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Mark Scheme (Results)

January 2015

Pearson Edexcel International Advanced Level in Physics (WPH06) Paper 01

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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:

'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.

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

<table>
<tr><th>Question Number</th><th>Answer</th><th>Mark</th></tr>
<tr><td>1(a)</td><td>
<table>
<tr><th>Measurement</th><th>Instrument</th><th>Expected precision</th></tr>
<tr><td>Width</td><td>Callipers
Or Micrometer</td><td>0.1 or 0.01 mm (1)
0.01 or 0.001 mm (1)</td></tr>
<tr><td>Thickness</td><td>Callipers
Or Micrometer</td><td>0.1 or 0.01 mm (1)
0.01 or 0.001 mm (1)</td></tr>
</table>
Precision must be appropriate for choice of instrument and is a dependent mark
1 mark per box
</td><td>4</td></tr>
<tr><td>1(b)</td><td>Length 0.26(%) or 0.13(%) (1)

Thickness 4(%) or 2(%) (1)

(Allows for use of range or half range)

<u>Example of calculation</u>
Length: half the range = 0.1 mm
% uncertainty = (0.1mm/75.8mm)×100% = 0.13%

Thickness: half the range = 0.02 mm
% uncertainty = (0.02 mm/ 1.00 mm)×100% = 2%</td><td>2</td></tr>
<tr><td>1(c)(i)</td><td>Density = 2.46 g cm^{-3} or 2460 kg m^{-3} Or 2.46 × 10^{-3} g mm^{-3}

Use of $d = m/v$ (1)
Correct value to 3 SF with appropriate unit (1)

<u>Example of calculation</u>
density = mass / volume
density = 4.82 g/(7.58 cm×2.58 cm×0.100 cm) = 2.46 g cm^{-3}</td><td>2</td></tr>
<tr><td>1(c)(ii)</td><td>Calculates %U for mass (1)
Adds to both their answers for (b) (1)

<u>Example of calculation</u>

((3g/482g) × 100%) + (2% + 0.13%) = 2.75%</td><td>2</td></tr>
</table>

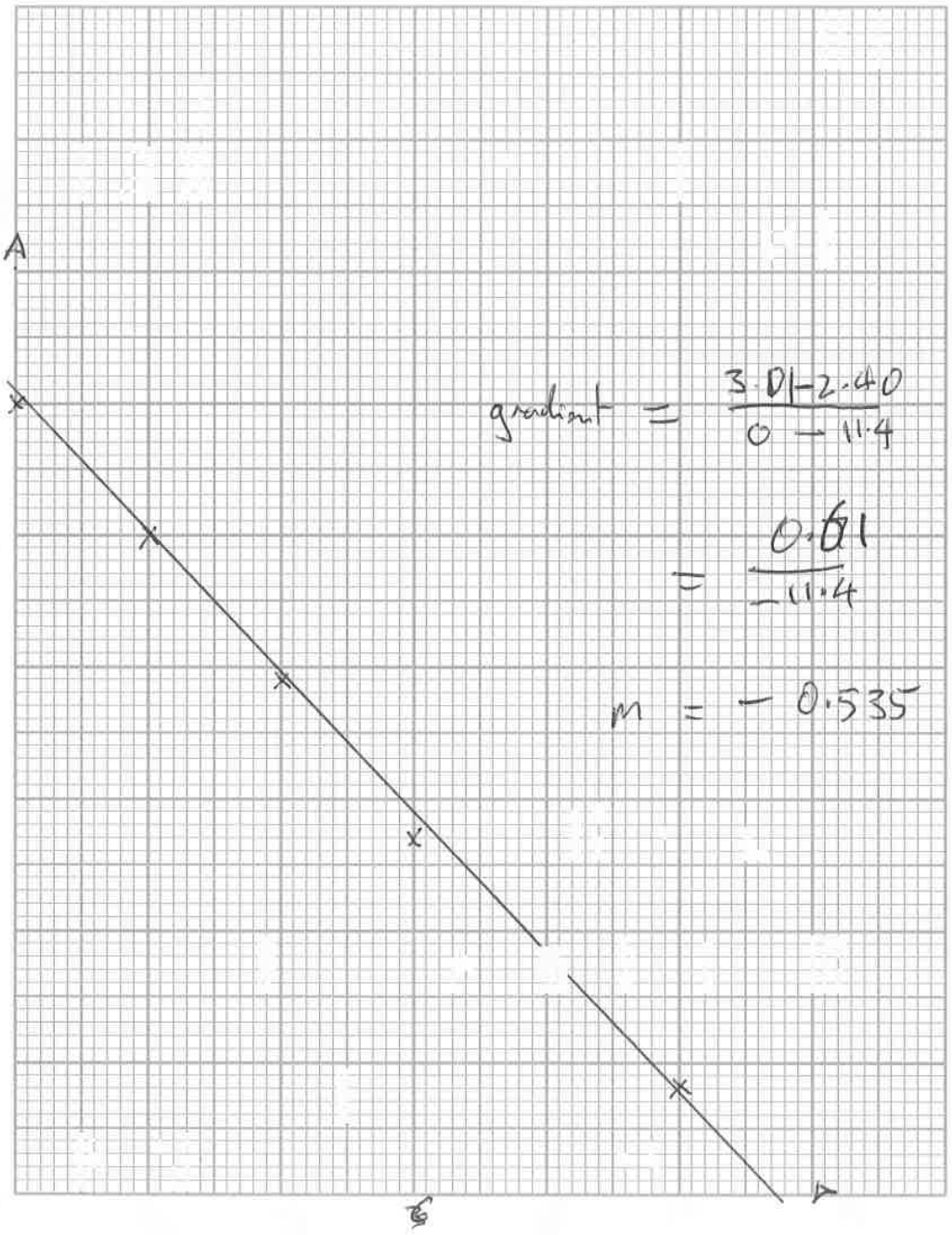
1(c)(iii)	**Compares ranges** Calculates range of values in their density using %U from (c)(ii) (1) Makes comment based on overlap of values comparing with 2500 to 2700 kg m^{-3} (dependent mark) (1) **Or** **Calculates % D** finds %D in values for density (5.4%) (1) makes comment to compare with %U in (c)(ii) **Or** %U in book value (3.8%) (dependent mark) (1) <u>Examples of calculation</u> **Compares ranges** Maximum value of calculated density =2460 kgm^{-3} × 1.0275 = 2528 kgm^{-3} Minimum value of book value =2600 – 100 = 2500 kgm^{-3} Comparison is 2528>2500 Ranges overlap so it could be Crown glass Allow ecf on their values **Calculates %D** %D = 100 × (2600 – 2460)/ 2600 = 5.4% %U in (c)(ii) = 2.75% **Or** %U in bookvalue = 100 ×(100/2600) =3.8% %D>%U therefore **not** Crown glass Allow ecf on their values	**2**
1(d)	<u>% U</u>ncertainty is reduced (1) Because measurement is larger **Or** accuracy of determination of 1 slide is increased since a mean of 10 slides is taken **Or** 1 slide might be anomalous (1)	**2**
	Total for Question 1	**14**

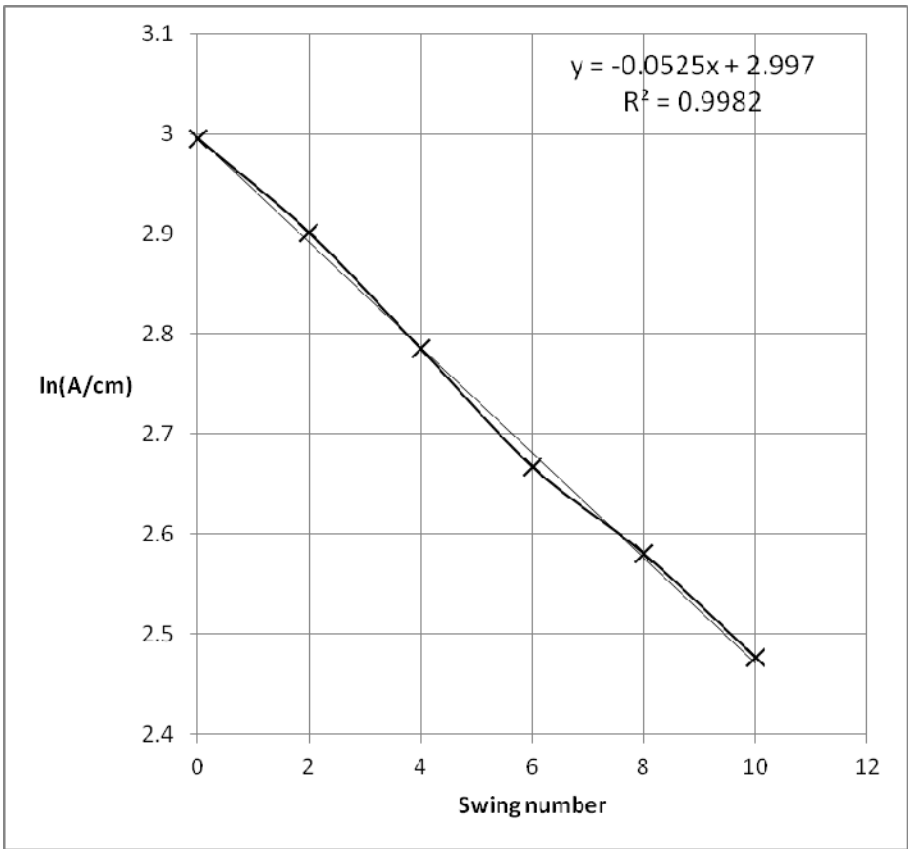
Question Number	Answer		Mark
2(a)	G-M tube **and** counter (allow rate-meter for both) **and** metre rule/absorbers	(1)	**1**
2(b)	**Range method** Background count recorded Count rate recorded as distance between source and GM tube increased In range 2cm (should be shorter than range for alpha) to longer than 25 cm **Or** **Absorber method** Background count recorded Varies distance to determine position at which count rate falls to background count Count rate recorded using different absorbers	(1) (1) (1) (1) (1) (1)	**3**
2(c)	Take them over a long time (minimum 60s)	(1)	**1**
2(d)	**Range method (Max 3)** Count rate should not change at short range (5 cm) Hence no alpha (dependent mark) At around 25 cm count rate should fall to background Hence no gamma (dependent mark) **Or** **Absorber method (Max 3)** No drop in count rate with paper Hence no alpha (dependent mark) Count rate drops to background with lead Hence no gamma (dependent mark)	(1) (1) (1) (1) (1) (1) (1) (1)	**3**
2(e)	Use handling tools	(1)	**1**
	Total for Question 2		**9**

Question Number	Answer		Mark
3(a)(i)	BFL is a <u>smooth</u> <u>curve</u> passing close to all the points With maximum clearly <25 kHz – by eye	(1) (1)	**2**
3(a)(ii)	Max V <35 mV and >27 mV – must include unit	(1)	**1**
3(a)(iii)	Peak frequency read correctly with unit from their BFL	(1)	**1**
3(b)	Take more readings of f near peak	(1)	**1**
	Total for Question 3		**5**

Question Number	Answer		Mark
4(a)(i)	Diagram showing displaced cone Indication of either edge of cone as point of measurement(dependent mark)	(1) (1)	**2**
4(a)(ii)	Value in range 5 mm → 10 mm	(1)	**1**
4(b)	$\ln A = \ln A_0 - kn$ Compares with y = mx + c **and** states that (−)k is the gradient	(1) (1)	**2**
4(c)(i)	Ln **Or** log <u>values</u> correct in table to 3SF Axes correct & labels shown eg n and ln(A/cm) Scales Plots BFL	(1) (1) (1) (1) (1)	**5**
4(c)(ii)	Large triangle – half the plotted line k = 0.0520 → 0.0550 to 3SF	(1) (1)	**2**
	Total for Question 4		**12**

n	*A*/cm	ln (*A*/cm)	*A*/m	ln (*A*/m)
0	20.0	3.00	0.200	-1.61
2	18.2	2.90	0.182	-1.70
4	16.2	2.79	0.162	-1.82
6	14.4	2.67	0.144	-1.94
8	13.2	2.58	0.132	-2.02
10	12.0	2.48	0.120	-2.12




y = -0.0525x + 2.997
R² = 0.9982
3.1
3
2.9
2.8
2.7
2.6
2.5
2.4
ln(A/cm)
0
2
4
6
8
10
12
Swing number

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