Mark Scheme (Results)

Summer 2017

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.

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) <u>Horizontal force of hinge on table top</u>

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. '<u>resonance</u>'
- 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:

<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] **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.

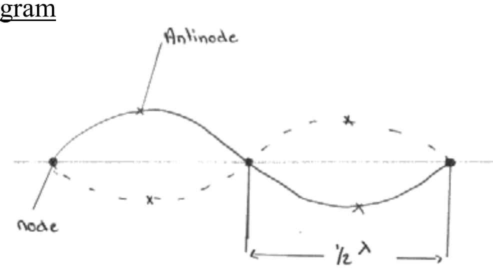
6.3 A mark given for choosing a scale requires that the chosen scale allows all points to be plotted, spreads plotted points over more than half of each axis and is not an awkward scale e.g. multiples of 3, 7 etc.

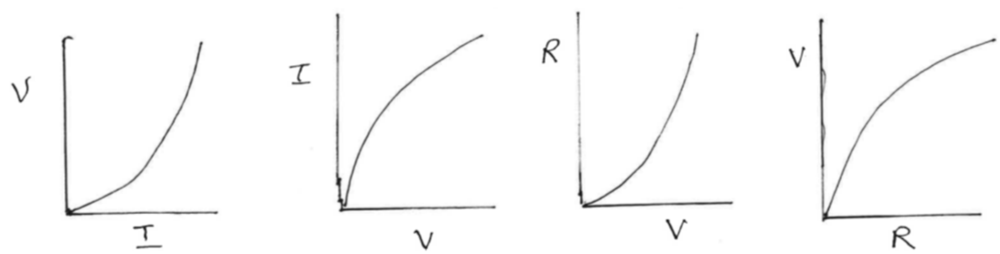
6.4 Points should be plotted to within 1 mm.

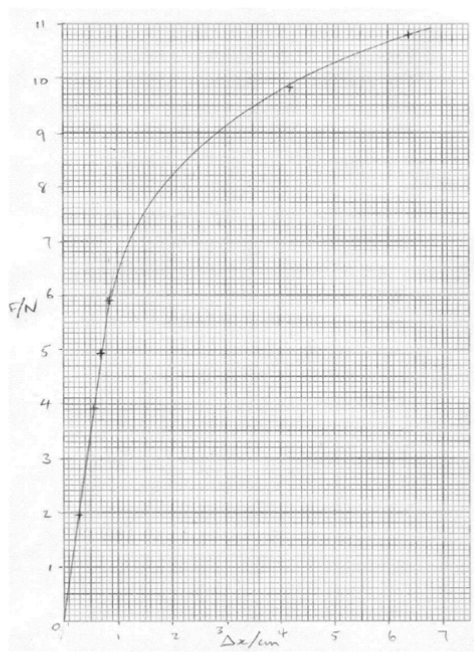
- Check the two points furthest from the best line. If both OK award mark.
- If either is 2 mm out do not award mark.
- If both are 1 mm out do not award mark.
- If either is 1 mm out then check another two and award mark if both of these OK, otherwise no mark.

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	**C current is the only base SI quantity**	**1**
	Incorrect answers A – this is a unit not a quantity B – charge is not an SI base quantity D – this is a unit not a quantity	
2	**B 0.20 ± 0.01 s which omits an anomalous result and derives the uncertainty from the three remaining readings**	**1**
	Incorrect answers A – this answer uses an uncertainty derived from half the whole range C – this answer has not omitted the anomalous reading D – this answer has not omitted the anomalous reading and uses the incorrect uncertainy derived from half the whole range	
3, 4, 5	**These three questions refer to an experiment to determine the viscosity of a liquid. In the method referred to a sphere is dropped through a column of the liquid**	
3	**D the volume of the liquid is not relevant to the experiment**	**1**
	Incorrect answers: all are quantities which occur in the required equation: $\eta = 2r^2(\rho - \sigma)g/9v$ The question asked for a quantity which is **not** included. A – the density of the liquid is σ B – the density of the sphere is ρ C - the radius of the sphere is r	
4	**C a micrometer screw gauge has a small resolution, suitable for measuring a very small diameter**	**1**
	Incorrect answers: A – this instrument does not have the required resolution B – this instrument does not have the required resolution D – this instrument does not have the required resolution	
5	**B N s m^{-2} can be derived from the required equation**	**1**
	Incorrect answer A – the indices are incorrect for s and m C – this unit does not have the required dimensions D - this unit does not have the required dimensions	

Question Number	Answer		Mark
6(a)(i)	Appropriate diagram showing antinode(s), (nodes), and wavelength (wavelength either on diagram or in text, half wave acceptable) <u>Example of diagram</u>  **Any one from** Greatest energy transfer at antinode positions Nodes: areas of least intensity so no burning Antinodes: areas of max intensity so burns. .	(1) (1) (1) (1)	**2**
6(a)(ii)	Use of $v = f\lambda$ Speed correct ignoring powers of 10 Value $2.94 \times 10^{8}\ \mathrm{ms^{-1}}$ <u>Example of calculation</u> $v = f\lambda = 2450 \times 10^{6}\ \mathrm{Hz} \times 0.12\ \mathrm{m}$ $v = 2.94 \times 10^{8}\ \mathrm{ms^{-1}}$	(1) (1) (1)	**3**
6(b)(i)	**Either** Metre rule or 30 cm ruler as appropriate to length to be measured Precision is to the nearest 1 mm **Or** Calipers Precision to the nearest 0.1 mm	 (1) (1) (1) (1)	**2**
6(b)(ii)	Percentage uncertainty consistent with answer to (b)(i) <u>Example of calculation</u> Uncertainty = (0.1/6) × 100 % = 1.67 %	(1)	**1**
	Total for question 6		**8**

Question Number	Answer **This question has to be marked holistically and in the context of the experiment described.**	Mark
7	(a) *draw and label a circuit diagram of the apparatus to be used,* Circuit that would work (1) Means of varying p.d. (1)	**2**
	(b*) state the quantities to be measured, suggesting a suitable measuring instrument for each quantity* Current with ammeter (1) p.d. with voltmeter (1) [Accept multimeters if setting identified]	**2**
	(c) *comment on whether repeat readings are appropriate in this case,* Repeat readings appropriate since mean can be found **Or** Repeat readings appropriate to identify errors (1)	**1**
	(d) *sketch the graph to be drawn and explain how the data collected will be used to determine the resistance at a given potential difference,* **Either** Plot graph of current against p.d. **Or** plot a graph of p.d. against current (1) Sketch of graph (1) Use of *R*= *V/I* at a point to determine resistance (1) **Or** Use of *R*= *V/I* to determine resistance (1) Plot graph of resistance against p.d. **Or** Plot graph of p.d. against resistance (1) Sketch of graph (1)  	**3**
	(e) *identify the main sources of uncertainty and/or systematic error,* Any **two** from Zero error on meter (1) Resistance inherent in circuit (1) Parallax errors with analogue meters (1)	**2**
	(f) *comment on safety* Sensible identification of risk with justification (1) <u>Example of answers</u> low risk experiment as only 12 V avoid touching the hot lamp (which could cause burns)	**1**
	Total for question 7	**11**

Question Number	Answer		Mark
8(a)	Inconsistent sf/dp No evidence of loading and unloading (accept no repetition) More readings needed between 600 (g) and 1000 (g) (accept at point of curvature)	(1) (1) (1)	**3**
8(b)	Repeat measurement and calculate the mean Different position / orientations along the length	(1) (1)	**2**
8(c)(i)	Axes labelled in the correct orientation With units Sensible scales Correct plotting of data Best fit line Force/N  Extension/cm	(1) (1) (1) (1) (1)	**5**
8(c)(ii)	**Max 2** Linear up to limit of proportionality **Or** not linear after point of proportionality Then becomes curved **Or** then greater increases in extension for equal increases in force Initially obeys Hooke's law	(1) (1) (1)	**2**
8(c)(iii)	Use of area $= \pi r^2$ (Area = 4.71×10^{-8} m^2) Use of $E = \frac{F}{A}\frac{x}{\Delta x}$ (either via gradient or stress/strain for a point in linear region) YM = 1.9×10^{10} (Pa) - 2.2×10^{10} (Pa) 2 or 3 sig fig and unit <u>Example of calculation</u> A = $\pi\,(0.245\text{ m} \times 10^{-3}/2)^2$ $E = 7.33 \times 10^2 \times 1.35 / 4.71 \times 10^{-8} = 2.10 \times 10^{10}$ Pa	(1) (1) (1) (1)	**4**
	Total for question 8		**15**

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