## MARK SCHEME for the May/June 2011 question paper

## for the guidance of teachers

## 9702 PHYSICS

9702/35

Paper 3 (Advanced Practical Skills 1), maximum raw mark 40

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes must be read in conjunction with the question papers and the report on the examination.

• Cambridge will not enter into discussions or correspondence in connection with these mark schemes.

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	Page 2			Mark Scheme: Teachers' version	Syllabus	Paper
				GCE A LEVEL – May/June 2011	9702	35
1	(a) '	Valu	le of	$l_0$ with unit in range 1.5 cm $l_0$ 3.0 cm.		[1]
	(b) (i			e of $T$ with unit 20 s $T$ 5 s. ence of repeat times.		[1]
				of readings of $l$ and $T$ scores 4 marks, five sets score trend then $-1$ Help from supervisor $-1$ .	s 3 marks etc.	[4]
		Ran	ige : /	$\Delta x \ge 7 \text{ cm.}$		[1]
Column headings: Each column heading must contain a quantity and a unit w There must be some distinguishing mark between the quar e.g. $T/s$ , $x/cm$ .						[1]
		Prec	cisior	n of x from raw values of $l$ and $l_0$ .		[1]
		Che	ck va	alues of x the same as the least precision in $l$ or $l_0$ .		[1]
	(d)		Axes: [1] Sensible scales must be used. Awkward scales (e.g. $3:10$ ) are not allowed. Scales must be chosen so that the plotted points on the grid occupy at least half the graph grid in both <i>x</i> and <i>y</i> directions. Scales must be labelled with the quantity which is being plotted. Ignore units. Scale markings should not be more than three large squares apart.			
		Plotting of points: All observations in table must be plotted. Write a ringed total of plotted points ignoring any point off the grid. Check points plo correctly. Tick if correct. Re-plot if incorrect. Work to an accuracy of half a small squ Do not accept 'blobs' (points with diameter greater than half a small square).				small square.
			scatt	lity: oints in the table must be plotted (at least five) for this ter of all points about straight line. All points must be ght line. Indicate tolerance on graph. Indicate reason if	e within 4 mm to	scale from a
		. ,	Judg be a	of best fit: ge by the balance of all the points (at least five) abou n even distribution of points either side of the line alo awarded indicate rotation or direction of best fit line. Lir	ng the whole len	gth. If mark is
			The Read Cheo	dient: hypotenuse of the triangle must be at least half the lend d-offs must be accurate to half a small square. ck for $\Delta y/\Delta x$ (i.e. do not allow $\Delta x/\Delta y$ ). correct, write in the correct value(s).	ngth of the drawn	[1] line.
			Eithe	ercept: er: check correct read off from a point on the line and s d off must be accurate to half a small square. Allow ec	•	

Page 3		3	Mark Scheme: Teachers' version	Syllabus	Paper		
			GCE A LEVEL – May/June 2011	9702	35		
	Or: check read-off of intercept directly from graph.						
(			value of the candidate's gradient in sm <sup>-1</sup> , scm <sup>-1</sup> , smm value of the candidate's <i>y</i> -intercept in s.	1 <sup>–1</sup> , mm <sup>–1</sup> s.	[1]		
(			x (10 – 100 cm) with consistent unit when $T = 75$ s. method seen.		[1]		
					[Total: 20]		
2 (			ement of <i>d</i> to nearest 0.01 mm with consistent unit. e of repeat readings.		[1]		
(	c) (ii)	Valu	ue of <i>h</i> in the range 9 cm – 11 cm with unit.		[1]		
(	d) (ii)	Valu	the of x in the range 1 cm $-$ 5 cm to the nearest mm with	า unit.	[1]		
	(iii)	Valu	ue of $y = x - (10 \pm 2)$ mm.		[1]		
(			e uncertainty in $y$ in range 2 – 5 mm (or half the range c calculation to get percentage uncertainty.	of repeated readi	ngs). [1]		
(	<b>f)</b> Se	econd	value of <i>d</i> < <b>(a)</b> .		[1]		
	Se	econd	value of <i>x</i> .		[1]		
	Q	uality :	second value of $y >$ first value of $y$ .		[1]		
(	g) (i)	Valu	ues of <i>k</i> calculated correctly.		[1]		
	(ii)		sible comment relating to the calculated values of prion.	k, testing again	st a specified [1]		
	(iii)	Just	ification of s.f. in <i>k</i> linked to least s.f. in <i>d</i> and <i>y</i> or <i>x</i> .		[1]		

Page 4	Mark Scheme: Teachers' version	Syllabus	Paper
	GCE A LEVEL – May/June 2011	9702	35

## (h)

	(i) Limitations 4 max		(iii) Improvemente <b>A max</b>	Do not credit
_			(ii) Improvements 4 max	
Ap	Two readings (of <i>d</i> and <i>l</i> ) not enough/ only two readings/too few readings.	As	Take more readings <u>and plot a</u> <u>graph</u> /more values of <i>k</i> (and compare).	Take more readings and calculate average <i>k</i> / only one reading.
B <sub>p</sub>	Maintaining <u>h</u> constant.	Bs	Clamp mass hanger/specified release mechanism/hold against fixed pointer.	
Cp	Explain difficulty in getting measurement of x/depth accurately with finger/position of finger and line may not be in line.	Cs	Put mark <u>on rod</u> /use a clip/ measure rod out of sand with scale or ruler/scale marked on ruler/draw mark all the way round.	
D <sub>p</sub>	Rod falls sideways/not entering sand vertically.	Ds	Practical method to keep rod vertical e.g. guide for rod.	
Ep	Cannot see if mass is directly above rod.	Es	Practical method to ensure centralisation of mass e.g. guide for mass.	Do not credit use of computers, assistants, dataloggers.
Fp	Depth/x very small	Fs	Increase height/mass	
X <sub>p</sub>	Specific problem candidate encountered e.g. uniformity of sand.	X <sub>s</sub>	e.g. solution to specific problem candidate encountered.	Ignore uneven surface.

[Total: 20]