## MARK SCHEME for the October/November 2009 question paper

## for the guidance of teachers

## 9702 PHYSICS

9702/32

Paper 32 (Advanced Practical Skills 2), 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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UNIVERSITY of CAMBRIDGE International Examinations

	Page 2				Syllabus	Paper
				GCE A/AS LEVEL – October/November 2009	9702	32
1	(a)	First value for <i>h</i> to nearest mm				[1]
	(b)	<ul> <li>Measurements table</li> <li>Four marks for six sets of readings for <i>m</i> and <i>h</i>,</li> <li>three for five sets, etc. (-1 if trend is positive, -1 if help from supervisor)</li> </ul>			[4]	
		Values of $m$ must be $\ge 10$ g and $\le 100$ g. Values must include 10 or 20 g and 90 or 100 with no interval greater than 20 g.				[1] nd 90 or 100g
						[1] (i.e. solidus is
		Table – consistency of presentation of raw readings All values of <i>h</i> must be given to the same number of decimal places.			[1]	
	(c)	<ul> <li>(c) (i) (Graph) Axes –</li> <li>Sensible scales must be used. Awkward scales (e.g. 3:10) are not allowed.</li> <li>Scales must be chosen so that the plotted points occupy at least half the graph grid both <i>x</i> and <i>y</i> directions.</li> <li>Scales must be labelled with the quantity which is being plotted. Ignore units.</li> <li>Allow reversed axes but do not allow wrong graph.</li> <li>Gaps between labels must not be greater than three large squares.</li> </ul>			aph grid in	
		/ F ł	All ol Ring half a	ph) Plotting – bservations must be plotted. and check a suspect plot. Tick if correct. Re-plot if inc a small square from the correct position). ot allow plots with diameter greater than half a small s		[1] is more than
		-	Judg Ther	ph) Line of best fit – le by scatter of at least 5 trend plots about the candida e must be a fair scatter of points either side of the line late best line if candidate's line is not the best line.		[1]
			Judg All po strai	ph) Quality of results – le by scatter of points about a best fit line oints in the table (which must be at least 5) must be wi ght line. ot award if wrong trend.	ithin 0.5 ' <i>h</i> -scale	[1] cm' of a
		• •		lient – hypotenuse must be at least half the length of the drav	wn line.	[1]
		(	corre Cheo	d-offs must be no more than half a small square from ect value). ck for $\Delta y / \Delta x$ . ck value is consistent with trend.	n the line (if inco	orrect, write in [1]

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(d) (i)	Measurement – value for raw $d$ in range 18.00 to 27.00 mm (or SV ±2.00 mm) given to nearest 0.1 mm or nearest 0.01 mm. Unit must be given.	, and [1]
	Measurement – repeated readings for <i>d</i> .	[1]
(ii)	A calculated correctly. Allow ecf. Check value. Penalise power of ten error. If incorrect, write in the correct value.	[1]
	S.f. in A the same as or one more than the s.f. in raw d.	[1]
Pe Va Igr	radient value from <b>(c)(ii)</b> equated to $-(k+\rho Ag)$ . Allow ecf. enalise sign error. alue for <i>k</i> in range 3.50 to 6.49 Nm <sup>-1</sup> (or SV ±30%). nore sign. Unit required. to not award this mark if the gradient has not been used.	[1] [1]
		[Total: 20]

	Page 4		l I	Mark Scheme: Teachers' version	Syllabus	Paper
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2	(a)			<i>l</i> , with unit, to nearest mm. p, then –1.		[1]
	(b)	(i)	First	value of <i>a</i> (< 25 cm)		[1]
		(ii)	First	value of <i>b</i> (less than <i>a</i> )		[1]
	(c)	(i)	Plac	named item as marker for rebound distance/ e ruler under path and view vertically from above/ second brick as releasing point.		[1]
		(ii)	lf re othe	centage uncertainty in <i>b</i> peated readings have been done then the uncerta rwise absolute uncertainty must be at least 2 mm and r ect ratio idea required.		
	(d)	Firs	st valu	ue of <i>k</i> substitution correct and value <1. There must b	e no unit.	[1]
		S.f.	in va	lue of $k$ – must be 2 or 3 s.f. (but allow 4 s.f. if <u>all</u> raw o	lata is to 3 s.f.)	[1]
	(e)	Second values of <i>a</i> and <i>b</i> .		[1]		
		Evi	dence	e of repeat readings for first or second value of <i>b</i>		[1]
		Sec	cond	value of <i>b</i> shows correct trend.		[1]
	(f)	Cal	culati	on of % difference (or equivalent) in <i>k</i> values.		[1]

Valid conclusion based on the two values of k (e.g. k is constant because values close), consistent with 20% difference as border between 'close' and 'not close' unless candidate has defined his own % difference. [1]

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## (g) Identifying limitations and improvements

	(g) (i) Difficulties (one from each box – max. 4)	(g) (ii) Improvements (one from each box – max. 4)	But <u>not</u>
А	Two sets of readings not enough.	Take more readings and plot a graph / calculate more <i>k</i> values.	Repeated readings.
В	Difficult to judge rebound point/distance <u>because</u> of movement / short static time.	Use video with slow playback / use position sensor to measure rebound / use sound of ball striking a block to judge rebound / use lightgate and refine its position.	Use computer or data logger / attach pointer to ball / change length of string / time rebound instead of measuring.
С	Difficult to release without exerting a force/movement.	Named, <u>realistic</u> method of release without a force (e.g. remote-controlled clamp).	
D	Parallax error in measuring rebound distance.	Observe shadow on screen.	View at eye level.
E	Inconsistent bounce / ball bounces at an angle.	Use smoother brick.	Use heavier ball.
F	Motion affected by air movement / ball swings around.	Turn off fans or air con / shield from draughts.	Air resistance / carry out in vacuum / constraining guides.
G	When measuring <i>l</i> it is difficult to judge centre of ball.	Suitable method for measuring diameter of ball.	

[8]

[Total: 20]