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Mark Scheme (Results)

Summer 2015

Pearson Edexcel International Advanced Subsidiary Level in Physics (WPH03) Paper 01 Exploring Physics

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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.

Quality of Written Communication

Questions which involve the writing of continuous prose will expect candidates to:

- write legibly, with accurate use of spelling, grammar and punctuation in order to make the meaning clear
- select and use a form and style of writing appropriate to purpose and to complex subject matter
- organise information clearly and coherently, using specialist vocabulary when appropriate.

Full marks will be awarded if the candidate has demonstrated the above abilities.
Questions where QWC is likely to be particularly important are indicated (QWC) in the mark scheme, but this does not preclude others.

Mark scheme notes

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:

(iii) Horizontal force of hinge on table top

66.3 (N) or 66 (N) **and** correct indication of direction [no ue] ✓ **1**
[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.

1. Mark scheme format

1.1 You will not see 'wtte' (words to that effect). Alternative correct wording should be credited in every answer unless the ms has specified specific words that must be present. Such words will be indicated by underlining e.g. 'resonance'
1.2 Bold lower case will be used for emphasis.
1.3 Round brackets ( ) indicate words that are not essential e.g. "(hence) distance is increased".
1.4 Square brackets [ ] indicate advice to examiners or examples e.g. [Do not accept gravity] [ecf].

2. Unit error penalties

2.1 A separate mark is not usually given for a unit but a missing or incorrect unit will normally mean that the final calculation mark will not be awarded.
2.2 Incorrect use of case e.g. 'Watt' or 'w' will **not** be penalised.
2.3 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, for example in a spreadsheet.
2.4 The same missing or incorrect unit will not be penalised more than once within one question (one clip in epen).
2.5 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.
2.6 The mark scheme will indicate if no unit error penalty is to be applied by means of [no ue].

3. Significant figures

3.1 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.
3.2 The use of g = 10 m s^{-2} or 10 N kg^{-1} instead of 9.81 m s^{-2} or 9.81 N kg^{-1} will be penalised by one mark (but not more than once per clip). Accept 9.8 m s^{-2} or 9.8 N kg^{-1}

4. Calculations

4.1 Bald (i.e. no working shown) correct answers score full marks unless in a 'show that' question.

4.2 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.

4.3 **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.

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

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

4.6 Example of mark scheme for a calculation:

'Show that' calculation of weight

Use of L × W × H ✓

Substitution into density equation with a volume and density ✓

Correct answer [49.4 (N)] to at least 3 sig fig. [No ue] ✓
[If 5040 g rounded to 5000 g or 5 kg, do not give 3rd mark; if conversion to kg is omitted and then answer fudged, do not give 3rd mark]
[Bald answer scores 0, reverse calculation 2/3] **3**

Example of answer:

80 cm × 50 cm × 1.8 cm = 7200 cm^3

7200 cm^3 × 0.70 g cm^{-3} = 5040 g

5040 × 10^{-3} kg × 9.81 N/kg

= 49.4 N

5. Quality of Written Communication

5.1 Indicated by QoWC in mark scheme. QWC – Work must be clear and organised in a logical manner using technical wording where appropriate.

5.2 Usually it is part of a max mark, the final mark not being awarded unless the QoWC condition has been satisfied.

6. Graphs

6.1 A mark given for axes requires both axes to be labelled with quantities and units, and drawn the correct way round.

6.2 Sometimes a separate mark will be given for units or for each axis if the units are complex. This will be indicated on the mark scheme.

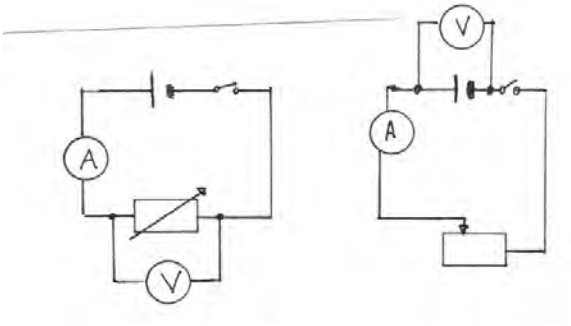
6.3 A mark given for choosing a scale requires that the chosen scale allows all points to be plotted, spreads plotted points over more than half of each axis and is not an awkward scale e.g. multiples of 3, 7 etc.

6.4 Points should be plotted to within 1 mm.

- Check the two points furthest from the best line. If both OK award mark.
- If either is 2 mm out do not award mark.
- If both are 1 mm out do not award mark.
- If either is 1 mm out then check another two and award mark if both of these OK, otherwise no mark.

6.5 For a line mark there must be a thin continuous line which is the best-fit line for the candidate's results.

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

Question Number	Answer	Mark
6(a)	Any correct circuit that would work. **(1)** Ammeter must be in series, voltmeter in parallel across either the cell or the total external resistance (assume ammeter resistance is zero). Potential divider circuit acceptable. <u>Examples</u> 	**1**
6(b)	Only 1.5 V cell **Or** (very) small voltage **(1)** (answer needs to refer to low p.d. or shock)	**1**
6(c)	So that the cell/circuit is not short circuited (otherwise it will get hot) **Or** to prevent a high current through the cell/circuit **(1)** (zero current, no marks)	**1**
	Total for Question 6	**3**

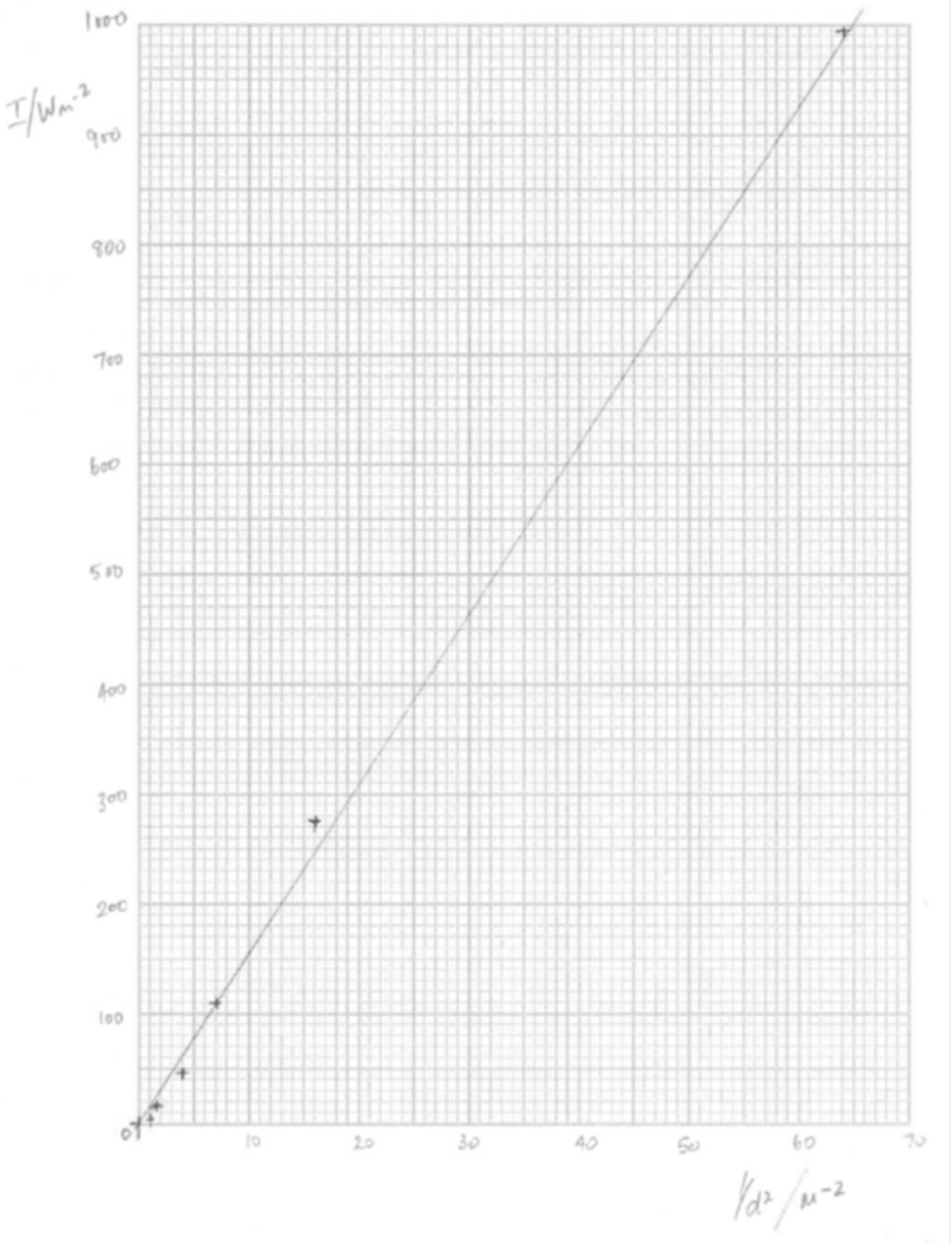
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Question Number	Answer		Mark
7	**This question has to be marked holistically and in the context of the experiment described.**		
	(a) *Draw a labelled diagram of the experimental set-up to be used and list any additional apparatus you might need*		
	Labelled diagram of a workable set-up (should include spring, mass/weight and support)	**(1)**	
	Rule, shown on diagram or mentioned in text	**(1)**	
	Appropriate additional apparatus (e.g. set square, pin, balance) (These may appear anywhere in the whole answer to Q7.)	**(1)**	**3**
	(b) *State what quantity is the independent variable and what quantity is the dependent variable*		
	Mass/weight/force **and** extension/length	**(1)**	
	Correctly identifies mass/weight/force as the independent variable **and** extension/length as the dependent variable	**(1)**	**2**
	(c) *For the independent and dependent variables state and explain your choice of measuring instruments*		
	States measuring instrument for mass/weight/force	**(1)**	
	Justification of choice of measuring instrument with reference to scale (uncertainty or range) and expected measurement	**(1)**	
	Either		
	States measuring length using metre rule	**(1)**	
	Justification of choice of metre rule with reference to scale and expected measurement	**(1)**	
	Or		
	States measuring extension using metre rule/vernier calliper	**(1)**	
	Justification of choice of metre rule/vernier callipers with reference to scale and expected measurement	**(1)**	**4**
	(d) *Describe how you would ensure that your measurement of the extension is as accurate as possible*		
	Max 2		
	Use of fiducial mark	**(1)**	
	Use of set square	**(1)**	
	Readings at eye level (to avoid parallax error)	**(1)**	**2**
	(e) *Comment on whether repeat readings are appropriate in this case*		
	Justified appropriate comment e.g. would not repeat because of permanent extension e.g. would repeat to identify anomalies e.g. would repeat and average to get more accurate result	**(1)**	**1**

	(f) *Explain how the data collected will be used to find the energy stored* Plot force against extension/length (Allow use of mass-extension graph only if conversion to force is explained.) **Either** The idea of finding an area under the graph Area under graph up to 300 mm Using squares or area of triangle **Or** The idea of reading values off the graph Mention of F =7.5 N **Or** x = 300 mm Mention of $E = Fx/2$	**(1)** **(1)** **(1)** **(1)** **(1)** **(1)** **(1)**	**4**
	(g) *Explain the main source of uncertainty and/or systematic error* Reference to measurement of length or extension **and** error/uncertainty e.g. parallax, small measurement, zero error, elastic limit not exceeded		
	(h) *Comment on safety* Sensible identification of risk **and** precaution e.g. risk from falling weights so use foot protection, risk from breaking spring so use goggles	**(1)** **(1)**	**1** **1**
	Total for Question 7		**18**

<table>
<tr><th>Question Number</th><th>Answer</th><th></th><th>Mark</th></tr>
<tr><td>8(a)</td><td>m^{-2} Or $1/m^2$</td><td>(1)</td><td>1</td></tr>
<tr><td>8(b)</td><td>Max 2
Inconsistent sf/dp (1)
No repeat readings Or no averaging (1)
Large gap between 64 and 16
Or poor choice of d values (1)
(just stating poor/small range does not get a mark)</td><td></td><td>2</td></tr>
<tr><td>8(c)</td><td>First value 1.8 (1)
2nd value 1 or 1.0 (1)
<table><tr><th>d/m</th><th>I/Wm^{-2}</th><th>$1/d^2$</th></tr><tr><td>0.125</td><td>996</td><td>64.0</td></tr><tr><td>0.25</td><td>276</td><td>16.0</td></tr><tr><td>0.375</td><td>109.3</td><td>7.1</td></tr><tr><td>0.5</td><td>48</td><td>4.0</td></tr><tr><td>0.75</td><td>18</td><td>1.8</td></tr><tr><td>1</td><td>3.3</td><td>1.0</td></tr></table></td><td></td><td>2</td></tr>
<tr><td>8(d)</td><td>Explicit or implicit comparison to $y = mx$ or $y = mx+c$ (1)

Intensity (directly) <u>proportional</u> to inverse square distance
Or intercept (c) is zero (1)</td><td></td><td>2</td></tr>
<tr><td>8(e)</td><td>Axes labelled (1)
With units (allow ecf from (a)) (1)
Sensible scales (1)
Correct plotting of candidate’s data from table (1)
Best fit line (1)
Please see the graph on the next page.</td><td></td><td>5</td></tr>
<tr><td>8(f)</td><td>Calculation of $1/d^2$ (may be implicit) (1)
I = 380 - 410 Wm^{-2} (1)
(accept gradient calculation method)</td><td></td><td>2</td></tr>
<tr><td></td><td>Total for Question 8</td><td></td><td>14</td></tr>
</table>


I/Wm⁻²
1000
900
800
700
600
500
400
300
200
100
0
10
20
30
40
50
60
70
1/d²/m⁻²

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