

# GCE 2005

## *January Series*



# Mark Scheme

## Physics Specification B

### PHB3 Practical Examination

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Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

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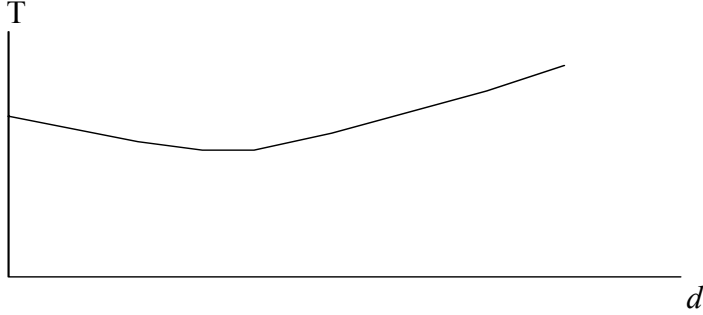
## PHB3 Practical Examination

### Question 1

(a)	$h = 50.0 \pm 0.5$ cm, given to nearest mm with unit	<b>B1</b>	<b>1</b>
(b)	five reasonable values for $y$ (typically 30..40 cm) five reasonable values for $x$ ( $x < y$ ) (typically 5..25.cm) award 1 mark if only four values in each column	<b>B1</b> <b>B1</b>	<b>2</b>
(c)	(i) <b>either</b> calculated correctly, 2 or 3 sf in metres	<b>B1</b>	<b>1</b>
	(ii) Method: $\frac{1}{2}$ x range <b>OR</b> $(\frac{1}{5})$ x range <b>OR</b> $\frac{1}{2}$ x range without highest and lowest <b>OR</b> $(\frac{1}{3})$ x range without highest and lowest Reasonable answer for <b>each</b> ( $\pm$ ), unit, 1 or 2sf for <b>both</b> (% is a T/O)	<b>C1</b> <b>M1</b> <b>A1</b>	<b>3</b>
(d)	(i) Correct calculation Any numerical answer with a <b>valid energy unit</b>	<b>C1</b> <b>B1</b>	<b>2</b>
	(ii) $\delta(\Delta h)$ = sum of absolute uncertainties Add % uncertainties <b>OR</b> upper and lower bounds calculated without $\delta m$ and/or $\delta g$ <b>OR</b> upper and lower bounds calculated with $\delta m$ and $\delta g$ <b>AND</b> correct answer in the form ( $\pm$ ) e % with 1 or 2 sf	<b>C1</b> <b>C1</b> <b>C1</b> <b>C2</b> <b>B1</b>	<b>3</b>
(e)	(i) As $h$ increases so will $X/X$ proportional to $h$ /accept good sketch graph because the ball will have more momentum/K.E. (on rebound) The ratio $X/h$ remains constant because the proportional energy loss is constant For large values of $h$ , $X$ will be constant (accept good sketch graph) since the ball will reach its terminal velocity	<b>M1</b> <b>A1</b> <b>M1</b> <b>A1</b> <b>M1</b> <b>A1</b>	<b>Max 2</b>
	(ii) Mention of a reasonable technique for improving the accuracy of measurement of the rebound height (e.g. photography) <b>Good</b> further detail of this method Plus <b>up to three</b> of the following: Drop the ball from at least 5 different heights Within a range (may be implied) of at least 0.5 m Minimum drop height $\geq 20$ cm For each height calculate $E$ and use the formula to find $Q$ Plot a graph of $Q$ against $h$ or $1/h$ <b>Another</b> good experimental point ( <b>not repeats and averages</b> )	<b>M1</b> <b>A1</b> <b>B1</b> <b>B1</b> <b>B1</b> <b>B1</b> <b>B1</b> <b>B1</b> <b>B1</b>	<b>Max 4</b>

	Accurate use of physics terminology + fluent description + good spelling, punctuation and grammar + at least <b>3 marks for physics</b>	<b>2</b>	
<b>Or</b>	Good physics but poor QWC Good QWC but only <b>1 or 2 marks for physics</b>	<b>1</b>	
	No marks for physics/very poor QWC	<b>0</b>	<b>6</b>
			<b>Total 20 Marks</b>

**Question 2**

(a)	(i)	At least 10 oscillations timed <i>in total</i> At least one repeat reading Answer in range 0.735 .. 0.804 s, 2 or 3 sf, unit, <i>or centre value <math>\pm 0.02</math></i>	<b>B1</b> <b>B1</b> <b>B1</b>	<b>3</b>
	(ii)	Answer in range 19.8 .. 20.2 cm, 3 sf, unit	<b>B1</b>	<b>1</b>
(b)		Answer in the range 0.635 .. 0.704 s <i>or centre value <math>\pm 0.02</math></i> Answer in the range 0.655 .. 0.684 s <i>or centre value <math>\pm 0.01</math></i>	<b>B1</b> <b>B1</b>	<b>2</b>
(c)		New side of triangle recorded as $15.0 \pm 0.05$ cm, 2 or 3 sf Calculation of $T^2$ for both readings Two results correctly stated Clearly stated consistent conclusion	<b>B1</b> <b>M1</b> <b>M1</b> <b>A1</b>	<b>4</b>
(d)	(i)	Reasonable value for $T_B$ ( <i>less than in part (b)</i> ) with unit	<b>B1</b>	<b>1</b>
	(ii)	Reasonable value for $T_C$ ( <i>greater than <math>T_B</math></i> )	<b>B1</b>	<b>1</b>
(e)				
		Plotted point on T axis = answer to part (b) Line slopes down at first to about $d = 3$ or 4 Line curves upwards to a higher point than intercept	<b>B1</b> <b>B1</b> <b>B1</b>	<b>3</b>
(f)		Use <b>at least five</b> pivot holes (to give) more points on the graph Use a larger triangle to give a greater range of measurements of $d$ Use a heavier/metal triangle to give more oscillations for better timing Use a thicker/more rigid triangle For less spurious movement during oscillations	<b>B1</b> <b>B1</b> <b>M1</b> <b>A1</b> <b>M1</b> <b>A1</b> <b>M1</b> <b>A1</b>	

	Use of fiducial mark for better timing	<b>B1</b>	
	Use of data logging for better timing	<b>B1</b>	
	One other <i>well-reasoned</i> modification	<b>B1</b>	
	<i>no marks for “repeats and averages”</i>		<b>Max 3</b>
	Accurate use of physics terminology + fluent description + good spelling, punctuation and grammar + at least <b>2 marks for physics</b>	<b>2</b>	
Or	Good physics but poor QWC		
	Good QWC but only <b>1 mark for physics</b>	<b>1</b>	
	No marks for physics/very poor QWC	<b>0</b>	<b>5</b>
			<b>Total 20 Marks</b>

**Question 3**

(a)	$I$ in the range 75..100 (mA), 2 or 3 sf $V$ approximately 3 Volts, 1 or 2 dp Unit for p.d.	<b>B1</b> <b>B1</b> <b>B1</b>	<b>3</b>
(b)	Neatly drawn table <i>with data</i> showing headed columns for $n$ , $I$ , $V$ , $N$ and $X$ units for $V$ and $I$ (V and mA) unit for $X$ (V)	<b>B1</b> <b>B1</b> <b>B1</b>	<b>3</b>
(c)	five complete rows of <i>sensible</i> data and results ( <i>-1 each one missing</i> ) repeats and averages for $I$ repeats and averages for $V$ $N$ values correct, (0.92, 1.67, 2.25, 2.67, 2.92) $X (=V/N)$ for $n = 1$ correctly calculated from values in table $X$ for $n = 5$ correctly calculated from values in table <i>All</i> values for $V_{av}$ given to 1 or 2 dp <i>All</i> values for $I_{av}$ given to nearest mA or 0.1 mA or to 3 or 4 dp, if given in A <i>All</i> values of $X$ given to 2 dp	<b>B5</b> <b>B2</b> <b>B1</b> <b>B1</b> <b>B1</b> <b>B1</b> <b>B1</b> <b>B1</b> <b>B1</b> <b>B1</b>	<b>14</b>
(d)	Axes correct way round and labelled with quantity Units given on both axes <i>allow ecf from table but not missing</i> Sensible scales ( <i>no 3's etc., zero origin, neither axis could be doubled</i> ) Five points plotted correctly ( <i>-1 each error or missing point</i> ) <b>Good</b> best fit line drawn ( <i>at least 4 points used, any ignored point should be <b>clearly</b> identified as such</i> ) General quality ( <i>neat, tidy, axes drawn in accurately, no blots or blobs or messy corrections</i> )	<b>B1</b> <b>B1</b> <b>M1</b> <b>A2</b> <b>B1</b> <b>B1</b>	<b>7</b>
(e)	(i) Triangle at least half the length of the best fit line Coordinates correctly read from best fit line Accurate calculation of gradient 2 or 3 sf quoted	<b>B1</b> <b>M1</b> <b>A1</b> <b>A1</b>	<b>4</b>

(ii)	Gradient equated to $1/r$ Accurate calculation of $r$ , 2 or 3sf $r$ in range 35 .. 43 $\Omega$ with unit ( $0.035..0.043 \text{ VmA}^{-1}$ <i>ok</i> )	<b>M1</b> <b>A1</b> <b>A1</b>	<b>3</b>
(f)	Resistance of voltmeter; could affect pd reading/ammeter reading Resistance of ammeter; could affect load current/voltmeter reading All resistors may not be identical; because of 5/10% tolerance Poor contact at joints/clips; could increase circuit resistance Internal resistance of the supply; could affect meter readings Resistance of connecting wires (may be significant) <i>Not human errors</i> <i>Any two for up to 2 marks each</i>	<b>M1, A1</b> <b>M1, A1</b> <b>M1, A1</b> <b>M1, A1</b> <b>M1, A1</b> <b>B1</b>	<b>4</b>
			<b>Total 38 Marks</b>
			<b>Paper Total 78 Marks</b>