

# 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"> <thead> <tr> <th>Idea</th> <th>Datalogger</th> <th></th> <th>Liquid-in-glass + Stopwatch</th> <th>Mark</th> </tr> </thead> <tbody> <tr> <td>Number of Readings</td> <td>Advantage - large number of readings or small time interval between readings.</td> <td>or</td> <td>Disadvantage - small number of readings Or large time interval between readings</td> <td>1</td> </tr> <tr> <td>Graph</td> <td>Advantage - drawn automatically</td> <td></td> <td></td> <td>1</td> </tr> <tr> <td>Simultaneity</td> <td>Advantage - simultaneous reading of temperature and time.</td> <td>or</td> <td>Disadvantage - reaction time (means readings are not simultaneous)</td> <td>1</td> </tr> <tr> <td>Conduction</td> <td>Advantage - metal is a good conductor.</td> <td>or</td> <td>Disadvantage - glass is a poor conductor</td> <td>1</td> </tr> <tr> <td>Power supply</td> <td>Disadvantage - power supply (or electricity) needed.</td> <td>or</td> <td>Advantage - no power supply required</td> <td>1</td> </tr> <tr> <td>Errors</td> <td>Disadvantage - may be zero or systematic errors</td> <td>or</td> <td>Disadvantage - may be random, systematic or parallax errors</td> <td>1</td> </tr> <tr> <td>Transport</td> <td></td> <td></td> <td>Advantage - easily transportable</td> <td>1</td> </tr> <tr> <td>Breakages</td> <td></td> <td></td> <td>Disadvantage - easily broken</td> <td>1</td> </tr> <tr> <td>Cost</td> <td>Disadvantage - expensive</td> <td></td> <td>Advantage - cheaper</td> <td></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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	Total marks for question 4	4																																																		

Question Number	Answer	Mark
5(a)	<p>Calculation using one pair of values (e.g. 0.18 s and 159 mm)</p> <p>Identifies <math>s = 0.5at^2</math> or <math>s = ut + 0.5at^2</math> with <math>u = 0</math></p> <p>Substitution of <math>s</math> and <math>g</math>, <math>t</math> and <math>g</math>, or <math>s</math> and <math>t</math></p> <p>Correct evaluation of <math>t</math>, <math>s</math> or <math>a</math> for chosen values</p> <p><u>Examples:</u></p> <p><math>t = \sqrt{2 \times 0.071 \text{ m} / 9.8 \text{ m s}^{-2}} = 0.12 \text{ (s)}</math>  <math>s = 0.5 \times 9.8 \text{ m s}^{-2} \times (0.18 \text{ s})^2 = 0.159 \text{ (m)}</math>  <math>a = 2 \times 0.012 \text{ m} / (0.05 \text{ s})^2 = 9.6 \text{ (m s}^{-2}\text{)}</math></p>	(1) (1) (1)
5(b)	<p><u>Examples:</u></p> <ul style="list-style-type: none"> <li>• Hold/drop the rule vertically</li> <li>• Drop the rule cleanly</li> <li>• Release from rest</li> <li>• Ensure your fingers are just at the end of the rule</li> <li>• Practice</li> <li>• Repeat</li> <li>• Use the same bit of your fingers for measurement</li> <li>• Avoid parallax errors in the reading</li> </ul> <p>Do not reward contradictory statements</p>	(1) (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:  <math>\pm 0.01</math> if anomalous result ignored or <math>\pm 0.06</math> if not</p> <p>Allow uncertainty as percentage eg 5(.3)% or 37(.5)%</p> <p>Note 0.16 <math>\pm</math> 0.06 scores second mark only  0.19 <math>\pm</math> 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)	$\rho$ and $A$ are constants or $\rho/A$ is constant $R \propto l$ or <u>comparison</u> to $y = mx + c$	(1) (1)
6(c)(ii)	<ul style="list-style-type: none"> <li>• 41.9 x answer for (a) (ignore inconsistent units)</li> <li>• answer in range <math>4.55 - 4.80 \times 10^{-7} \Omega \text{ m}</math></li> <li>• correct answer to 2 sig fig</li> </ul>	(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"> <li>• Small diameter or diameter only measured once</li> <li>• Any zero error</li> <li>• Kinks in wire</li> <li>• Contact resistance</li> <li>• Resistance of connecting wires</li> <li>• Accuracy of ohmmeter</li> </ul>	(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"> <tbody> <tr> <td><math>i/^\circ</math></td> <td>20</td> <td>30</td> <td>40</td> <td>50</td> </tr> <tr> <td><math>r/^\circ</math></td> <td>15</td> <td>20</td> <td>26</td> <td>32</td> </tr> <tr> <td><math>\sin i</math></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><math>\sin r</math></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> </tbody> </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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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 $\geq 60$ mm horizontally to determine gradient	(1)																				
	Answer in range 1.35 - 1.64	(1)																				
Total marks for question 7		14																				

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