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Mark Scheme (Results)

June 2011

GCE Physics (6PH07) Paper 01
Exploring Physics (WA)

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

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Physics Specific Marking Guidance

Underlying principle

The mark scheme will clearly indicate the concept that is being rewarded, backed up by examples. It is not a set of model answers.

For example:

Horizontal force of hinge on table top

66.3 (N) or 66 (N) **and** correct indication of direction [no ue]

[Some examples of direction: acting from right (to left) / to the left / West / opposite direction to horizontal. May show direction by arrow. Do not accept a minus sign in front of number as direction.] This has a clear statement of the principle for awarding the mark, supported by some examples illustrating acceptable boundaries.

Mark scheme format

- Bold lower case will be used for emphasis.
- Round brackets ( ) indicate words that are not essential e.g. "(hence) distance is increased".
- Square brackets [ ] indicate advice to examiners or examples e.g. [Do not accept gravity] [ecf].

Unit error penalties

- A separate mark is not usually given for a unit but a missing or incorrect unit will normally cause the final calculation mark to be lost.
- Incorrect use of case e.g. 'Watt' or 'w' will not be penalised.
- There will be no unit penalty applied in 'show that' questions or in any other question where the units to be used have been given.
- The same missing or incorrect unit will not be penalised more than once within one question but may be penalised again in another question.
- Occasionally, it may be decided not to penalise a missing or incorrect unit e.g. the candidate may be calculating the gradient of a graph, resulting in a unit that is not one that should be known and is complex.
- The mark scheme will indicate if no unit error penalty is to be applied by means of [no ue].

Significant figures

- Use of an inappropriate number of significant figures in the theory papers will normally only be penalised in 'show that' questions where use of too few significant figures has resulted in the candidate not demonstrating the validity of the given answer.
- Use of an inappropriate number of significant figures will normally be penalised in the practical examinations or coursework.
- Using g = 10 m s^{-2} **will** be penalised.

Calculations

- Bald (i.e. no working shown) correct answers score full marks unless in a 'show that' question.
- Rounding errors will not be penalised.
- If a 'show that' question is worth 2 marks then both marks will be available for a reverse working; if it is worth 3 marks then only 2 will be available.
- use of the formula means that the candidate demonstrates substitution of physically correct values, although there may be conversion errors e.g. power of 10 error.
- recall of the correct formula will be awarded when the formula is seen or implied by substitution.
- The mark scheme will show a correctly worked answer for illustration only.

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Question Number	Answer	Mark
1	B	**1**
2	D	**1**
3	B	**1**
4	A	**1**
5	B	**1**

Question Number	Answer	Mark
6 (a)	Any **TWO** from Inconsistent precision for <u>extension</u> (Accept reference to sig figs/ dec pl.) **(1)** Comment on lack of precision of <u>mass</u> **(1)** Missing unit for force **(1)** No evidence of repeat readings **(1)**	**2**
6(b)	Best fit straight line through origin **(1)** Force (directly) proportional to extension **(1)** **OR** Best fit straight line not through origin **(1)** Linear relationship/systematic error **(1)** **OR** Best fit straight line, curving at end **(1)** Force (directly) proportional to extension up to approx 7 N **(1)**	**2**
6(c)	Large triangle over half data points **(1)** k = (0.86 - 1.02) x 10^3 Nm^{-1} (ignore unit and power of ten) **(1)** correct value and unit (1 or 2 dec pl in standard form **OR** 3 sig fig max) **(1)** Allow ecf from candidate's line e.g. for line not through origin.	**3**
6(d)	<u>Diameter</u> **(1)** Micrometer (screw gauge) **OR** digital (vernier) callipers **(1)** (Original) <u>length</u> of wire **(1)** metre rule **OR** measuring tape **(1)**	**4**
	Total for question 6	**11**

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Question Number	Answer	Mark
7	*(a) a labelled diagram of the apparatus to be used* *(b) list additional apparatus required which is not on diagram* Mark (a) and (b) together A complete circuit that could be used to measure resistance (allow correct symbols or clear labelling) 1 mark 3 points from list below for 1 mark: thermistor in water means of heating/cooling (bunsen or water bath or ice) means of taking temperature **(1)** stirrer **(1)** *(c) state the quantities to be measured* resistance, temperature (not temperature change) **OR** current, pd, temperature (not temperature change) **(1)** *(d) for **two** of these quantities explain your choice of measuring instrument, **max two per quantity*** e.g. resistance - ohmmeter – direct reading / precision temperature – liquid in glass thermometer – adequate range and precision p.d.(voltage) – voltmeter – comment on appropriate range current – ammeter - comment on appropriate range **(4)** *(e) state which is the independent and which is the dependent variable:* temperature, resistance **(1)** *(f) explain how the data will be used* e.g. graph drawn of resistance against temperature **(1)** (allow *V/I* graph if change of gradient is related to temperature) (g) *identify the main source of uncertainty and/or systematic error*: e.g. simultaneous reading of two variables / systematic error on thermometer / parallax error of scale readings / meter zero error / uneven temperature in liquid **(1)** (*h*) *appropriate comment on safety* e.g. sensible precaution to prevent injury when using hot materials (e.g. hot water, heated wires) **(1)**	**11**
	Total for question 7	**11**

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Question Number	Answer		Mark
8 (a)	Line	**(1)**	**1**
8(b)(i)	• Normal or subtraction from 90˚ seen or triangular method • $i = 59^\circ - 61^\circ$ $r = 31^\circ - 33^\circ$ • correct second set of i and r • Unit degree for angle • Use of $\mu = \sin i / \sin r$ • Averages used (angles or values of μ) • μ between 1.55 and 1.65, to 2 or 3 sf	**(1)** **(1)** **(1)** **(1)** **(1)** **(1)** **(1)**	**7**
8(b)(ii)	• Uncertainty in angle ± 1˚or ± 0.5˚ (may be within an equation but should be clearly identified) • Use of their uncertainty in equation with max and min values (allow combination of errors for 2nd mark) Example of calculation $\mu_{max} = \sin(60 + 1)/\sin(32 - 1) = 1.7$ $\mu_{min} = \sin(60 - 1)/\sin(32 + 1) = 1.6$ $\Delta\mu/2 = (1.7 - 1.6)/2 = 0.05$ **OR** Use of own μ results from 8(b)(ii) • Sensible method • 0.05 as uncertainty in μ Example of calculation Uncertainty is $\mu_{max} - \mu_{mean} = (1.7 - 1.65) = 0.05$	**(1)** **(1)** **(1)** **(1)**	**2 max**
8(c)	Answer consistent with candidate's value for 8(b)(i)	**(1)**	**1**
8(d)	**TWO** from Repeat with various values of angle of incidence Plot a graph of sin i against sin r Find gradient	 **(1)** **(1)** **(1)**	**2**
	Total for question 8		**13**

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