Pearson

Mark Scheme (Results)

January 2018

Pearson Edexcel
International Advanced Subsidary Level
in Physics (WPH03)
Paper 01 Exploring Physics

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January 2018
Publications Code WPH03_01_1801_MS
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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.

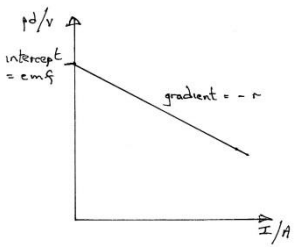
- Check the two points furthest from the best line. If both OK award mark.
- If either is 2 mm out do not award mark.
- If both are 1 mm out do not award mark.
- If either is 1 mm out then check another two and award mark if both of these OK, otherwise no mark.

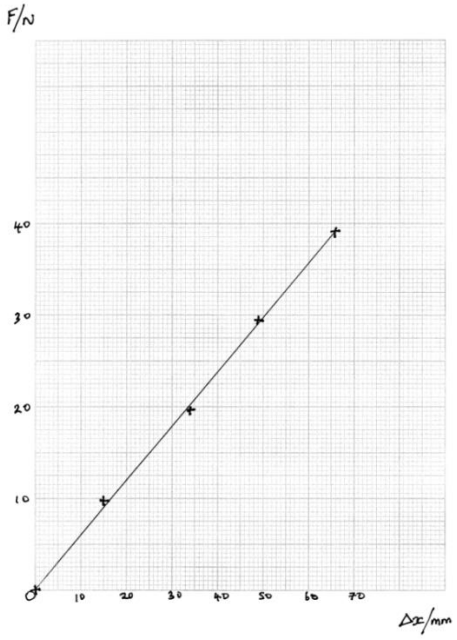
For a line mark there must be a thin continuous line which is the best-fit line for the candidate's results.

Question Number	Answer	Mark
1	**1. The only correct answer is B** ***A*** *is not correct as it is a base quantity* ***C*** *is not correct as it is a base quantity* ***D*** *is not correct as it is a base quantity*	**(1)**
2	**2.The only correct answer is C** ***A*** *is not correct as it is too low a reading* ***B*** *is not correct as it is a too low a reading* ***D*** *is not correct as it is too high a reading*	**(1)**
3	**3.The only correct answer is C** ***A*** *is not correct because the anomalous time (4.5) is included in the calculation of the mean.* ***B*** *is not correct because the anomalous time (4.5) is included in the calculation and there are too many significant figures in the mean.* ***D*** *is not correct because although the anomalous time (4.5) has been omitted there are too many significant figures in the calculated mean.*	**(1)**
4	**4.The only correct answer is C** ***A*** *is not correct because the power input is needed in the calculation of the efficiency.* ***B*** *is not correct because the power output is needed in the calculation of the efficiency.* ***D*** *is not correct because the weight of the mass is needed in the calculation of the power output for deciding the efficiency.*	**(1)**
5	**5.The only correct answer is D** ***A*** *is not correct because the uncertainty in height measurement is independent of the measured value and depends only upon the instrument used.* ***B*** *is not correct because the percentage uncertainty in height is reduced as the measured value has increased (denominator in the equation).* ***C*** *is not correct because the uncertainty in the time measurement is independent of the measured value and depends only upon the instrument used.*	**(1)**
	Total for multiple choice questions	**5**

Question Number	Answer		Mark
6(a)(i)	Vernier calipers **Or** digital vernier **Or** micrometer (screw gauge)	(1)	**1**
6(a)(ii)	1.45 – 1.55 (accept 0.10)	(1)	**1**
6(a)(iii)	Divides 0.05 or 0.10 by 1.50 Percentage uncertainty = 3(%) or 7(%) (accept 3.3(%) or 6.7(%)) Example of calculation (0.05/1.5) × 100 % = 3%	(1) (1)	**2**
6(b)	Use of density = mass/volume Density = 1.13 (x 10^4 kg m^{-3}) Answer to 2 or 3 sig fig with × 10^4 (dependent on MP2) Example of calculation $\frac{38.1\times10^{-3}\text{ kg}}{(1.5\times10^{-2}\text{m})^3} = 1.13 \times 10^4$ kg m^{-3}	(1) (1) (1)	**3**
	Total for question 6		**7**

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Question Number	Answer	Mark
7	**This question has to be marked holistically and in the context of the experiment described.** (a) *draw a circuit diagram of the apparatus to be used,* An appropriate circuit that includes cell (not battery), resistor, ammeter, voltmeter **(1)** Means of varying current / p.d. **(1)**	**2**
	(b) *state the quantities to be measured,* Current and p.d. **(1)**	**1**
	(c) *state which is the independent variable and which is the dependent variable,* Current: independent p.d. dependent **(1)**	**1**
	(d) *for one of the quantities listed in (b) explain your choice of measuring instrument,* Current and ammeter **Or** p.d. and voltmeter **(1)** (accept multimeter for either if scale mentioned) Reference to appropriate scale e.g. 2 V because cell labelled 1.5 V **(1)**	**2**
	(e) *comment on whether repeat readings are appropriate in this case,* Yes – so a mean can be calculated for each value **Or** to reduce random errors No – because cell might run down **Or** better to take many readings **(1)** (Ignore references to heating)	**1**
	(f) *explain how the data collected will be used, include a sketch of the expected graph,* Plot graph of p.d. (*y*-axis) against current (*x*-axis) **(1)** Sketch of graph (showing *y*-intercept and negative gradient) **(1)** Identifies e.m.f. as intercept **(1)** Identifies internal resistance as (–) gradient **(1)** 	**4**
	(g) *identify the main sources of uncertainty and/or systematic error,* **Max** 2 Difficulty of reading meters simultaneously **(1)** Parallax error on analogue meter **(1)** Fluctuating readings on meters **(1)** Zero error on meter **(1)**	**2**
	(h) *comment on safety* low risk experiment as only 1.5 V **(1)**	**1**
	Total for question 7	**14**

Question Number	Answer		Mark
8(a)	No repetition shown Only 4/5 sets shown **Or** insufficient number of readings	**(1)** **(1)**	**2**
8(b)	39.2 66	**(1)** **(1)**	**2**
8(c)	Comparison of $F = kx$ to $y = mx + c$ k is a constant **and** $c = 0$ (dependent on MP1) [If no other credit given, allow 1 mark for Because force is (directly) proportional to extension]	**(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 Force constant in range 580 N m^{-1} to 610 N m^{-1} to 2/3 sf with unit <u>Example of calculation</u> $\frac{35.5-0}{60-0} = 0.592$ (N mm^{-1})	**(1)** **(1)**	**2**
8(d)(iii)	Use of $E = ½ kx^2$ allow ecf from (d)(ii) **Or** Use of $E = ½ F\Delta x$ with substitution of F value from their line Energy stored in range 0.73 J to 0.76 J to 2 sf with unit <u>Example of calculation</u> $E = ½ kx^2$ $E = ½ \times 600$ N m^{-1} $\times$ (0.05 m)^2 $E = 0.75$ J	**(1)** **(1)**	**2**
	Total for question 8		**14**

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