

Mark Scheme (Results) Summer 2010

GCE

GCE Physics (6PH07) Paper 1

Unit 3B: Exploring Physics

International Alternative to Internal Assessment

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Question Number	Answer	Mark
1(a)	C	(1)
(b)	B	(1)
Total marks for question 1		2

Question Number	Answer	Mark
2(a)	A	(1)
(b)	D	(1)
Total marks for question 2		2

Question Number	Answer	Mark
3(a)	A	(1)
Total marks for question 3		1

Question Number	Answer	Mark																																																		
4	<p>1 mark for each appropriate idea explained. Do not credit converse for a second mark: see table for examples. Do not penalise incorrect comments.</p> <p>1 mark for each correct row to a maximum of 4</p> <table border="1" data-bbox="347 434 1302 1704"> <thead> <tr> <th data-bbox="347 434 544 506">Idea</th> <th data-bbox="544 434 754 506">Datalogger</th> <th data-bbox="754 434 810 506"></th> <th data-bbox="810 434 1195 506">Liquid-in-glass + Stopwatch</th> <th data-bbox="1195 434 1302 506">Mark</th> </tr> </thead> <tbody> <tr> <td data-bbox="347 506 544 741">Number of Readings</td> <td data-bbox="544 506 754 741">Advantage - large number of readings or small time interval between readings.</td> <td data-bbox="754 506 810 741">or</td> <td data-bbox="810 506 1195 741">Disadvantage - small number of readings Or large time interval between readings</td> <td data-bbox="1195 506 1302 741">1</td> </tr> <tr> <td data-bbox="347 741 544 846">Graph</td> <td data-bbox="544 741 754 846">Advantage - drawn automatically</td> <td data-bbox="754 741 810 846"></td> <td data-bbox="810 741 1195 846"></td> <td data-bbox="1195 741 1302 846">1</td> </tr> <tr> <td data-bbox="347 846 544 1016">Simultaneity</td> <td data-bbox="544 846 754 1016">Advantage - simultaneous reading of temperature and time.</td> <td data-bbox="754 846 810 1016">or</td> <td data-bbox="810 846 1195 1016">Disadvantage - reaction time (means readings are not simultaneous)</td> <td data-bbox="1195 846 1302 1016">1</td> </tr> <tr> <td data-bbox="347 1016 544 1155">Conduction</td> <td data-bbox="544 1016 754 1155">Advantage - metal is a good conductor.</td> <td data-bbox="754 1016 810 1155">or</td> <td data-bbox="810 1016 1195 1155">Disadvantage - glass is a poor conductor</td> <td data-bbox="1195 1016 1302 1155">1</td> </tr> <tr> <td data-bbox="347 1155 544 1326">Power supply</td> <td data-bbox="544 1155 754 1326">Disadvantage - power supply (or electricity) needed.</td> <td data-bbox="754 1155 810 1326">or</td> <td data-bbox="810 1155 1195 1326">Advantage - no power supply required</td> <td data-bbox="1195 1155 1302 1326">1</td> </tr> <tr> <td data-bbox="347 1326 544 1496">Errors</td> <td data-bbox="544 1326 754 1496">Disadvantage - may be zero or systematic errors</td> <td data-bbox="754 1326 810 1496">or</td> <td data-bbox="810 1326 1195 1496">Disadvantage - may be random, systematic or parallax errors</td> <td data-bbox="1195 1326 1302 1496">1</td> </tr> <tr> <td data-bbox="347 1496 544 1565">Transport</td> <td data-bbox="544 1496 754 1565"></td> <td data-bbox="754 1496 810 1565"></td> <td data-bbox="810 1496 1195 1565">Advantage - easily transportable</td> <td data-bbox="1195 1496 1302 1565">1</td> </tr> <tr> <td data-bbox="347 1565 544 1635">Breakages</td> <td data-bbox="544 1565 754 1635"></td> <td data-bbox="754 1565 810 1635"></td> <td data-bbox="810 1565 1195 1635">Disadvantage - easily broken</td> <td data-bbox="1195 1565 1302 1635">1</td> </tr> <tr> <td data-bbox="347 1635 544 1704">Cost</td> <td data-bbox="544 1635 754 1704">Disadvantage - expensive</td> <td data-bbox="754 1635 810 1704"></td> <td data-bbox="810 1635 1195 1704">Advantage - cheaper</td> <td data-bbox="1195 1635 1302 1704"></td> </tr> </tbody> </table>	Idea	Datalogger		Liquid-in-glass + Stopwatch	Mark	Number of Readings	Advantage - large number of readings or small time interval between readings.	or	Disadvantage - small number of readings Or large time interval between readings	1	Graph	Advantage - drawn automatically			1	Simultaneity	Advantage - simultaneous reading of temperature and time.	or	Disadvantage - reaction time (means readings are not simultaneous)	1	Conduction	Advantage - metal is a good conductor.	or	Disadvantage - glass is a poor conductor	1	Power supply	Disadvantage - power supply (or electricity) needed.	or	Advantage - no power supply required	1	Errors	Disadvantage - may be zero or systematic errors	or	Disadvantage - may be random, systematic or parallax errors	1	Transport			Advantage - easily transportable	1	Breakages			Disadvantage - easily broken	1	Cost	Disadvantage - expensive		Advantage - cheaper		(4)
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Question Number	Answer	Mark
5(a)	<p>Calculation using one pair of values (e.g. 0.18 s and 159 mm)</p> <p>Identifies $s = 0.5at^2$ or $s = ut + 0.5at^2$ with $u = 0$</p> <p>Substitution of s and g, t and g, or s and t</p> <p>Correct evaluation of t, s or a for chosen values</p> <p><u>Examples:</u></p> <p>$t = \sqrt{2 \times 0.071 \text{ m} / 9.8 \text{ m s}^{-2}} = 0.12 \text{ (s)}$ $s = 0.5 \times 9.8 \text{ m s}^{-2} \times (0.18 \text{ s})^2 = 0.159 \text{ (m)}$ $a = 2 \times 0.012 \text{ m} / (0.05 \text{ s})^2 = 9.6 \text{ (m s}^{-2}\text{)}$</p>	(1) (1) (1)
5(b)	<p><u>Examples:</u></p> <ul style="list-style-type: none"> • Hold/drop the rule vertically • Drop the rule cleanly • Release from rest • Ensure your fingers are just at the end of the rule • Practice • Repeat • Use the same bit of your fingers for measurement • Avoid parallax errors in the reading <p>Do not reward contradictory statements</p>	(1) (1) (1) (1) (1) (1) (1) (1) (max 3)
5(c)	<p>Value, uncertainty - 1 mark each</p> <p>Value : 0.19 (s)</p> <p>Absolute uncertainty seen or implied: ± 0.01 if anomalous result ignored or ± 0.06 if not</p> <p>Allow uncertainty as percentage eg 5(.3)% or 37(.5)%</p> <p>Note 0.16 \pm 0.06 scores second mark only 0.19 \pm 0.06 scores first mark only</p>	(1) (1)
Total marks for question 5		8

Question Number	Answer	Mark
6(a)	Calculation correct plus unit <u>Example of calculation:</u> $\pi d^2/4 = \pi (0.12 \times 10^{-3})^2/4 = 1.1(3) \times 10^{-8} \text{ m}^2$ (or $1.1(3) \times 10^{-2} \text{ mm}^2$)	(1)
6(b)	1 mm (in 100 mm) is reasonable (allow 1/100 or 1%)	(1)
6(c)(i)	ρ and A are constants or ρ/A is constant $R \propto l$ or <u>comparison</u> to $y = mx + c$	(1) (1)
6(c)(ii)	<ul style="list-style-type: none"> 41.9 x answer for (a) (ignore inconsistent units) answer in range $4.55 - 4.80 \times 10^{-7} \Omega \text{ m}$ correct answer to 2 sig fig 	(1) (1) (1)
6(d)	Valid points, do not reward single word responses Ignore comments on length 2 max <u>Examples:</u> <ul style="list-style-type: none"> Small diameter or diameter only measured once Any zero error Kinks in wire Contact resistance Resistance of connecting wires Accuracy of ohmmeter 	(1) (1) (1) (1) (1) (1) (max 2)
Total marks for question 6		9

Question Number	Answer	Mark																				
7(a)	Refraction towards normal ($r > 0$) at first face, away at second	(1)																				
	Angle of incidence and refraction marked correctly <u>at first face</u>	(1)																				
7(b)	Mark the emergent ray OR Mark the point of emergence	(1)																				
	Appropriate joining up statement to give path of ray through block	(1)																				
7(c)	Too few values	(1)																				
	Limited range	(1)																				
	Should use protractor with 0.5 degree markings	(1)																				
	Repeat measurements <u>at second face</u>	(1)																				
		(max 2)																				
7(d)	Correct completion of $\sin i$ and $\sin r$ rows (values consistent to 2 or 3 sf and penalise rounding errors)	(1)																				
	<table border="1"> <tr> <td>$i/^\circ$</td> <td>20</td> <td>30</td> <td>40</td> <td>50</td> </tr> <tr> <td>$r/^\circ$</td> <td>15</td> <td>20</td> <td>26</td> <td>32</td> </tr> <tr> <td>$\sin i$</td> <td>0.34/0.342</td> <td>0.50/0.500</td> <td>0.64/0.643</td> <td>0.77/0.766</td> </tr> <tr> <td>$\sin r$</td> <td>0.26/0.259</td> <td>0.34/0.342</td> <td>0.44/0.438</td> <td>0.53/0.530</td> </tr> </table>	$i/^\circ$	20	30	40	50	$r/^\circ$	15	20	26	32	$\sin i$	0.34/0.342	0.50/0.500	0.64/0.643	0.77/0.766	$\sin r$	0.26/0.259	0.34/0.342	0.44/0.438	0.53/0.530	
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	$\sin r$	0.26/0.259	0.34/0.342	0.44/0.438	0.53/0.530																	
Suitable scales, starting at zero	(1)																					
Labels on axes	(1)																					
Correct plotting of points using sensible scale	(1)																					
7(e)	Line of best fit	(1)																				
	Valid comment on whether the line should / should not go through the origin	(1)																				
	<u>Example of calculation:</u> when $i = 0, r = 0$, therefore should $\sin i = n \sin r$, therefore should $\sin i \propto \sin r$ (or <u>directly</u> proportional), therefore should maybe systematic error, therefore not																					
7(f)	Large triangle ≥ 60 mm horizontally to determine gradient	(1)																				
	Answer in range 1.35 - 1.64	(1)																				
Total marks for question 7		14																				

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