Mark Scheme (Results)

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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 schemes will indicate within the table where, and which strands of QWC, are being assessed. The strands are as follows:

  i) ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear
  ii) select and use a form and style of writing appropriate to purpose and to complex subject matter
  iii) organise information clearly and coherently, using specialist vocabulary when appropriate

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.

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 e.g. ‘**and**’ when two pieces of information are needed for 1 mark.
   - 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 This does not apply in ‘show that’ questions or in any other question where the units to be used have been given, for example in a spreadsheet.
   - 2.3 The mark will not be awarded for the same missing or incorrect unit only once within one clip in epen.
   - 2.4 Occasionally, it may be decided not to insist on a 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.
   - 2.5 The mark scheme will indicate if no unit error is to be applied by means of [no ue].

3. Significant figures
   - 3.1 Use of too many significant figures in the theory questions will not be prevent a mark being awarded if the answer given rounds to the answer in the MS.
   - 3.2 Too few significant figures will mean that the final mark cannot be awarded in ‘show that’ questions where one more significant figure than the value in the question is needed for the candidate to demonstrate the validity of the given answer.
   - 3.3 The use of one significant figure might be inappropriate in the context of the question e.g. reading a value off a graph. If this is the case, there will be a clear indication in the MS.
   - 3.4 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 mean that one mark will not be awarded. (but not more than once per clip). Accept 9.8 m s^{-2} or 9.8 N kg^{-1}
   - 3.5 In questions assessing practical skills, a specific number of significant figures will be required e.g. determining a constant from the

gradient of a graph or in uncertainty calculations. The MS will clearly identify the number of significant figures required.

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.

5. Graphs

5.1 A mark given for axes requires both axes to be labelled with quantities and units, and drawn the correct way round.

5.2 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.

5.3 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.

5.4 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.

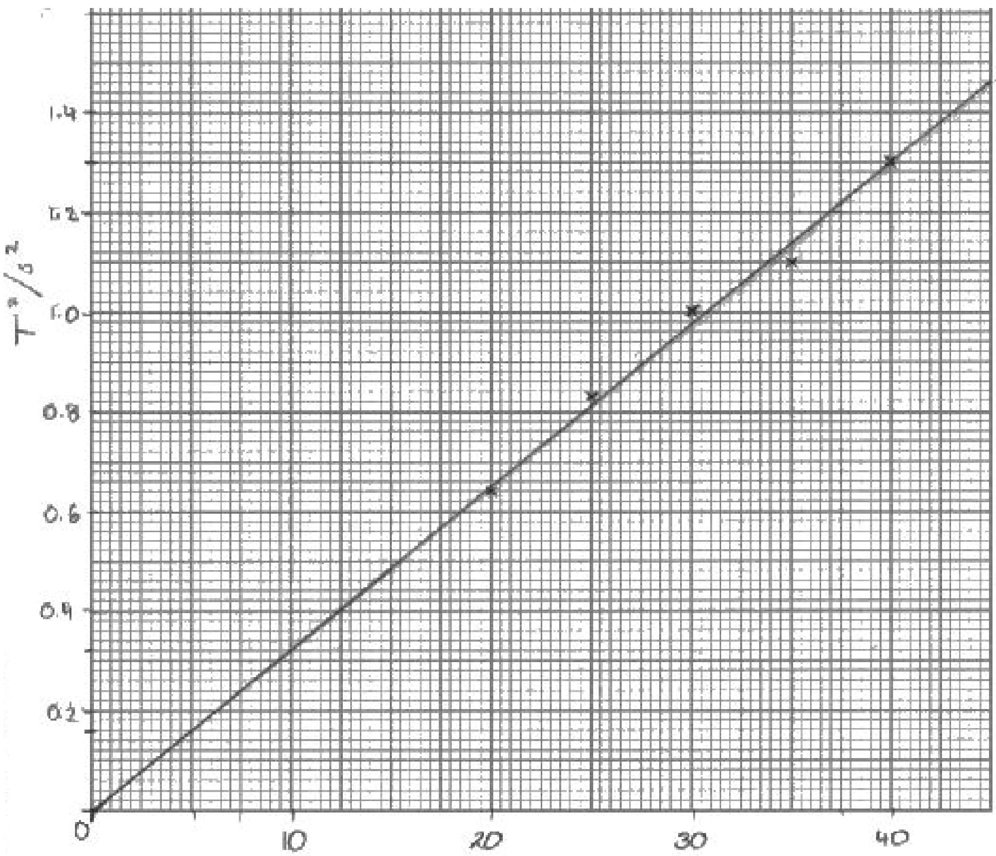
For a line mark there must be a thin continuous line which is the best-fit line for the candidate's results.

Question Number	Answer	Mark
1	The only correct answer is **C**. **A** is not correct as it is a unit. **B** is not correct as it is not a base quantity. **D** is not correct as it is a unit.	**1**
2	The only correct answer is **D**. **A** is not correct as the powers of ten are incorrect. **B** is not correct as the powers of ten are incorrect. **C** is not correct as the powers of ten are incorrect.	**1**
3	The only correct answer is **A** because density is not in the required formula. **B** is not correct because resistance is a required quantity. **C** is not correct because area is a required quantity. **D** is not correct because length is a required quantity.	**1**
4	The only correct answer is **C**. **A** is not correct because no measurement of mass is required. **B** is not correct because a metre rule does not have the necessary precision. **D** is not correct because vernier calipers do not have the necessary precision.	**1**
5	The only correct answer is **C**. **A** is not correct because Ω is the unit for resistance not resistivity. **B** is not correct because the power for m is incorrect. **D** is not correct because the power for m is incorrect.	**1**
	Total for multiple choice questions	**5**

Question Number	Answer		Mark
6(a)	0.145 – 0.155 (mm) to 3 d.p. (allow 0.010)	(1)	**1**
6(b)	Value from half range or full range [0.005 or 0.010] 3 (%) or 7 (%), value to 1 or 2 s.f. <u>Example</u> (0.005/0.15) × 100% = 3.3%	(1)	**1**
6(c)	Uncertainty = 0.004 mm [unit required] to 1 or 2 s.f. Allow full range or half range as in parts (a) and (b) <u>Example of calculation</u> 0.075 × 0.05 = 0.0038 mm	(1)	**1**
	Total for question 6		**3**

Question Number	Answer		Mark
7	**Question to be marked holistically and in the context of the experiment described.** (a) *draw and label a diagram showing how the apparatus will be used,* Appropriate diagram including two markers on measuring cylinder or two light gates (first marker/light gate shown below surface of liquid)	**(1)**	**1**
	(b) *list any additional measuring instruments required that are not shown in your diagram,* Metre rule [allow ruler] or tape, stopwatch or light gates, and micrometer or <u>digital</u> calliper	**(1)**	**1**
	(c) *list the quantities to be measured,* Diameter of sphere, time and distance between markers or time and distance between light gates	**(1)**	**1**
	(d) *for two quantities listed in (c) explain your choice of measuring instrument,* For each Quantity and instrument Explanation, including indication of precision related to expected measurement	**(2)** **(2)**	**4**
	(e) *state which is the independent variable and which is the dependent variable,* Diameter **and** time [allow radius for diameter and velocity for time] Independent **and** dependent variables correctly identified	**(1)** **(1)**	**2**
	(f) *for one quantity comment on whether repeat readings are appropriate in this case,* Quantity **and** comment <u>Examples</u> Repeat diameter measurement at various orientations and averaged Times should be repeated and averaged Repeat identified measurement to eliminate anomalous values	**(1)**	**1**
	(g) *explain how the data collected will be used to determine the viscosity including a sketch of the expected graph,* Calculate velocity for each diameter/radius of sphere **Or** calculate r using $d/2$ for each sphere Plot v against r^2 or $v^{1/2}$ against r Sketch of graph showing labelled axes and straight line through origin Uses equation to identify gradient (to calculate η) consistent with their graph	**(1)** **(1)** **(1)** **(1)**	**4**
	(h) *identify the main sources of uncertainty and/or systematic error,* **MAX 2** <u>Terminal</u> velocity not reached before timing starts. Ball not dropped in centre of cylinder to eliminate edge effects. Time of fall short so reaction time is significant Diameter of spheres small so large percentage uncertainty Zero error on micrometer or metre rule. Parallax error in specified measurement	**(1)** **(1)** **(1)** **(1)** **(1)** **(1)**	**2**
	(i) comment on safety. Identification of risk with appropriate precaution <u>Example</u> Spills can cause slips, mop up A safe experiment, no precautions necessary	**(1)**	**1**
	Total for question 7		**17**

Question Number	Answer	Mark
8(a)	**Max 2** Small range **(1)** No repetition shown **(1)** Only 5 sets **(1)** Inconsistent d.p. **Or** inconsistent s.f. **(1)** Should have timed more than one oscillation **(1)**	**2**
8(b)	$T^2 = \dfrac{4\pi^2}{g} l$ compared to $y = mx + c$ **(1)** $4\pi^2/g$ is constant **and** $c = 0$ **(1)**	**2**
8(c)(i)	Axes labelled, with quantities and units **(1)** Sensible scales **(1)** Correct plotting of data **(2)** Best fit line **(1)** <u>Example</u>	**5**



l / 10^{-2} m

8(c)(ii)	Large triangle, at least half drawn line (accept from just numerical values if on drawn line) **(1)** 3.10 ($s^2\ m^{-1}$) to 3.30 ($s^2\ m^{-1}$) to 2 or 3 s.f. **(1)** **Or** 0.031($cm^2\ m^{-1}$) to 0.033 ($cm^2\ m^{-1}$) if unit on graph axis is shown as cm	**2**
8(c)(iii)	11.7 m s^{-2} to 12.7 m s^{-2} **(1)** to 2 or 3 s.f. with unit **(1)**	**2**
8(d)	Use of calculation to find %D **(1)** Correct value from student's calculation to 1 or 2 s.f. **(1)** <u>Example of calculation</u> %D = (value from (c)(iii) –9.81) / 9.81 × 100 %	**2**
	Total for question 8	**15**

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