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Mark Scheme (Results)

Summer 2014

Pearson Edexcel International Advanced 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.

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] [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.]	✓	**1**

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:

<u>'Show that' calculation of weight</u> 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] 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	✓ ✓ ✓	**3**

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.

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	A	**1**
3	B	**1**
4	C	**1**
5	C	**1**

Question Number	Answer	Mark
6(a)	Newcomb's range is 299 880 to 299 820 **Or** a numerical approach which can be used to show Newcomb's value is outside current range **(1)** A comparative statement e.g. Newcomb's value is outside the (currently) accepted range **(1)** Example of answer 299 850 – 30 is outside range of current accepted value (scores 2)	**2**
6(b)	**2 max** Michelson's range is 299 800 to 299 792 **Or** an appropriate numerical approach **(1)** Currently accepted value is (just) inside this range **(1)** Comparative statement about (%) uncertainties **(1)** Example of an answer 299796 −4 **or** % uncertainty is 1×10^{-3} % (scores MP1only)	**2**
6(c)	Attempt to find % uncertainty using half the range or the whole range **(1)** % uncertainty = 3.3×10^{-7} (%) or 6.7×10^{-7} (%) **(1)**	**2**
	Total for Question 6	**6**

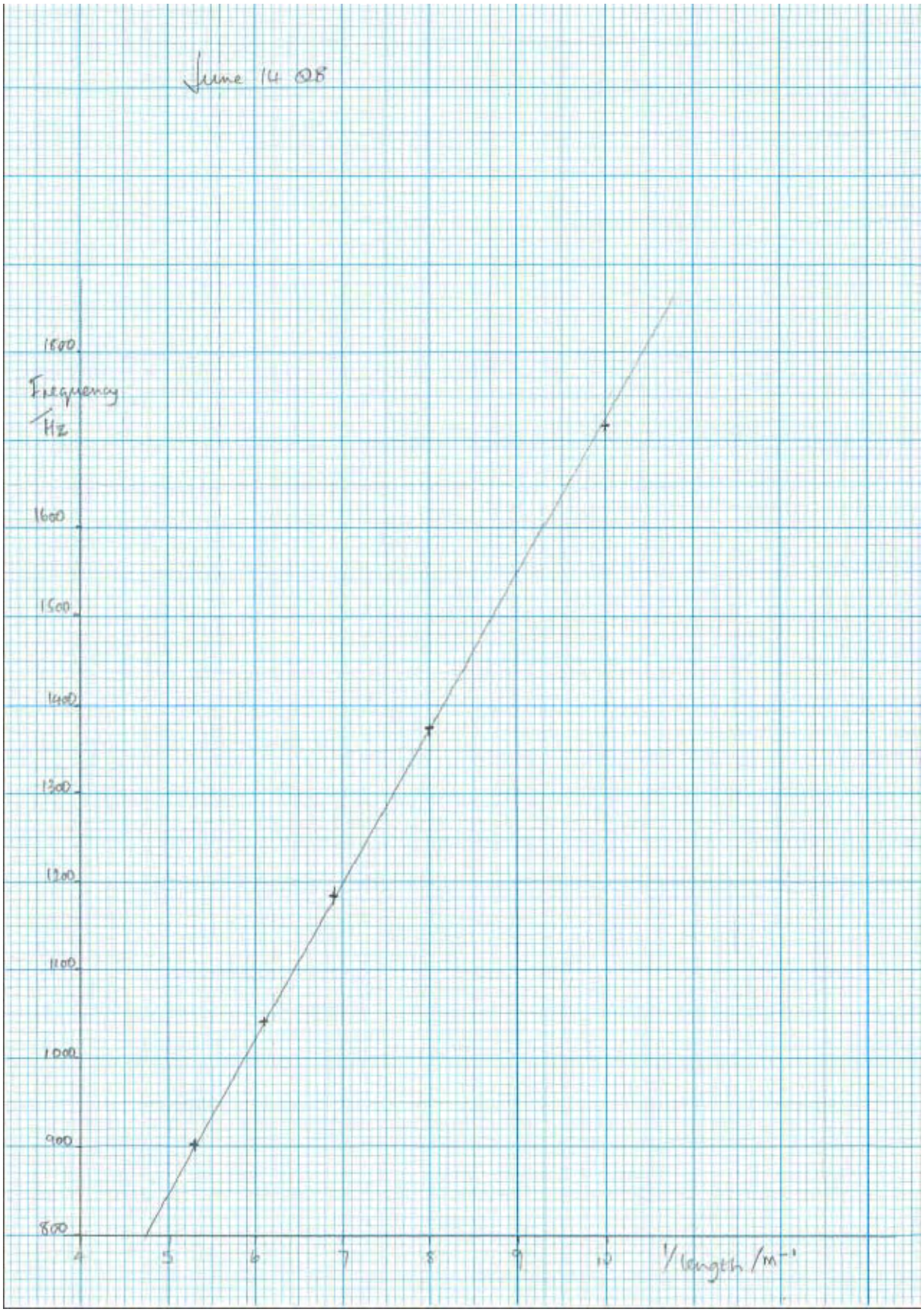
Question Number	Answer Question must be marked holistically, and points credited wherever they appear if they are in the context of the described experiment		Mark
7			
	(a) Draw on the diagram the distance 's' to be measured		
	height drawn from base of ball to trap door	**(1)**	**1**
	(b) state the apparatus required to measure s and explain your choice		
	(metre) rule or tape	**(1)**	
	reference to distance fallen **and** 1 mm divisions on rule	**(1)**	**2**
	(c) explain why an electronic timer is used to measure t		
	Time/distance is too short for reliable measurement by hand/stopwatch **Or** reaction time is significant compared to (measured) time	**(1)**	**1**
	(d) comment on whether repeat readings are appropriate in this case, **Max one**		
	Repeating/averaging readings leads to a more reliable result	**(1)**	
	Repeating allows anomalous results to be identified	**(1)**	
	Comment on difficulty of hitting switch/alignment	**(1)**	**1**
	(e) explain what data will be collected and how it will be used to determine the acceleration of free fall,		
	times for at least 5 heights	**(1)**	
	graph should be straight line (words or labelled sketch graph)	**(1)**	
	determine gradient	**(1)**	
	use of $s = ut + ½ at^2$ or $s = ½ at^2$	**(1)**	
	multiply gradient by 2	**(1)**	**5**
	(f) identify the main sources of uncertainty and/or systematic error, **Max two**		
	time taken by electromagnet to release ball,	**(1)**	
	parallax in specified measurement	**(1)**	
	systematic/zero error on height or timer	**(1)**	**2**
	(g) *comment on safety*.		
	Relevant hazard identified and precaution to be taken	**(1)**	**1**
	<u>Examples</u> There is no major hazard as low voltage supply/falling mass is small Care should be take not to tread on steel ball to prevent slipping Wearing shoes to prevent harm from falling steel ball		
	Total for Question 7		**13**

<table>
<tr><th>Question Number</th><th>Answer</th><th>Mark</th></tr>
<tr><td>8(a)</td><td>Max 2 from
• no repeats shown (1)
• inconsistent precision (in length) (1)
• only five sets of results Or not enough readings (1)</td><td>2</td></tr>
<tr><td>8(b)</td><td>unit (1)
values (1)
consistent decimal places (1)

<table>
<tr><th>Length l /cm</th><th>Frequency f /Hz</th><th colspan="2">1/length / m^{-1}</th><th>1/length / cm^{-1}</th></tr>
<tr><td>10</td><td>1719</td><td>10.0</td><td>10.00</td><td>0.100</td></tr>
<tr><td>12.5</td><td>1375</td><td>8.0</td><td>8.00</td><td>0.080</td></tr>
<tr><td>14.5</td><td>1185</td><td>6.9</td><td>6.90</td><td>0.069</td></tr>
<tr><td>16.5</td><td>1042</td><td>6.1</td><td>6.06</td><td>0.061</td></tr>
<tr><td>19</td><td>904</td><td>5.3</td><td>5.26</td><td>0.053</td></tr>
</table></td><td>3</td></tr>
<tr><td>8(c)</td><td>Label axes with units, (1)
Appropriate choice of scale (1)
Plotting of points (1)
Line of best fit (1)</td><td>4</td></tr>
<tr><td>8(d)</td><td>Large triangle used (1)
Attempt to calculate gradient (1)
Value 172 ± 5 Or 17 200 ± 500 (1)

<u>Example of calculation</u>
(1720 – 800)/(10 – 4.75) = 920/5.25 = 175</td><td>3</td></tr>
<tr><td>8(e)</td><td>• gradient from (d) x 2 (1)
• value to 2 or 3 sig fig (1)
• unit (1)

<u>Example of calculation</u>
175 x 2 = 350 ms^{-1}</td><td>3</td></tr>
<tr><td>8(f)</td><td>Max 1 from
• inaccuracy in measuring frequency (1)
• error in measuring length (1)
• comment on temperature/humidity (1)
• variation in playing technique (1)</td><td>1</td></tr>
<tr><td></td><td>Total for Question 8</td><td>16</td></tr>
</table>


June 14 08
Frequency / Hz
1800
1600
1500
1400
1300
1200
1100
1000
900
800
4
5
6
7
8
9
10
1/length /m⁻¹

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