Pearson Edexcel

Mark Scheme

June 2019

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.

Quality of Written Communication

Questions which involve the writing of continuous prose will expect candidates to:

- write legibly, with accurate use of spelling, grammar and punctuation in order to make the meaning clear
- select and use a form and style of writing appropriate to purpose and to complex subject matter
- Organise information clearly and coherently, using specialist vocabulary when appropriate.

Full marks will be awarded if the candidate has demonstrated the above abilities.
Questions where QWC is likely to be particularly important are indicated (QWC) in the mark scheme, but this does not preclude others.

Physics Specific Marking Guidance

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:

Horizontal force of hinge on table top

66.3 (N) or 66 (N) **and** correct indication of direction [no ue]

[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.

Mark scheme format

• Bold lower case will be used for emphasis.

• Round brackets ( ) indicate words that are not essential e.g. "(hence) distance is increased".

• Square brackets [ ] indicate advice to examiners or examples e.g. [Do not accept gravity] [ecf].

Unit error penalties

• 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.

• Incorrect use of case e.g. 'Watt' or 'w' will not be penalised.

• 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.

• The same missing or incorrect unit will not be penalised more than once within one question but may be penalised again in another question.

• 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.

• The mark scheme will indicate if no unit error penalty is to be applied by means of [no ue].

Significant figures

• 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.

• Use of an inappropriate number of significant figures will normally be penalised in the practical examinations or coursework.

• Using $g = 10\ m\ s^{-2}$ **will** be penalised.

Calculations

• Bald (i.e. no working shown) correct answers score full marks unless in a 'show that' question.

• Rounding errors will not be penalised.

• 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.

• 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.

• recall of the correct formula will be awarded when the formula is seen or implied by substitution.

• The mark scheme will show a correctly worked answer for illustration only.

Question Number	Answer	Mark
1	C	**1**
2	C	**1**
3	B	**1**
4	D	**1**
5	D	**1**
	Total for multiple choice questions	**5**

Question Number	Answer **This question is marked holistically and in the context of the experiment described.**	Mark
6(a)	Suspend the card (so that it is free to rotate) (1) Mark a vertical line on the card below pin using an appropriate method (1) (e.g. using a plumb line) Repeat with pin in a different position in the card (1) C of G is where lines cross (1) **Or** Balance card on a straight edge (1) Mark position of straight edge on card using an appropriate method (e.g. with a ruler) (1) Repeat with straight edge in a different position under the card (1) C of G is where lines cross (1)	4
6(b)	(When suspended) C of G must be vertically below support **Or** (when balanced) C of G must be vertically above support (1) so weight provides no moment (1) **Or** When in equilibrium resultant moment is zero (1) about any point (1) Allow 1 mark for a statement that (sum of) clockwise moments = (sum of) anticlockwise moments	2
	Total for question 6	**6**

Question 7

Answer **This question is marked holistically and in the context of the experiment described.**		Mark
(a) *explain how the temperature will be varied,* Means of varying temperature below room temperature Means of varying temperature above room temperature	**(1)** **(1)**	**2**
(b) *state the quantities to be measured and a measuring instrument for each quantity,* Resistance with ohmmeter **Or** p.d. and current with appropriate meters Temperature with thermometer **Or** appropriate sensor	**(2)** **(2)**	**4**
(c) *identify the dependent and independent variables,* Dependent and independent variables correctly identified	**(1)**	**1**
(d) *explain why repeat readings are not appropriate in this case,* Not possible to repeat at (exactly) the same temperatures Sensible reason for this (e.g. because it's not easy to maintain a constant temperature using a water bath)	**(1)** **(1)**	**2**
(e) *sketch the graph expected,* Axes labelled with resistance and temperature Graph drawn with correct curve	**(1)** **(1)**	**2**
(f) *identify the main source of uncertainty and state how this could be minimised,* Temperature on thermometer not same as temperature of thermistor Stir the water **Or** thermistor and thermometer should be in contact **Or** allow time for apparatus to reach thermal equilibrium	**(1)** **(1)**	**2**
(g) *comment on safety* Sensible identification of risk with appropriate precaution e.g. Hot water so take care	**(1)**	**1**
Total for question 7		**14**

Question Number	Answer	Mark
8(a)	**Max 2** No repetition shown (1) Only 4 sets **Or** small range (1)	**2**
8(b)	Comparison of $V = (h/e)f - b/e$ to $y = mx + c$ (may be implicit) (1) Identification of h/e as gradient and states that this is constant (1)	**2**
8(c)	Axes labelled, with units (1) Sensible scales (1) Correct plotting of data (1) Best fit line (1) f /10¹⁴ Hz: 7.41, 6.88, 5.40, 5.20 V / V: 1.43, 1.25, 0.67, 0.55	**4**
8(d)(i)	Large triangle - at least half of **drawn** line (1) Value of gradient in range 3.7 ($\times 10^{-15}$) - 4.3 ($\times 10^{-15}$) (1) Value to 2 or 3 sf with appropriate power of ten (expect $\times 10^{-15}$) (1)	**3**
8 d (ii)	Value from 8(d)(i) multiplied by e (expect $h \approx 6.3 \times 10^{-34}$) (1) Value to 2 or 3 sf with unit (Js) (1)	**2**
8(e)	Repeat measurements (1) In order to calculate a mean **Or** identify an anomalous reading (1) **Or** Work in a dark room (1) So lit LED can be seen more clearly (1) **Or** Measure wavelength (accept frequency) (1) Because manufacturer's data may be uncertain (1) **Or** Increase the range of measurements (by using more LEDs) (1) To reduce the uncertainty in the value of the gradient (1)	**2**
	Total for question 8	**15**