## UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

## MARK SCHEME for the October/November 2010 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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-	J -		GCE AS/A LEVEL – October/November 2010	9702	31
(a)	(i)	No h	nelp from Supervisor.		[1]
	(ii)	Valu	ies of a and b with consistent units to the nearest mm.		[1]
(b)	Inco	orrect	of readings of $a$ , $b$ and $R$ scores 5 marks, five sets sco trend then $-1$ . Correct trend $b/a$ increases, $R$ increase $p$ from supervisor $-1$ .		[5]
	Rar	nge: ι	used $R$ = 8000 $\Omega$ or 7000 $\Omega$ .		[1]
	Column headings ( $R/\Omega$ , $a/m$ , $b/m$ , $b/a$ ). Must have $R$ and either $b/a$ or $a$ and $b$ columns. Each column heading must contain a quantity and a unit where appropriate. Ignore any units in the body of the table. There must be some distinguishing mark between the quantity and the unit (solidus is expected but accept, for example, $R$ ( $\Omega$ ).				[1] colidus is
			ency of presentation of readings. s of raw <i>a</i> and <i>b</i> must be given to the nearest mm.		[1]
	Significant figures. Significant figures for $b/a$ must be the same as, or one more than, the least number o s.f. used in $a$ or $b$ .				[1] umber of
	Cor	rect o	calculation of <i>b/a</i> .		[1]
(c)	(i)	Scal grid Scal	s: sible scales must be used. No awkward scales (e.g. 3: les must be chosen so that the plotted points occupy in both <i>x</i> and <i>y</i> directions. les must be labelled with the quantity which is being plo le markings should be no more than three large square	vat least half thotted. Ignore un	
		Write Ring Wor	observations must be plotted. Ignore any plot off the gripe a ringed total of plotted points.  Ig and check a suspect point.  It to an accuracy of half a small square.  Inot accept blobs (points with diameter > 0.5 small squa		[1]
	(ii)	Judo Theo leng	of best fit. ge by balance of at least 5 trend points about candidate re must be an even distribution of points either side of th. must not be kinked. Do not allow lines thicker than ha	of the line along	
			lity. Iter of points must be less than $\pm$ 200 $\Omega$ in the $R$ – axis points in the table must be plotted (at least 5) for this materials.	•	
	(iii)	The	dient. hypotenuse of the triangle must be at least half the len read-offs must be accurate to half a small square.	gth of the drawr	[1] n line.

Mark Scheme: Teachers' version

**Syllabus** 

Paper

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(d) Gradient = 
$$\frac{1}{X}$$
 [1]

Value of X in range 3000–3600  $\Omega$  with unit.

(e) 
$$\frac{b}{a} = 1$$
 [1]

Correct reading off graph.

[Total: 20]

[1]

- **2** (c) (ii) Measurement of h to nearest mm with consistent unit. 0.900 m < h < 1.100 m [1]
  - (d) (ii) Value of  $m_A m_B = 20$  g with consistent unit. [1]
    - (iii) Value of t with unit. t < 5 seconds [1]
      - Evidence of repeated measurements of *t*. [1]
  - (e) Absolute uncertainty in *t* in range 0.1–0.6 s. [1] If repeated readings have been taken, then the uncertainty can be half the range.
    - Correct method of calculation to get percentage uncertainty. [1]
  - (f) Second value of  $m_A m_B = 40 \text{ g}$  [1]
    - Second value of t. [1]
    - Quality: second value of t < first value of t. [1]
  - (g) (i) Values of *k* calculated correctly. [1]
    - (ii) Justification of sf in k linked t and  $(m_A m_B)$  or  $m_A$  and  $m_B$  or masses. [1]
    - (iii) Valid conclusion based on the calculated values of *k*. [1] Candidate must test against a stated criterion.

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## (h) Identifying limitations marks and suggesting improvements

(i)	Limitations [4]	(ii)	Improvements [4]	Do not credit
Ap	Two readings are not enough (to draw a conclusion)	As	Take more readings <u>and</u> plot a graph/calculate more values of <i>k</i> .	One reading/few readings/take more readings and average.
Bp	Masses hit each other/ masses slipping off.	Bs	Use larger pulley/method of securing masses to hanger.	
Cp	Uncertain starting position	Cs	Method of fixing rule e.g. clamp rule/electromagnetic release mechanism	
Dp	Difficult to measure time as time short/reaction time large compared with time.	Ds	Drop through greater height/ expand on trap door mechanism/ light gate with timer/motion sensor with data logger/video timer with timer.	
Ep	Friction at pulley	Es	Lubricate pulley	Friction between pulley and string
Fp	Retort stand moves	Fs	Method of fixing to the bench e.g. clamp/add weights	
Gp	Mass (values) not accurate	Gs	Use balance/method of measuring mass	

Do not credit parallax error.

[Total: 20]