [−1] for using a point **not** in the BFL

20

Total **40**