Pearson Edexcel

Mark Scheme (RESULTS)

October 2020

Pearson Edexcel International Advanced
Subsidiary/Advanced Level
In Physic (WPH13)
Paper 1: Practical Skills in Physics I

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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.

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.

1. **Quality of Written Communication**

1.1 Indicated by QoWC in mark scheme. QWC – Work must be clear and organised in a logical manner using technical wording where appropriate.

1.2 Usually it is part of a max mark, the final mark not being awarded unless the QoWC condition has been satisfied.

2. **Graphs**

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

2.2 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.

2.3 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.

2.4 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)(i)	• Heating apparatus e.g. hot plate **Or** Cooling apparatus e.g. ice/water bath (1)	**1**
1(a)(ii)	• Timing apparatus e.g. stop clock, stopwatch (1)	**1**
1(b)	• Digital thermometer has higher resolution e.g. measures to 0.1˚C **Or** digital thermometer has no parallax error (1) • Digital thermometer has a lower (percentage) uncertainty (1) Accept attempts to calculate percentage uncertainty for both thermometers for MP1	**2**
1(c)(i)	• Suitable control variable e.g. volume of oil, mass of oil (1) Do not accept temperature of oil/room	**1**
1(c)(ii)	• Suitable method of control for the control variable identified e.g. check the volume in the measuring cylinder after each pour check the mass using a balance (1)	**1**
1(d)(i)	• Rate of flow = volume/time (1)	**1**
1(d)(ii)	**Max 2 from** • Starting timer after oil has been poured e.g. marking a start position, starting at 10 cm^3 (1) • Stopping timer before the funnel is empty e.g. stopping after a fixed volume or at a marker (1) • Record the volume after a fixed time period (1) • Repeat for the same temperature and calculate the mean time (1) • Use of light gates and (electronic) timer to avoid (human) reaction time (1)	**2**
	Total for question 1	**9**

Question Number	Answer	Mark
2(a)	• Curved line of best fit (1)	**1**
2(b)(i)	• Minimum p.d. read from their line on the graph (1)	**1**
2(b)(ii)	• Use of $W = VQ$ with $Q = 1.6\times10^{-19}$ C and value of V from (b)(i) (1) • Value of W in the range of 2.5×10^{-19} to 3.0×10^{-19} (J) (1) <u>Example of calculation</u> $W = VQ$ $W = 1.8\text{ V} \times 1.6\times10^{-19}\text{ C}$ $W = 2.9\times10^{-19}\text{ J}$	**2**
2(c)	• Use of $c = f\lambda$ (with $\lambda = 625$ nm) (1) • Use of $E = hf$ (1) • $h = 6.5 \times 10^{-34}$ J s (1) (Use of $E = hc/\lambda$ scores MP1 and MP2) <u>Example of calculation</u> $c = f\lambda$ $3.0\times10^{8}\text{ m s}^{-1} = f \times 625\times10^{-9}\text{ m}$ $f = 4.8\times10^{14}\text{ Hz}$ $E = hf$ $3.1\times10^{-19}\text{ J} = h \times 4.8\times10^{14}\text{ Hz}$ $h = 6.5\times10^{-34}\text{ J s}$	**3**
2(d)	• There would be an uncertainty in wavelength/frequency **Or** there would be a range of wavelengths/frequencies **Or** the LED emits different wavelengths/frequencies (1) • If wavelength was longer, the calculated Planck constant would be larger **Or** if the frequency was lower, the calculated Planck constant would be larger (1) • There would be an uncertainty in the calculated Planck constant **Or** there would be a range of possible values of the Planck constant (1) MP2 - Accept converse arguments for shorter wavelength or higher frequency	**3**
2(e)	• Take measurements for additional p.d.s between 1.5 and 2.0V **Or** Take measurements for smaller increments in p.d. (1) • This would allow for a more accurate line of best fit to be drawn **Or** to more accurately identify the p.d. where the line touches the *x*-axis (1) Accept use of a datalogger for MP1	**2**
	Total for question 2	**12**

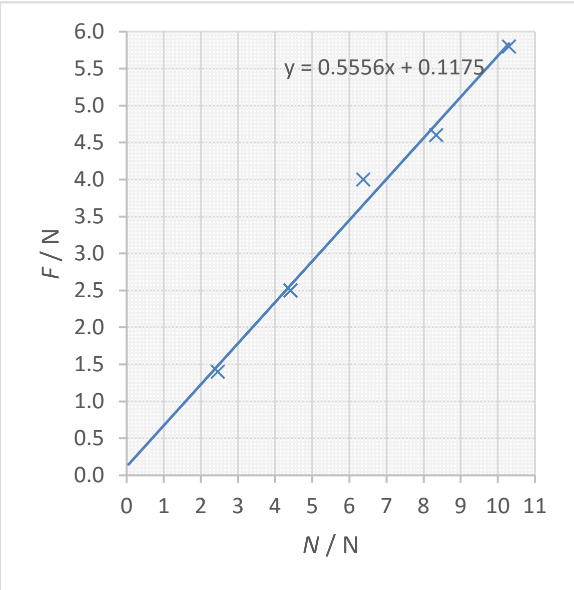
Question Number	Answer	Mark
3(a)	• Voltmeter connected in parallel to solar cell only (1) • Ammeter connected in series with the solar cell **and** resistor (1) MP1 - Accept voltmeter connected in parallel to the resistor only, if no other resistance components (e.g. variable resistor, bulb, etc) are added Additional cells added – Not MP2.	**2**
3(b)	**Max 2 from** • Same distance between lamp and solar cell (1) • Keep angle of solar cell to light the same (1) • Block background light **Or** control background light level **Or** avoid casting shadows on the solar cell (1)	**2**
3(c)	• Suitable method to vary solar cell temperature e.g. immersion in a water bath, clamped a fixed distance from a hair dryer (must include a method, rather than just naming a heat source) (1)	**1**
3(d)	• Use of $P = VI$ (1) • $P = 0.12$ W (1) <u>Example of calculation</u> $P = VI$ $P = 2.74\text{V} \times 45\times10^{-3}\text{A}$ $P = 0.12$ W	**2**
3(e)	• Use of $I = P / A$ (1) • Use of efficiency = useful power output / total power input (1) • Efficiency = 0.17 (17%) (1) Allow ecf from 3(d) for useful power output For MP1 & 2 accept a calculation of power output per m^2 and efficiency calculated using input of 200 W m^{-2} For MP3 there should be no unit given or correct conversion to % <u>Example of calculation</u> $I = P / A$ $P = 200 \text{ W m}^{-2} \times (60\times10^{-3})^2$ $P = 0.72$ W Efficiency = useful power output / total power input Efficiency = 0.12 W / 0.72 W = 0.17	**3**
3(f)(i)	**Max 2 from** • Too few readings (1) • Too small a range of temperatures (1) • Inconsistent intervals in temperature readings (1) • Inconsistent d.p. in current values (1)	**2**

3(f)(ii)	• Calculate output power for each temperature (1) • Plot graph of power (on the y-axis) against temperature (on the *x*-axis) (1) • Calculate the gradient (which is the power change per 1˚C) (1) **OR** • Calculate output power for each temperature (1) • Plot graph of temperature (on the y-axis) against power (on the *x*-axis) (1) • Calculate 1/gradient (which is the power change per 1˚C) (1)	**3**
	Total for question 3	**15**

<table>
<tr><th>Question Number</th><th>Answer</th><th></th><th>Mark</th></tr>
<tr><td>4(a)</td><td>• Increase the mass of the slotted masses until rubber starts to slide
• Calculate friction/tension/weight using mg
Or measure weight of slotted masses (with a newton meter)</td><td>(1)

(1)</td><td>2</td></tr>
<tr><td>4(b)(i)</td><td>• Add 250 g to mass m
Or add 0.25 kg to mass m
Or add 2.45 N to the weight of m
• Use $W = mg$</td><td>(1)

(1)</td><td>2</td></tr>
<tr><td>4(b)(ii)</td><td>• Labels axes with quantities and units
• Sensible scales
• Plotting
• Line of best fit



<table>
<tr><th>N / N</th><th>F / N</th></tr>
<tr><td>2.45</td><td>1.4</td></tr>
<tr><td>4.41</td><td>2.5</td></tr>
<tr><td>6.38</td><td>4.0</td></tr>
<tr><td>8.34</td><td>4.6</td></tr>
<tr><td>10.3</td><td>5.8</td></tr>
</table></td><td>(1)
(1)
(2)
(1)</td><td>5</td></tr>
<tr><td>4(c)</td><td>• Calculates gradient using large triangle
• Value of μ in the range of 0.54 to 0.59
• Value given to 2 or 3 s.f. with no unit

<u>Example of calculation</u>
Gradient = (5.6 N – 0.6 N) ÷ (10.0 N – 1.0 N) = 0.556</td><td>(1)
(1)
(1)</td><td>3</td></tr>
<tr><td>4(d)</td><td>• To test tyres would provide enough friction/braking force
Or to test tyres provide enough grip
Or to test the rubber on wet/icy/cold/loose surface materials
• So that the tyres can stop the car in a safe distance/time
Or to prevent cars from skidding/sliding</td><td>

(1)

(1)</td><td>2</td></tr>
<tr><td></td><td>Total for question 4</td><td></td><td>14</td></tr>
</table>

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