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Mark Scheme (Results)

October 2016

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] ✓ **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 cause the final calculation mark to be lost.
   - 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.
   - 2.4 The same missing or incorrect unit will not be penalised more than once within one question.
   - 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.

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.

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.

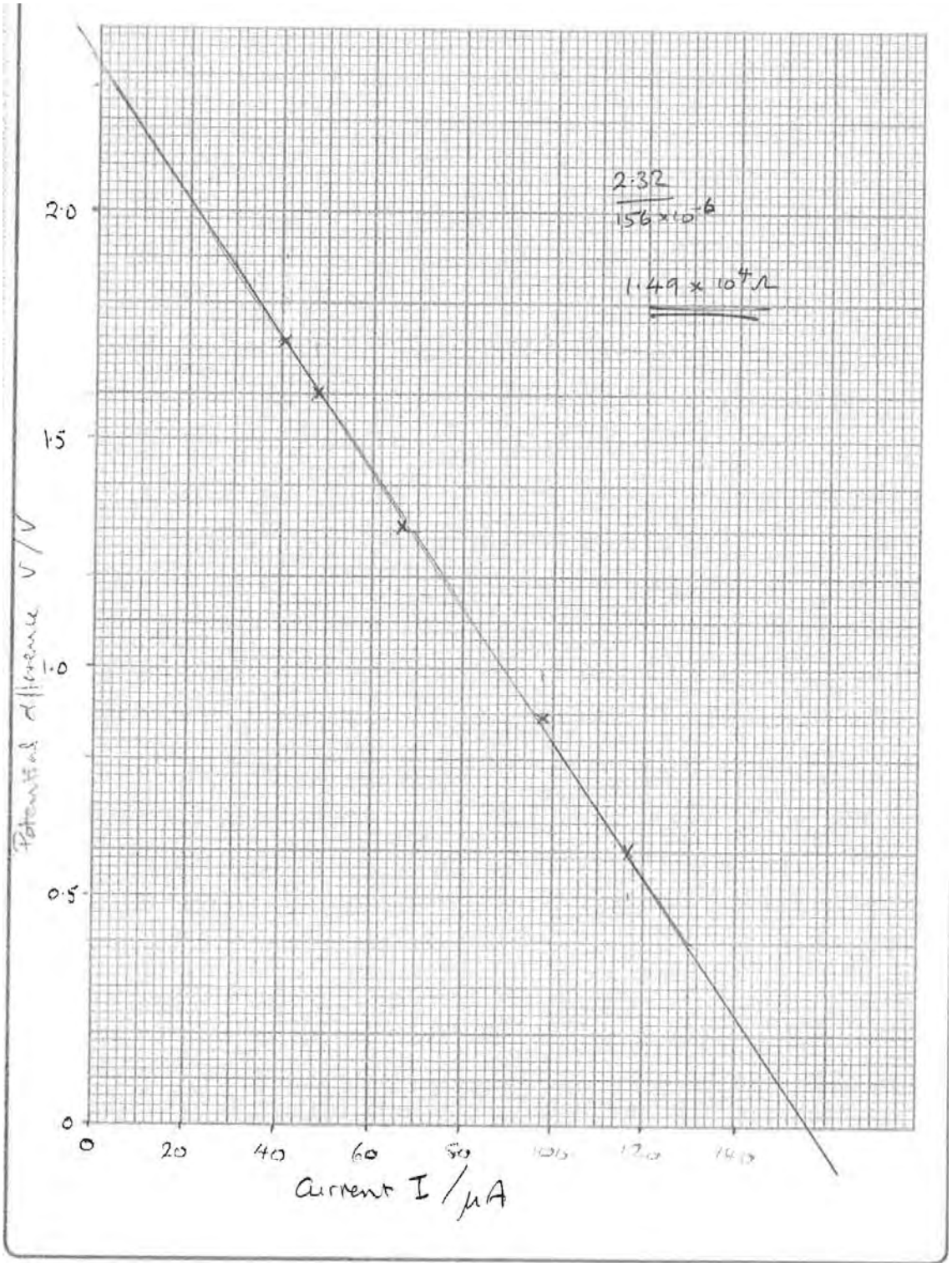
For a line mark there must be a thin continuous line which is the best-fit line for the candidate's results.

Question Number	Answer	Mark
1	A correct answer B and D are not a base units C is a quantity not a base unit	**1**
2	D correct answer A has an incorrect power of ten and incorrect unit B has an incorrect power of ten C has an incorrect unit	**1**
3	B correct answer A, C, and D all include an unmeasured quantity	**1**
4	D correct numerical answer with appropriate number of significant figures A and B are incorrect as the anomalous result has not been excluded C has too many significant figures	**1**
5	A correct answer as mass is not required so a balance is not needed B is needed to measure height C is needed to ensure the metre rule is upright D is needed for timing	**1**

Question Number	Answer **This question to be marked holistically as answers to (a) might appear in (b) and vice versa**	Mark
6(a)	**Max 4** Measure <u>height</u> of all 500 sheets **(1)** Divide answer by 500 **(1)** Use vernier callipers **Or** metre rule or ruler **(1)** Precision/uncertainty/resolution for calliper 0.1 mm **(1)** Precision/uncertainty/resolution for metre rule/ruler 1 mm **(1)** Percentage calculation based on instrument **(1)** <u>Example (for vernier)</u> Percentage uncertainty calculation e.g. 0.1x 100/60 % = 0.17%	**4**
6(b)	**Max 2** Ensure pile is 'straight' **Or** ensure pile is not compressed **(1)** Use set square to square off pile **Or** ensure ruler vertical **(1)** Check for zero error **(1)** Avoid parallax errors **Or** read at eye level **(1)** Repeat <u>and</u> average **(1)**	**2**
	Total for question 6	**6**

Question Number	Answer **This question has to be marked holistically, in the context of the experiment described and credit given for answers given where-ever they appear**		Mark
7	(a) *draw and label a diagram of the apparatus to be used* Labelled diagram of workable horizontal set-up, with mass/weight, pulley and bench	**(1)**	**1**
	(b) *list any additional measuring instruments required that are not shown in the diagram* Rule, vernier callipers or micrometer **NB may be on diagram or elsewhere in text**	**(1)**	**1**
	(c) *list the quantities to be measured,* Diameter, original length, extension or stretched length	**(1)**	**1**
	(d) *for two quantities explain your choice of measuring instrument,* States measuring instrument and quantity Justification of choice of measuring instrument with reference to scale (uncertainty/range) <u>Examples</u> States measuring length using metre rule to +/- 1 mm States measuring diameter using micrometer (screw gauge) to +/- 0.01 mm	**(2)** **(2)**	**4**
	(e) *for one quantity comment on whether repeat readings are appropriate* Justified appropriate comment <u>Examples</u> Repeat measurement of diameter <u>and</u> average in case fishing line is not circular. Carry out experiment only once in case the elastic limit is exceeded.	**(1)**	**1**
	(f) *state which is the independent variable and which is the dependent variable* Mass / weight / force <u>and</u> extension / length Identifies mass / weight / force as the independent variable <u>and</u> extension/length as the dependent variable	**(1)** **(1)**	**2**
	(g) *explain how the data collected will be used to determine the Young modulus, include a sketch of the expected graph,* Plot force / mass against extension / length **Or** stress against strain Sketch of graph Determine gradient of straight line section Explains how measurements relate to variables plotted.	**(1)** **(1)** **(1)** **(1)**	**4**
	(h) *comment on a main source of uncertainty and/or systematic error* Reference to measurement of extension or diameter with corresponding reason	**(1)** **(1)**	**2**
	(i) *comment on safety* Sensible identification of risk <u>and</u> precaution E.g. risk from falling weights so use foot protection or risk from breaking line so use goggles	**(1)**	**1**
	Total for question 7		**17**

Question Number	Answer	Mark
8(a)	**Max 2** Inconsistent significant figures **(1)** Poor range **(1)** No repetition shown **(1)** Only 5 sets **(1)**	**2**
8(b)	Explicit or implicit comparison to $y = mx+c$ **(1)** states ε and r constant **(1)**	**2**
8(c)	Axes labelled **(1)** With units **(1)** Sensible scales (multiple of 1, 2, 5) [allow truncated scale] **(1)** Correct plotting of data **(1)** Best fit line **(1)** (See the graph on the following page)	**5**
8(di)	Reading of intercept to give ε in range 2.15 - 2.50 V and to 2 or 3 sf **(1)** Calculation of gradient to give value of r in range 1.20 – 1.55 x 10^4 Ω to 2 or 3 sf **(1)**	**2**
8(dii)	Divide values for both ε and r by 3 (either described or values given) **(1)**	**1**
	Total for question 8	**13**


2·0
1·5
1·0
0·5
0
0
20
40
60
80
100
120
140
Potential difference V / V
Current I / μA
2·32
1·56 × 10⁻⁶
1·49 × 10⁴ Ω

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