Mark Scheme (Results)

January 2019

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.

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.

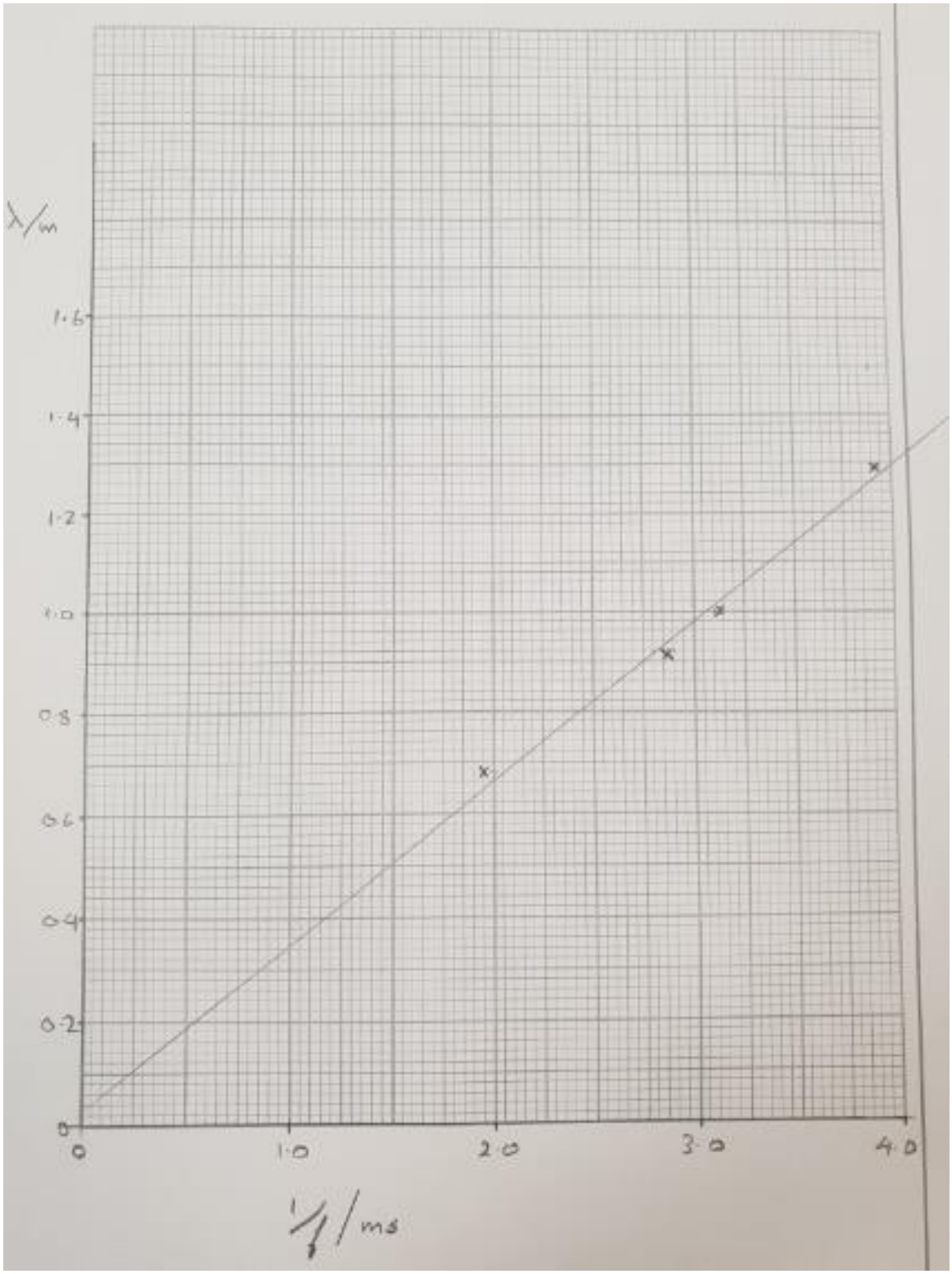
Question Number	Answer	Mark
1	The only correct answer is **D**. **A** is not correct as it is not a base quantity. **B** is not correct as it is a unit. **C** is not correct as it is a unit.	**1**
2	The only correct answer is **B**. **A** is not correct as it does not start from 0 on the small scale. **C** is not correct as it starts after the 0 on the small scale. **D** is not correct as it starts after the 0 on the small scale.	**1**
3	The only correct answer is **D**. **A** is not correct as it includes the anomalous reading. **B** is not correct as it includes the anomalous reading. **C** is not correct as it has too many significant figures.	**1**
4	The only correct answer is **A**. **B** is not correct as it is not required. **C** is not correct as it is not required. **D** is not correct as it is not required.	**1**
5	The only correct answer is **D**. **A** is not correct as it is a source of error. **B** is not correct as terminal velocity is not reached.	**1**
	Total for multiple choice questions	**5**

Question Number	Answer	Mark
6 (a)	Power supply, lamp **and** ammeter in series (1) Means to vary current in lamp (1) Voltmeter in parallel with appropriate component (1)	**3**
6 (b)	No parallax (error) (1) **Or** Easy to switch range. (1)	**1**
6 (c)	Repeat readings and average (1) to reduce (effect of) random errors/anomalies (1) **Or** Readings on a digital meter fluctuate (1) so take readings of *I* and *V* simultaneously. (1) **Or** Allow time for the temperature to become steady (1) As *I* **Or** *R* depend on the temperature of the filament (1)	**2**
	Total for question 6	**6**

Question Number	**This question must be marked holistically, so award marks for any valid method and valid points wherever they appear.**		Mark
7	*(a) state the quantities to be measured* length, width, thickness **and** mass/weight	(1)	**1**
	(allow volume if replacing length, width and thickness **and** clear from later parts that displacement method used. NB will then need measuring cylinder in (b)		
	(b) list the apparatus required		
	Metre rule or Vernier callipers **and** micrometer [accept digital calliper in place of Vernier calliper and micrometer]	(1)	
	Balance/scales	(1)	**2**
	(c) for two of the quantities listed in (a) explain your choice of measuring instrument For each quantity		
	Instrument	2 x (1)	
	Justification, including indication of precision related to expected measurement	2 x (1)	**4**
	(d) comment on whether repeat readings are appropriate		
	Repeat readings are appropriate to identify anomalies **Or** deal with random error **Or** deal with variation in named measurement.	(1)	**1**
	(e) suggest how to make the measurement of thickness as accurate as possible,		
	Measure the thickness of all 10 slides together	(1)	
	Or measure thickness in various places (or different slides) and average	(1)	
	To reduce the percentage uncertainty in the measurement	(1)	**2**
	(f) explain how the measurements made will be used to determine the density		
	Use of volume = length × width × thickness	(1)	
	Use of density = mass/volume	(1)	**2**
	(g) state the main sources of uncertainty and/or systematic error **Max 2**		
	Variation of thickness or length or width of slides	(1)	
	Thickness is small value	(1)	
	Zero error in named instrument	(1)	**2**
	Volume incorrect as chip/dust on slide	(1)	
	(h) comment on safety. **Hazard and precaution**		
	Glass can have sharp edges or break so handle with care (to avoid injury)	(1)	**1**
	Don't overtighten micrometer as the glass might break	(1)	
	Total for question 7		**15**

Question Number	Answer	Mark
8(a)	**Max 2** Small range **Or** uneven spacing (1) No repetition shown (1) Only 4 sets (1) Inconsistent sf/dp (1)	**2**
8(b)	An antinode would be formed at the open end of the tube and a node at the closed end (water surface). (1) Distance between node and antinode = λ / 4 (1) MP1 and 2 may be shown by means of a labelled diagram.	**2**
8 (c) (i)	Comparison of $v = f\lambda$ and $y = mx$ (+ c) (1) Rearrangement to show $m = v$ and v is constant (at a given temperature) **and** $c = 0$ (1)	**2**
8(c) (ii)	1/f to 2 or 3 sig fig (1) Axes labelled, with units (1) Sensible scales (1) Correct plotting of data (1) Best fit line (1)	**5**
8(d)	Large triangle - at least half of **drawn** line (1) Value to 3 sf: ~327 ms^{-1} (1) [range 315 - 339]	**2**
8(e)	**Max 1** <u>Examples</u> Marked frequency may be incorrect (1) Accept end correction **Or** the length of the tube may not correspond exactly to λ/4 (1) Speed of sound in air depends on temperature (1) Difficult to locate the exact position for the loudest sound (1) Parallax error in measuring length (1) Poor line of best fit from small number of points (1)	**1**
	Total for question 8	**14**

f / Hz	l / m	Wavelength λ / m	1/f /s
256	0.322	1.29	0.00391
320	0.25	1.00	0.00313
348	0.228	0.912	0.00287
512	0.160	0.64	0.00195


λ/m
1·6
1·4
1·2
1·0
0·8
0·6
0·4
0·2
0
0
1·0
2·0
3·0
4·0
1/f/ms

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