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Mark Scheme (Results)
January 2012

GCE Physics (6PH07) Paper 01
Exploring 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.

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.

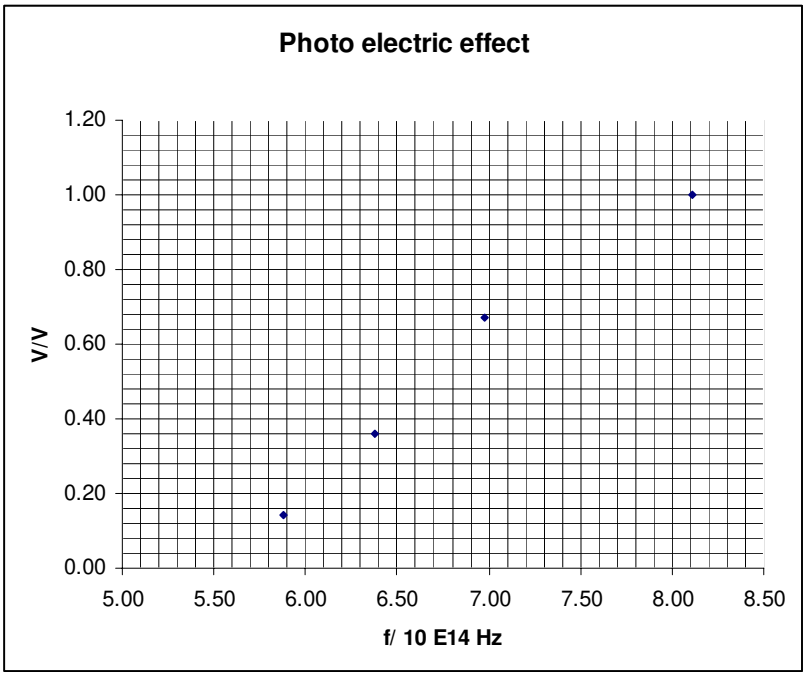
• recall of the correct formula will be awarded when the formula is seen or implied by substitution.

• The mark scheme will show a correctly worked answer for illustration only.

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

<table>
<tr><th>Question Number</th><th>Answer
The question must be marked holistically within the context of the candidate's experimental method.</th><th>Mark</th></tr>
<tr><td>6</td><td>1 mark for each appropriate idea explained. Do not credit converse for a second mark: see table for examples. Do not penalise incorrect comments.
1 mark for each correct row to a maximum of 5
<table>
<tr><th>Idea</th><th>Analogue</th><th></th><th>Digital</th><th>Mark</th></tr>
<tr><td>Equipment /cost</td><td>two meters needed / may be more expensive</td><td>Or</td><td>only one meter needed / may be cheaper option</td><td>1</td></tr>
<tr><td>Ease of reading</td><td>two readings must be taken</td><td>Or</td><td>one reading only / fluctuates</td><td>1</td></tr>
<tr><td>Parallax</td><td>needs to be considered</td><td>Or</td><td>digital display / no parallax error</td><td>1</td></tr>
<tr><td>Systematic errors</td><td>zero errors
contact resistance</td><td>Or</td><td>zero error
contact resistance</td><td>1</td></tr>
<tr><td>Scales</td><td>fixed/
requires interpolation</td><td>Or</td><td>variable/can be changed / numeric reading</td><td>1</td></tr>
<tr><td>Sensitivity</td><td>limited by size of scale divisions</td><td>Or</td><td>two decimal places</td><td>1</td></tr>
<tr><td>Setting up</td><td>requires both series and parallel connections / additional apparatus</td><td>Or</td><td>only requires series connection / must set function switch / use correct terminals</td><td>1</td></tr>
<tr><td>Heating effect of current</td><td>heating may change resistance of wire</td><td>Or</td><td>unlikely to be much heating effect</td><td>1</td></tr>
<tr><td>Power supply</td><td>meters do not require individual batteries / but circuit needs a power supply</td><td>Or</td><td>internal battery required</td><td>1</td></tr>
<tr><td>Uncertainties</td><td>greater since two readings</td><td>Or</td><td>smaller since only one reading</td><td>1</td></tr>
<tr><td>Data</td><td>needs calculation from two readings</td><td>Or</td><td>no calculation required/direct reading</td><td>1</td></tr>
<tr><td>Graphical method</td><td>possible</td><td>Or</td><td>less simple for a fixed wire</td><td>1</td></tr>
</table></td><td>5</td></tr>
<tr><td></td><td>Total for question 6</td><td>5</td></tr>
</table>

Question Number	Answer **The question must be marked holistically within the context of the candidate's experimental method.**	Mark
7	*(a) labels on diagram plus additional apparatus required which is not on diagram* markers or reference to light gates **(1)** rule, timing device, micrometer **(1)**	**2**
	(b) state the quantities to be measured diameter, distance, time **(1)** **Or** diameter, velocity **(1)**	**1**
	*(c) for **two** of these quantities explain your choice of measuring instrument,* **Max 2 per quantity** e.g. diameter – micrometer **(1)** reading to 0.01 mm (0.001 mm) **(1)** length – metre rule **(1)** reading to 1 mm **(1)** time – stopwatch **(1)** reading to 0.1 s (0.01 s) **(1)**	**4**
	(d) *state which is the independent and which is the dependent variable*: diameter/radius, (terminal) velocity or time **(1)**	**1**
	(e) explain how the data will be used **Max 2** e.g. radius determination from measured diameter **Or** velocity from distance and time **(1)** graph of v against r^2 and reference to gradient (**1**)	**2**
	(f) identify the main source of uncertainty and/or systematic error: **Max 2** terminal velocity not reached **(1)** reaction time **(1)** temperature not constant **(1)** measurement of diameter **(1)** micrometer zero error **(1)** measurement of distance fallen **(1)** parallax error **(1)**	**2**
	(g) *appropriate comment on safety* **Max 1 Answer should have some explanation/justification** e.g. mop up spills **(1)** wear goggles to avoid splashes in eye **(1)** use gloves (if allergic to oil) **(1)** normal laboratory rules should be followed **(1)** low risk experiment **(1)**	**1**
	Total for question 7	**13**

Question Number	Answer		Mark
8 (a)	**Max 2**		
	only 4	**(1)**	
	precision or sig fig inconsistent	**(1)**	
	no repetition	**(1)**	
	small range	**(1)**	**2**
8(b)	use of $\lambda = c/f$ **Or** 6.9/7/7.0 (equation use implicit)	**(1)**	
	value 7.0	**(1)**	**2**
8(c)	Label on axes with units, including powers of 10	**(1)**	
	Appropriate choice of scale – frequency should not have zero origin	**(1)**	
	Plotting of points (if no value written in table, ignore missing point - ecf)	**(1)**	
	Line of best fit: either 'balanced' or through any 3 (allow ecf)	**(1)**	**4**
			
8(d)	Correct rearrangement of equation	**(1)**	
	comparison to $y = mx + c$ (may be implicit or diagrammatic)		
	Or		
	h, e, φ are constants, hence straight line	**(1)**	**4**
	gradient is h/e	**(1)**	
	multiply gradient by e to find h	**(1)**	
8(e)	Use of gradient (may be implicit)	**(1)**	
	Gradient multiplied by e	**(1)**	
	Value (from candidate graph) with unit (allow J Hz^{-1})	**(1)**	
	<u>Example of calculation</u>		**3**
	$0.386 \times 10^{-14} \times 1.6 \times 10^{-19} = 6.17 \times 10^{-34}$ Js		
8(f)	**For graph of V against f**		
	Identification of use of either x or y intercept	**(1)**	
	Multiplication by h (x-intercept) or e (y-intercept)	**(1)**	**2**
	[Candidate may describe plotting f against V, or even eV with hf, explanation will need to be checked carefully for this.]		
	Total for question 8		**17**

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