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 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:

<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] **3**
[Bald answer scores 0, reverse calculation 2/3]

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. 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 D** A Is not correct because it is an SI base unit. B Is not correct because it is an SI base unit. C Is not correct because it is an SI base unit.	**1**
2	**The only correct answer is C** A Is not correct because the Vernier scale reading is not included. B Is not correct because 0.5 is not in line. D Is not correct because the zero Vernier reading is before 20.	**1**
3	**The only correct answer is D** A Is not correct because the 1.9 s reading is included B Is not correct because the answer has been rounded down. C Is not correct because there are too many sig figs.	**1**
4	**The only correct answer is A** B Is not correct because mass is not required. C Is not correct because the temperature is not required. D Is not correct because the temperature is not required.	**1**
5	**The only correct answer is B** A Is not correct because the temperature should be constant. C Is not correct because terminal velocity should be reached. D Is not correct because zero error should be checked.	**1**

Question Number		Mark
6(a)	Greater time (1) Reduces percentage uncertainty in measurement of the time (1) **Or** Larger distance (fallen) (1) Reduces percentage uncertainty in measurement of the distance (1) [allow reverse argument]	**2**
6(b)	Allows start and end points to be seen more clearly (1) So reduces problem of reaction time (1) **Or** Recording can be replayed (1) So data can be checked (1) **Or** Recording/data can be analysed **Or** distance and time are recorded (1) So that graph of the motion can be plotted (1)	**2**
	Total for question 6	**4**

Question Number	Answer		Mark
7	**This question has to be marked holistically and in the context of the experiment described.**		
	(a) *draw and label a diagram for the experiment,*		
	Drawing shows an appropriate arrangement with means of securing wire	**(1)**	
	Mass (and hanger)	**(1)**	**2**
	(b) *list any additional apparatus required that is not shown in your diagram,*		
	Micrometer, means of measuring extension if not on diagram	**(1)**	**1**
	(c) *state the quantities to be measured,*		
	diameter, original length, extension/final length, (mass/force)	**(1)**	**1**
	(d) *state which is the independent variable and which is the dependent variable,*		
	Identifies: mass/force and extension/final length as the variables	**(1)**	
	Correctly identifies independent and dependent variable	**(1)**	**2**
	(e) *for one of the quantities listed in (c) explain your choice of measuring instrument,*		
	Quantity and instrument	**(1)**	
	Justification	**(1)**	**2**
	Example Measure length with a metre rule as readings are to 1mm which is small compared to the expected length.		
	(f) *comment on whether repeat readings are appropriate in this case,*		
	Comment with justification	**(1)**	**1**
	Example Repeats of extension values appropriate, but the load must be such that the wire stays within its elastic limit		
	(g) *explain how the data collected will be used, including a sketch of the expected graph,*		
	Use of $\frac{\pi d^2}{4}$ to calculate area	**(1)**	
	Use of stress = F/A, strain = $\Delta x/x$ and use of $F = mg$	**(1)**	
	Sketch of graph of stress against strain	**(1)**	
	Young modulus = gradient of graph	**(1)**	
	OR		
	Use of $\frac{\pi d^2}{4}$ to calculate area	**(1)**	
	Use of $F = mg$	**(1)**	
	Sketch of graph of force against extension	**(1)**	
	Young modulus = (gradient of graph) × x/A	**(1)**	**4**
	(h) *explain the main source of uncertainty and/or systematic error,*		
	Extension/diameter is very small	**(1)**	
	Hence large percentage error	**(1)**	**2**
	(i) *comment on safety*		
	Use goggles to prevent injury if wire breaks		
	Or use foot protection to prevent injury if wire breaks	**(1)**	**1**
	Total for question 7		**16**

Question Number	Answer		Mark
8(a)	**Max 2** No repetition shown **Or** no mean/average Only 5 sets Resistance should be to 2 sf [Accept inconsistent sf/dp]	**(1)** **(1)** **(1)**	**2**
8(b)	0.87 to 2 sig fig	**(1)**	**1**
8(c)	Comparison of $R = \rho l/A$ with $y = mx$ (+ c) ρ/A is a constant **and** $c = 0$	**(1)** **(1)**	**2**
8(d)(i)	Axes labelled with quantities and units Sensible scales Correct plotting of data Best fit line	**(1)** **(1)** **(1)** **(1)**	**4**
8(d)(ii)	Use of large triangle to determine gradient Use of area = πr^2 (may be implicit) Resistivity: $1.7 \times 10^{-8}\ \Omega$ m **Or** correct calculation from their gradient Value to 2 sig fig with unit <u>Example of calculation</u> $A = \pi\ (0.27/2 \times 10^{-3}\ \text{m})^2 = 5.7 \times 10^{-8}\ \text{m}^2$ $\rho = R/l \times A = 0.294\ \Omega\ \text{m}^{-1} \times 5.7 \times 10^{-8}\ \text{m}^2 = 1.68 \times 10^{-8}\ \Omega$ m	**(1)** **(1)** **(1)** **(1)**	**4**
8(e)	**Max 2** Switch off between readings to prevent overheating Repeat diameter readings at different positions/orientations of wire Check named instrument for zero error	**(1)** **(1)** **(1)**	**2**
	Total for question 8		**15**

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