

## PHYSICS

9702/34 May/June 2016

Paper 3 Advanced Practical Skills 2 MARK SCHEME Maximum Mark: 40

Published

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International Examinations

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1	(b) (ii)	$0.9V_{\rm S}$ calculated correctly and to the same number of s.f. as, or one the s.f. of $V_{\rm S}$ in <b>(b)(i)</b> .	e more than	, [1]
	(c) (ii)	Value for <i>t</i> in range 1.0s to 9.0s.		[1]
	(d) (ii)	Six sets of values for $V_{\rm C}$ and $t$ with correct trend scores 5 marks, five sets scores 4 marks etc. Minor help from supervisor –1, major help from supervisor –2.		es [5]
		Range: Range of values to include $V_{\rm C} \le 3.0$ V and $V_{\rm C} \ge 8.0$ V.		[1]
		Column headings: Each column heading must contain a quantity and an appropriate unit. The presentation of quantity and unit must conform to accepted scientific convention e.g. $V_{\rm C}/{\rm V}$ or $V_{\rm C}$ (V).		
		Consistency: All values of <i>t</i> must be given to the nearest 0.1 s, or all to the neares	st 0.01 s.	[1]
	(e) (i)	<ul> <li>Axes: Sensible scales must be used. Awkward scales (e.g. 3:10) are not allowed. Scales must be chosen so that the plotted points occupy at least half the graph of in both x and y directions. Scales must be labelled with the quantity that is being plotted. Scale markings must be no more than three large squares apart.</li> </ul>		[1] 1 grid
		Plotting of points: All observations in the table must be plotted on the grid. Diameter of plotted points must be ≤ half a small square (no "blobs" Plotted points must be accurate to half a small square.	').	[1]
	(ii)	Line of best fit: Judge by balance of all points on the grid about the candidate's curve points). There must be an even distribution of points either side of to the full length. Allow one anomalous point only if clearly indicated by the candidate Line must not be kinked or thicker than half a small square.	the curve a	
	(f) (ii)	Tangent drawn at $V_c = 0.5 V_s$ .		

(f) (ii) Tangent drawn at  $V_{\rm C} = 0.5 V_{\rm S}$ . Tangent must touch curve at the candidate's value of  $0.5 V_{\rm S}$  from (f)(i). [1]

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	(iii)	Gradient: The hypotenuse of the triangle used must be greater than half the le drawn line. The method of calculation must be correct. Both read-offs must be accurate to half a small square in both <i>x</i> and	-	[1] s.
		<i>y</i> -intercept: Either: Correct read-off from a point on the tangent is substituted into <i>y</i> = <i>n</i>		[1]
		Read-offs must be accurate to half a small square in both <i>x</i> and <i>y</i> d Or:	lirections.	
		Intercept read off directly from the graph (accurate to half a small se	quare).	
	<b>(g)</b> Va	lue of <i>a</i> = candidate's gradient and value of <i>b</i> = candidate's intercept		[1]
	Co	rrect units for $a$ (e.g. Vs <sup>-1</sup> ) and $b$ (s).		[1]
	<b>(h)</b> Co	rrect calculation of <i>T</i> .		[1]
	Qu	ality: $T$ in the range 8.0 s to 14.0 s, with consistent unit.		[1]
2	<b>(a)</b> dii	n the range 0.5mm to 0.9mm, to nearest 0.1mm or to 0.01mm, with	unit.	[1]
	(b) (iii)	Value for $x$ in the range 11–19 mm, with unit.		[1]
		Evidence of repeat readings of <i>x</i> .		[1]
	ĺfr	solute uncertainty in $x$ in range 2 mm to 5 mm. epeated readings have been taken, then the uncertainty can be half t it not zero) if the working is clearly shown.	the range	
		rrect method of calculation to obtain percentage uncertainty.		[1]
	(e) (ii)	$h_1$ recorded to nearest mm, with consistent unit.		[1]
	(iv)	Correct calculation of <i>k</i> to the number of s.f. given by the candidate	).	[1]
		Value of <i>k</i> given to the same number of s.f. as, or one more than, th s.f. in $(h_1 - h_2)$ or <i>m</i> , whichever is lower.	he number o	f [1]
	(f) Se	cond values of <i>x</i> and <i>n</i> .		[1]
	Se	cond values of $h_1$ and $h_2$ .		[1]
	Qu	ality: Value of $(h_1 - h_2)$ for smaller x less than the value of $(h_1 - h_2)$ for	or larger <i>x</i> .	[1]

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<sup>(</sup>g) (i) Two values of *c* calculated correctly.

(ii) Valid comment consistent with the calculated values of *c*, testing against a criterion specified by the candidate.

[	1	]	

[1]

(h)	(i) Limitations [4]	(ii) Improvements [4]	Do not credit
A	Two readings are not enough to draw a conclusion	Take more readings and plot graph/ take more readings and compare <i>c</i> values	Repeat readings/ few readings/ only one reading /not enough readings for accurate value
В	<i>d</i> is small/ large (percentage) uncertainty in <i>d</i>	Use a micrometer (to measure diameter)	Digital calipers
С	<i>n</i> not an integer	Estimate <i>n</i> to the nearest ¼ turn	
D	Diameter not constant/ coils vary in diameter/ coils not equally spaced/ coils not circular	Method of making equally- spaced coils e.g. make small marks/grooves on wooden rod Use motor to wind spring by rotating rod	Spring not straight Use 'factory' spring
E	Difficult to measure diameter ( <i>x</i> ) with reason e.g. calipers distort coils/end of coil gets in the way of ruler	Use thin ruler/graph paper placed between loops of spring	
F	<i>h</i> ₁ – <i>h</i> ₂ small, so <u>uncertainty</u> <u>large</u>	Use larger mass/larger range of masses Travelling microscope with reference to $h_1 - h_2$ Use wires of longer length to increase $h_1 - h_2$	