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Mark Scheme (Results)
January 2012

GCE Physics (6PH08) Paper 01
Experimental Physics (Written Alternative)

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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 (a)(i)	mean value for d = 15.52 or 15.5 (mm) 3/4 SF and no u.p. **(1)**	**1**
1(a)(ii)	l = 48.76 or 48.69 mm to 3/4 SF allow ecf **(1)**	**1**
1(a)(iii)	Calculates percentage uncertainty in d (this is the same as the %U in l) Half range is 0.04 mm assume this as uncertainty in d. Ignore SF allow ecf **(1)** (Allow whole range for 0.6 %,) Example of calculation %U = 0.04/15.52 = 0.3 %	**1**
1 (b)(i)	l = 1682 mm to 3/4 SF **(1)** Example of calculation 48.76 x 34.5 = 1682 mm (accept 1680) allow ecf on d	**1**
1(b)(ii)	%U = 11.6% **(1)** (allow 2 in 32.5 (6.15%)) Example of calculation Error is 4 coils in 34.5 ie 4/34.5	**1**
1(c)	Measure the coiled length of spring with callipers and divide by the number of loops (do not credit use of micrometer screw gauge) **(1)** Sensible precaution for their choice of instrument eg repeat and average **(1)** measure in different places/orientations	**2**
	Total for question 1	**7**

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Question Number	Answer		Mark
2(a)(i)	Shows a measured height or distance along bench uses correct trigonometry	**(1)** **(1)**	**2**
2(a)(ii)	**Max 2** • Distances large • (hence) at least 3 SF • small percentage uncertainty • precision of protractor is 1^o	 **(1)** **(1)** **(1)** **(1)**	**Max 2**
2(b)(i)	0.1% or 0.2% (uncertainty is 1 or 2 mm)	**(1)**	**1**
2(b)(ii)	Any valid physics technique eg Repeat the reading **and** find the mean Keep eye level with can (do not accept simply "avoid parallax")	**(1)**	**1**
2(c)(i)	Acceleration = 1.39 (ms^{-2})with 3SF <u>Example of calculation</u> $a = 2 \times 1.000 / (1.20)^2 = 1.39\ ms^{-2}$	**(1)**	**1**
2(c)(ii)	Percentage uncertainty in t = 8.3 % (8 %) doubles percentage uncertainty in t **and** adds percentage uncertainty in s from b(i) Also allow ecf from b(i) <u>Example of calculation</u> 0.10/1.20 = 8.3% so overall 16.6% + 0.1% or 0.2% = 17% Allow 16% overall if 8% used for t	**(1)** **(1)**	**2**
2(d)(i)	g = 8.00 ms^{-2}(accept N kg^{-1}) with 3 SF allow ecf on their value from (c)(i) <u>Example of calculation</u> $g = a/\sin\theta = 1.39/\sin 10.0 = 1.39/0.174 = 8.00\ ms^{-2}$	**(1)**	**1**
2(d)(ii)	Calculates %D using 9.81 as denominator <u>Example of calculation</u> 1.81/9.81 = 18.45% Allow 18% or 19%	**(1)**	**1**
2(d)(iii)	Comment based on comparison of %D with %U <u>Example of calculation</u> %D is not explained by %U - 2% bigger so assumptions not valid	**(1)**	**1**
	Total for question 2		**12**

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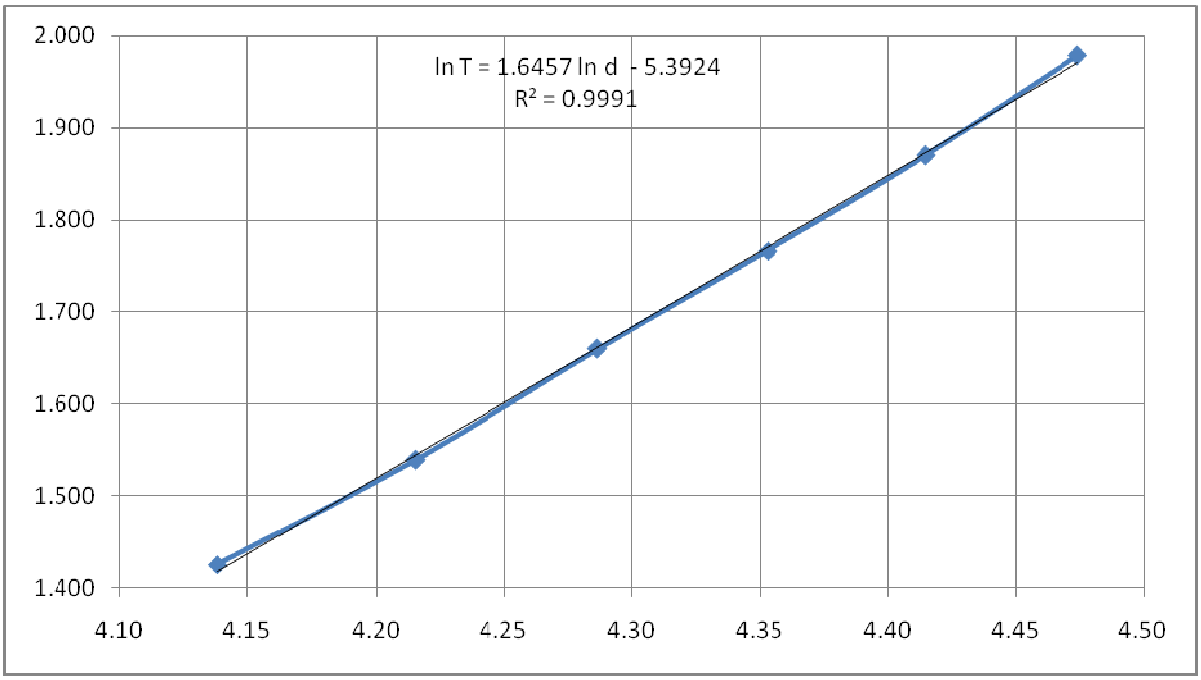
Question Number	Answer		Mark
3(a)	Circuit showing power supply unit (psu), heater, ammeter and voltmeter in parallel with heater	**(1)**	**1**
3(b)	**Max 6** • Start below and finish above room temperature • Measure the p.d. (voltage) and current • at start and at the end and average • Switch off current and measure highest temperature reached • Insulate block • Measure mass of block (& heater) • (Put oil into holes to help) Good thermal contact between heater, thermometer & block • Use stopclock to measure time of current flow • Calculate (energy) by multiplying voltage by current by time • Draws appropriate graph and finds gradient • Uses gradient correctly to find *c*	**(1)** **(1)** **(1)** **(1)** **(1)** **(1)** **(1)** **(1)** **(1)** **(1)** **(1)**	**Max 6**
	Total for question 3		**7**

Question Number	Answer		Mark
4(a)(i)	*d* drawn <u>horizontally</u> between edge of bench and centre of mass	**(1)**	**1**
4(a)(ii)	**Max 2** • Use a timing marker in centre of oscillation • Record the time of at least 10 oscillations at a time • Means of ensuring accuracy of count eg tap in time with oscillation or count from zero • Repeat reading and take average	**(1)** **(1)** **(1)** **(1)**	**Max 2**
4(b)(i)	The smallest significant figure (scale division) is 0.01 s **Or** measures to the nearest 0.01 s **Or** records time to 2 dp	**(1)**	**1**
4(b)(ii)	0.01 s « human reaction time (accept 0.1 s) **Or** small percentage uncertainty	**(1)**	**1**
4(c)(i)	Correct expansion to $\ln T = q \ln d + \ln p$ (compare with y = mx + c comparison need not be direct)	**(1)**	**1**
4(c)(ii)	Gradient of line equals *q*	**(1)**	**1**

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4(d)(i)	ln values correct and to 2/3DP **(1)** Axes & labels **(1)** Scales, (expect 1cm:0.1 vertically) **(1)** Plots & line **(1)**	**4**
4(d)(ii)	Large triangle - i.e 10 cm base or ecf their scale **(1)** Correct calculation of q in range $1.55 < q < 1.80$ 3SF ignore unit **(1)**	**2**
4(d)(iii)	Value likely to be valid since points lie close to good straight line **Or** Plots look as though line should be a curve so some doubt about validity **Or** Conclusion only valid for range of data **(1)**	**1**
	Total for question 4	**14**

d/cm	*T*/s	ln (*d/cm*)	ln (*T/s*)
87.7	7.23	4.474	1.978
82.7	6.49	4.415	1.870
77.7	5.85	4.353	1.766
72.7	5.26	4.286	1.660
67.7	4.66	4.215	1.539
62.7	4.16	4.138	1.426



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