edexcel

Mark Scheme (Results)

January 2016

Pearson Edexcel
International Advanced Level
in Physics (WPH03)

Paper 01 – Exploring Physics

Edexcel and BTEC Qualifications

Edexcel and BTEC qualifications come from Pearson, the world's leading learning company. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information, please visit our website at www.edexcel.com.

Our website subject pages hold useful resources, support material and live feeds from our subject advisors giving you access to a portal of information. If you have any subject specific questions about this specification that require the help of a subject specialist, you may find our Ask The Expert email service helpful.

www.edexcel.com/contactus

Pearson: helping people progress, everywhere

Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your students at: www.pearson.com/uk

January 2016
Publications Code IA043313*

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] [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.]	✓	**1**

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.

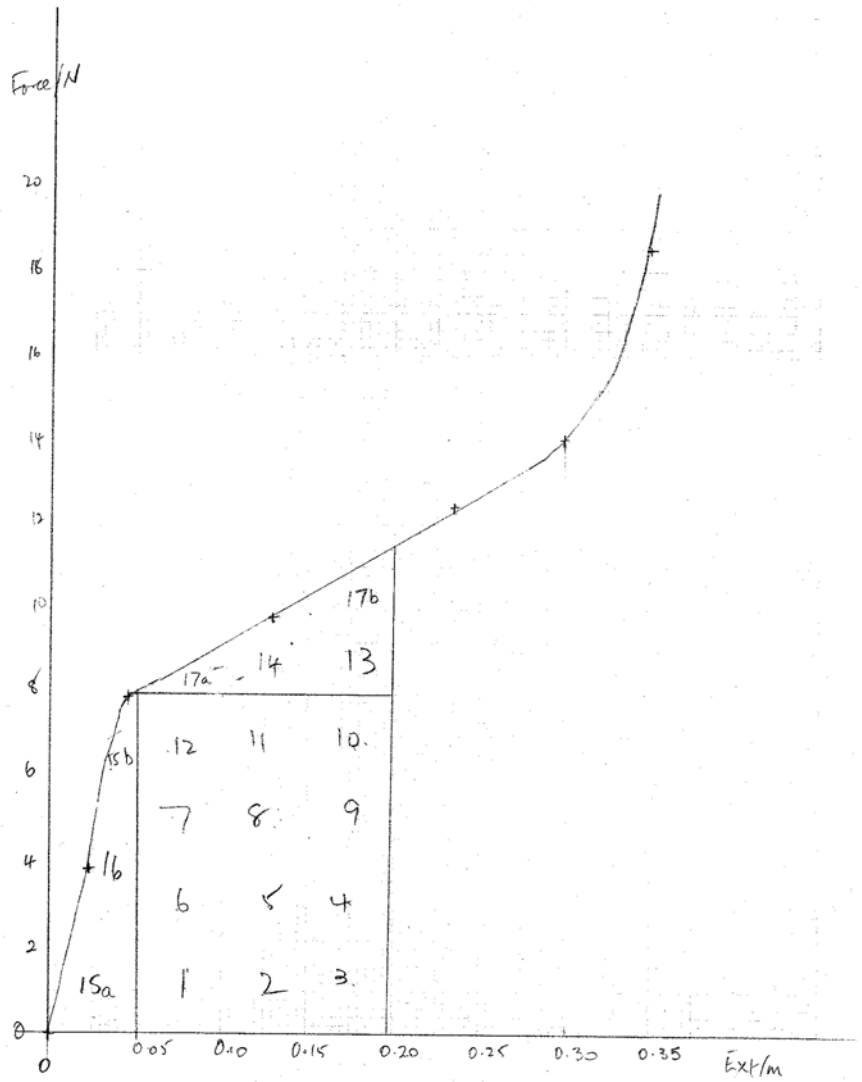
- Check the two points furthest from the best line. If both OK award mark.
- If either is 2 mm out do not award mark.
- If both are 1 mm out do not award mark.
- If either is 1 mm out then check another two and award mark if both of these OK, otherwise no mark.

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	A	**1**
2	C	**1**
3	C	**1**
4	D	**1**
5	B	**1**

Question Number	Answer	Mark
6(a)	8500 – 8900 (kg m^{-3}) (accept 400 (kg m^{-3})) (1)	**1**
6(b)	Divides 200 or 400 by 8700 (1) Percentage uncertainty = 2.3(%) or 4.6(%) to **2 sig figs** (1) Example of calculation (200/8700) x 100 % = 2.3 % **Or** (400 /8700) x 100% = 4.6 %	**2**
6(c)	Bronze **Or** choice of metal(s) consistent with their value (1)	**1**
	Total for Question 6	**4**

Question Number	Answer **NB: This question has to be marked holistically and in the context of the experiment described.**		Mark
7	(a) *state the quantities to be measured* potential difference, current, height and time 1 mark for 2 correct quantities from list, 2 marks for all four (no credit for mass /weight)	(1) (1)	**2**
	(b) *for **two** of these quantities explain your choice of measuring instrument,* max 2 per quantity, one mark for instrument and quantity and one mark for justification e.g. metre rule for height 1 mm divisions and likely size of measurement e.g.Voltmeter for potential difference Precision 0.1 V for a 9V battery **Or** range of 0 -15 V for a 9V battery	(2) (2)	**4**
	(c) *comment on whether repeat reading are appropriate in this case* Yes, repeat readings to **obtain an average** to give more reliable results. **Or** No repeats because motor heats up **Or** No because battery p.d. reduces.	(1)	**1**
	(d) *explain how the data collected will be used to calculate the efficiency of the motor* Power input =*VI* power output = *mgh/t* use of efficiency = power output/power input **Or** Energy input =*VIt* Energy output = *mgh* Use of efficiency = energy output/energy input **Or explicit graphical method** e.g. Graph of *h* against *t,* find gradient, gradient x *mg/VI*	(1) (1) (1) (1) (1) (1) (1) (1) (1)	**3**
	(e) *identify the main sources of uncertainty and/or systematic error* **Max 2** parallax or random error in identified measurement zero error in named instrument string slipping on winding mechanism reaction time	(1) (1) (1) (1)	**2**
	(f) *appropriate comment on safety* identification of risk and precaution e.g. risk of mass falling on feet, wear shoes, low risk as 9 V only, risk of injury to eye if string breaks, wear goggles	(1)	**1**
	Total for Question 7		**13**

Question Number	Answer	Mark
8(a)	**Max 2** Inconsistent sig fig/precision/ dec pl for **extension** (1) No evidence of repetition (1) Length of rubber not measured to nearest mm (1) (do not credit small range and inconsistent intervals)	**2**
8(b)(i)	Sensible scales (1) Correct plotting of data from table (all correct: 2, 1 error: 1, > 1 error 0) (2) Line of best: smooth curve through all points (1) (Straight line can gain first 3MP)  	**4**
8(b)(ii)	**Max two** Non-linear (could be in terms of changing gradients) (1) It does not obey Hooke's Law (1) Initially it is difficult to extend (1) Identifies linear section(s) (1) It gets more difficult to extend as it gets longer (1)	**2**

8(b)(iii)	States value of one square Number of squares Value 1.60 to 1.75 Correct to 2/3 sig figs and unit **Or** Approximates area to other shapes Areas identified or shown Value as above Correct to 2/3 sig figs and unit **Or For straight line graph in (b)(i)** use of $W = 0.5Fx$ candidate's correctly calculated value correct to 2/3 sig fig with unit <u>Example of calculation</u> States value of one **large** square is 0.1 (J), Number of squares is 17 Work done = 1.7 J **Or** Approximates area to 2 triangles and square, Total area = (.0.5 x 0.05 x 8) + (8 x 0.15) + (0.5 x 0.15 x 3.5) Work done = 1.66 J	(1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1)	**4**
8(c)	**Stress** Use of stress = force/area Use of correct area = $1.05 \times 10^{-3} \times 2.71 \times 10^{-3}$ $(2.85 \times 10^{-6}\ m^2)$ Stress = 6.5×10^6 Pa **Or** Nm^{-2} **Strain** Use of strain = $\Delta x/x$ Strain = 2.3 with no unit **Assumption** Cross-section has remained constant <u>Example of calculation</u> Stress = $18.5/ (1.05 \times 10^{-3} \times 2.71 \times 10^{-3}) = 6.5 \times 10^6$ Pa Strain = 0.35/0.15 = 2.3	(1) (1) (1) (1) (1) (1)	**6**
	Total for Question 8		**18**

Pearson Education Limited. Registered company number 872828
with its registered office at 80 Strand, London, WC2R 0RL, United Kingdom