UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the May/June 2009 question paper for the guidance of teachers

9702 PHYSICS

9702/31

Paper 31 (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.

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- 1	age z	GCE A/AS LEVEL – May/June 2009	9702	31				
1 (b)	One Inco	esurements e mark for each set of readings for different $R_{\text{total }47\Omega}$. orrect trend -1 (wrong trend is $R \uparrow I \uparrow$ / negative gradier		[6]				
		more incorrect values of <i>R</i> –1. earatus setup correctly without help from supervisor.		[1]				
	• •	age of R : to include (12 / 16 Ω) and (71 / 94 Ω) and (141	/ 188 O)	[1]				
	Column headings (R/Ω , I/A , $1/I/A^{-1}$). Must have R and $1/I$ columns. Each column heading must contain a quantity and a unit where appropriate. Ignore units in the body of the table. Do not accept $1/I/A$ or $1/I/A$. There must be some distinguishing mark between the quantity and the unit (i.e. solidus is expected I/A , but accept, for example, I/A).							
	Consistency of presentation of \underline{raw} readings. All values of raw I must be given to the same number of decimal places. Ignore converted current columns. If trailing zeros consistency = 0. If current same consistency = 0.							
	_	nificant figures		[1]				
	If ra	ly to $1/I$. w I is given to 2 sf, then accept $1/I$ to 2 or 3 sf. w I is given to 3 sf, then accept $1/I$ to 3 or 4 sf. w I is given to 4 sf, then accept $1/I$ to 4 or 5 sf.						
		ues of $1/I$ correct. Underline and check a value for $1/I$ at correct, write in the correct value.	R = lowest value.	[1]				
(c)	(i)	(Graph) Axes. Sensible scales must be used. Awkward scales Scales must be chosen so that the plotted points must the graph grid in both <i>x</i> and <i>y</i> directions. Indicate false Scales must be labelled with the quantity which is being	occupy at least half origin with FO.					
		All observations must be plotted. Do not accept blobs Ring and check a suspect plot. Tick if correct. Re-plot Work to an accuracy of half a small square.		e). [1]				
		Line of best fit. Judge by scatter of points about the ca There must be a fair scatter of points either side of the 5 trend points. No kinked lines.		[1]				
		Quality. Judge by scatter of all points. All table values Min 6 needed If wrong trond Q = 0. If any plot out by 10 Q from even	·					
	(:::)	If wrong trend Q = 0. If any plot out by 10 Ω from exam	mers line Q = 0.	[1]				
	(ii)	Gradient The hypotenuse of the Δ must be equal to or greated drawn line. Read-offs must be accurate to half a small scheck for $\Delta y/\Delta x$ (i.e. do not allow $\Delta x/\Delta y$).	_	[1] th of the				
		<i>y</i> -intercept from graph or substitute correct read-offs in Penalise for incorrect algebra. Label FO.	y = mx + c.	[1]				

Mark Scheme: Teachers' version

Syllabus

Paper

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Page 3		Mark Scheme: Teachers' version	Syllabus	Paper
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(d) Co	rrect r	method for finding P and Q . $m = 1/P$. $c = Q/P$		
P		method needed. Value for P and Q . Ignore negative s $-$ 5.0 V (or $A\Omega$). Q = 50 $-$ 150 Ω (or V/A) (Res AE.	_	required.
				[Total: 2
		same, Measurements = 5 max, Consistency = 0, Axe by = 0, $1/I$ calculation = 0, SF = 0. Allow CH mark on c		
(a) (ii)		w reference to measuring cylinder and consistent numerence to precision of measuring cylinder . Consisten	_	•
(b) (i)	All ra	aw heights to nearest mm. (heights < 30.0 cm)		
(ii)	θ < 9	90°		1
(iii)	If rep	centage uncertainty in θ . $\Delta\theta=2-5^{\circ}$. Deated readings have been done then the uncertainty ect ratio idea required. $\Delta\theta\theta$ (×100%) (×100% can be in		ange.
(c) Me	easure	ment of 2 nd height less than first height.		
Me	easure	ment of $2^{ ext{nd}}$ raw $ heta$ (any value) to nearest degree or half	a degree	I
Me	easure	ment of 2 nd volume		1
(c)/(b)(ii) E	vidence of repeats in angle measurement		I
	θ_0	$(b)(ii) > \theta_{(c)}$		I
(c), (b)	(iv) ∨	folume in (c) half of volume in (b)(iv) . $0.4 \le V_c / V_b \le 0$.	6.	
(d) Co On	orrect one	calculation to check inverse proportionality. $\sqrt{h} \times \cos \theta$ nerical check: check $2^{\rm nd}$ value if available.	9 = k	1

Special case: If 2^{nd} Volume $\frac{3}{4}$ and not $\frac{1}{4}$ full, then 2^{nd} Vol = 0 and allow for 2^{nd} height and 2^{nd} angle greater than the first height and first angle respectively.

If incorrect ideas or no ratio then conclusion = 0.

Conclusion. Sensible comments relating to calculations to within 20% or their own value and suggested relation. Allow ecf in conclusion if arithmetical error in calculation.

[1]

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(e)(i) and (ii)

Sources of error or limitation. [4]		Improvements. Use of other apparatus or different procedures. [4]		
Ap	Two readings are not enough (to draw a valid conclusion).	As	Take many (sets of) readings <u>and plot a</u> <u>graph</u> of the results. Be clear NOT just repeat readings.	
Bp	Parallax error in measuring h/θ .	Bs	Get eye level/'eye level' perpendicular (to protractor lines, ruler scale or meniscus). Put scale onto bottle.	
Cp	Difficult to measure height owing to refraction/shape of bottle/thickness of bottom not taken into account/ruler does not start at zero/cannot see meniscus clearly.	Cs	Add dye/use ruler with a zero at the start.	
Dp	Difficulty in deciding the toppling point.	D _s	Move by increments/hold with newtonmeter and tilt until F = 0/bottle on tilting ramp idea.	
Ep	Difficulty in measuring θ owing to container not perfectly right angled (curved) at the bottom/difficult to line up protractor/horizontal line of protractor not on table/difficult to manipulate bottle and measure angle/flexible container/shape of bottle.	Es	Make bottom square with plasticine/use protractor with horizontal line flush to table top/freestanding or clamped protractor.	

[Total: 20]

No reference to light gates, motion sensors, video, reaction time, volume measurements, pointers, changing bottle, repeat readings, calipers or movement of container.