MARK SCHEME for the May/June 2012 question paper

for the guidance of teachers

9702 PHYSICS

9702/33

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 AS/A LEVEL – May/June 2012	9702	33		
1	(a) (ii)	Valu	ie of h_0 in range 0.70 m > h_0 > 0.50 m. Consistent with ur	nit.	[1]		
	(b) (iii)	Valu	ie of <i>h,</i> less than <i>h</i> ₀ in (a)(ii) , with unit.		[1]		
		 (c) Five sets of readings of <i>h</i> and <i>m</i> scores 5 marks, four sets scores 4 marks etc. Major help from Supervisor –2 (setting up apparatus). Minor help from Supervisor –1. [5] 					
		nge o incluc	f <i>m</i> : de 0.350 kg.		[1]		
	Eac The	ch col e unit	headings: umn heading must contain a quantity and a unit. must conform to accepted scientific convention e. $m / m kg^{-1}$, 1/m / kg ⁻¹	g. <i>m /</i> kg, <i>m</i> (kg	[1]) or <i>m</i> in kg,		
		nsiste value	ency: s of <i>h</i> must be given to the nearest mm.		[1]		
	Sig		nt figures: nt figures for every row of values of 1/ <i>m</i> same as or or ble.	ne greater than	[1] <i>m</i> as recorded		
		lculati lues o	on: f $(h_0 - h)/m$ calculated correctly.		[1]		
	(d) (i)	Sen Scal both Scal	s: sible scales must be used, no awkward scales (e.g. 3: les must be chosen so that the plotted points occupy a <i>x</i> and <i>y</i> directions. les must be labelled with the quantity that is being plott le markings must be no more than 3 large squares apa	at least half the	[1] e graph grid in		
		All o Diar	ting of points: bservations in the table must be plotted. neter of plots must be ≤ half a small square (no 'blobs') k to an accuracy of half a small square.).	[1]		
			lity: points in the table must be plotted (at least 4) for this n ts must be less than 0.5 kg ⁻¹ (0.0005 g ⁻¹) of 1/ <i>m</i> of a s		[1] ded. Scatter of		
	(ii)	Judą Thei Allov	of best fit: ge by balance of all points on the grid about the candid re must be an even distribution of points either side of w one anomalous point only if clearly indicated by the o must not be kinked or thicker than half a small square	the line along the candidate.			
	(iii)	The Both	dient: hypotenuse of the triangle must be at least half the len n read-offs must be accurate to half a small square in b not allow $\Delta x / \Delta y$.	-			

	Page 3	3	Mark Scheme: Teachers' version	Syllabus	Paper
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	y-intercept: Either: Check correct read off from a point on the line and substituted into $y = mx$ Read off must be accurate to half a small square in both x and y directions Or: Check read-off of the intercept directly from the graph.				
	(e) Val	ue of <i>l</i>	P = candidate's gradient. Value of Q = candidate's inte	ercept.	[1]
	Unit for <i>P</i> (e.g. m) consistent with value, and <i>Q</i> (m kg ^{-1})				[1]
					[Total: 20]
2	(b) (ii)	Value	e of θ_0 to the nearest degree or 0.5° in range 70° # θ $=$	∉ 80°	[1]
	(iii)	Value	e of θ with unit, $\theta < \theta_0$		[1]
	(iv)	Corre	ect calculation of $(\theta_0 - \theta)$		[1]
	(c) (i)	Value	e of raw <i>d</i> with unit to nearest mm.		[1]
	(ii) Absolute uncertainty in 2 mm < d < 5 mm. If repeated readings have been taken, then the absolute uncertainty can l range. Correct method shown to find the percentage uncertainty.		[1] n be half the		
	 (d) Second value of θ₀ within 1 °C of first value of θ₀. Second value of θ. Second value of Δθ > first value of Δθ (check second value of d > first value of d). Evidence of repeat readings of d here or in (c)(i). 		[1] [1] 1). [1] [1]		
	(e) (i)	Two	values of <i>k</i> calculated correctly.		[1]
	(ii)	Justif	fication of s.f. in <i>k</i> linked to <u>significant figures</u> in <i>d</i> and	$\Delta \theta$.	[1]
	(iii)		ible comment relating to the calculated values of ified by the candidate.	<i>k</i> , testing agair	ist a criterion [1]

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(f)

	(i) Limitations 4 max.	(ii) Improvements 4 max.	No credit/not enough
A	two results not enough	take more readings <u>and plot a graph/</u> calculate more <i>k</i> values and <u>compare</u>	'repeat readings' on its own/ few readings/ take more readings and (calculate) average k/ only one reading
В	heat lost <u>through sides and /or</u> <u>bottom</u>	method to reduce heat loss/ lag/ insulate/ polystyrene container	use of lid/ heat loss in warming bowl/cup/ draughts/ heat loss to surroundings
С	temperature change is small/ $\Delta \theta$ values too close	time for longer/ higher starting temperature/ greater range of surface areas	
D	large (percentage) uncertainty in $\Delta \theta$	use thermometer with greater sensitivity or precision/ use thermometer that can read to 0.1 °C	use more accurate thermometer/ thermometer not precise enough/ not just 'digital thermometer'
E	water in bowl barely covers (bulb of) thermometer	use larger volume of water/ use of thermocouple/ other <u>small</u> temperature <u>sensor</u> (e.g. probe)	not just 'digital thermometer' any reference to stirrer/ non-uniform temperature/ thermometer touching base
F	parallax error in measuring <u>d</u> / reason for difficulty in access in measuring <u>d</u>	use dividers/calipers	string measurements to measure <i>d</i>
G	difficult to mark level with reason	method of making mark stay e.g. depth gauge/ calibrated marks/ marker on outside	

Do not allow: use of coloured ink/reaction time/fans/draughts/water left behind/beakers not accurate/ helpers.

[Total: 20]