Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2013

Physics

Assessment Unit AS 3

assessing

Practical Techniques (Internal Assessment)

Session 1

[AY131]

TUESDAY 14 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 judgement, 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.

					AVAILABLE MARKS
1	**(a)**	Time for 10 oscillations repeated ⩾ 2 and averaged for both sets [1] Period calculated correctly in both cases [1] [2] Penalty [–1] **once** only **(a)** y not halved **(b)** y not in mm **(c)** separation measured **(d)** T ∝ y **(e)** clear timing error			
	(b)	**(i)** As y increases, T increases (or equivalent, e.g. T does not decrease as y increases/T does not halve when y doubles) [1]			
		(ii) No ticked – allow ECF from **(a)** [1] Appropriate calculation and explanation, e.g. T = ky and has proved k is not constant [1] [2]			5
2	**(a)**	29.7 (accept 29.6 – 29.8) 21.0 (accept 20.9 – 21.1) (Both to nearest mm) error ± 0.1 cm (accept ± 0.2 cm) Accept either value for length/breadth [1]			
	(b)	Works out both percentage uncertainties correctly ECF **(a)** [1] Adds together two **percentage** uncertainties (even if incorrect values) [1] Quotes consistent area from their values in **(a)** and actual uncertainty in area (from their percentage uncertainty) [1] [3] **or** Max (min) calculated [1] Difference found between Max (min) and most probable value [1] Quotes consistent area and uncertainty [1]			
	(c)	Use micrometer screw gauge or vernier calipers and several sheets of paper/fold paper several times, divide value by number of sheets [1]			5
3	**(a)**	3 values of current and voltage in correct columns [1]			
	(b)	P calculated correctly from candidate's I and V values [1]			
	(c)	Chooses the resistance corresponding to highest power output [1] THREE OPTIONS Option A • Sub into E = V + Ir, repeat and average [1] • Describes how E is obtained [1] **or** Option B • Take more results **around value** [1] • Plot graph of P against R, find resistance at peak of graph [1] **or** Option C • Take more results and plot graph of V v I [1] • r = – gradient [1] [3]			5

						AVAILABLE MARKS
4	**(a)**	Value for R recorded				
		Average Diameter 0.27 ± 0.02 mm (2 dp)		[1]		
		Average Length 30 ± 1 cm		[1]	[2]	
		Penalty of [–1] if readings not repeated – apply once only				
	(b)	Area consistent with candidate's d value		[1]		
		Resistivity value consistent with candidate's results	ECF* area	[2]	[3]	5
		Penalty of [–1] for 10^n error				
5	**(a)**	0.838, 1.05, 1.21, 1.34, 1.51				
		All 5 values correct			[2]	
		[–1] if not all to 3 sf				
	(b)	**(i)** $v^2 = \frac{P\lambda}{2\pi}$		[1]		
		Clear mapping to y = mx + c with intercept c = 0				
		or mapping to y = mx		[1]	[2]	
		(ii) Any correct alternative			[1]	
	(c)	**(i)** Column headed $v^2/m^2\ s^{-2}$			[1]	
		(ii) ecf from **(a)**				
		All values correct: 0.702, 1.10, 1.46, 1.80, 2.28			[2]	
		[–1] for each incorrect value				
		No sf penalty here				
		(iii) Axes labelled (Penalise for wrong plots)		[1]		
		Scales		[1]		
		Points plotted		[2]		
		[–1] each error, to a maximum of [–2]				
		Straight line		[1]	[5]	
	(d)	**(i)** Large triangle or values for gradient		[1]		
		Consistent value for gradient		[1]		
		Units consistent with graph axes		[1]	[3]	
		(ii) Equates gradient with $P/2\pi$ and calculates consistent value for P **or** correctly uses a point on BFL*		[1]		
		Quality P = 9.4 – 9.9		[1]	[2]	
		*Not using a point on BFL → [1] if in quality range				
	(e)	Straight line drawn on graph with steeper gradient through (0, 0)		[1]		
		Gradient of graph = candidate's value of P		[1]	[2]	20
					Total	**40**