Pearson Edexcel

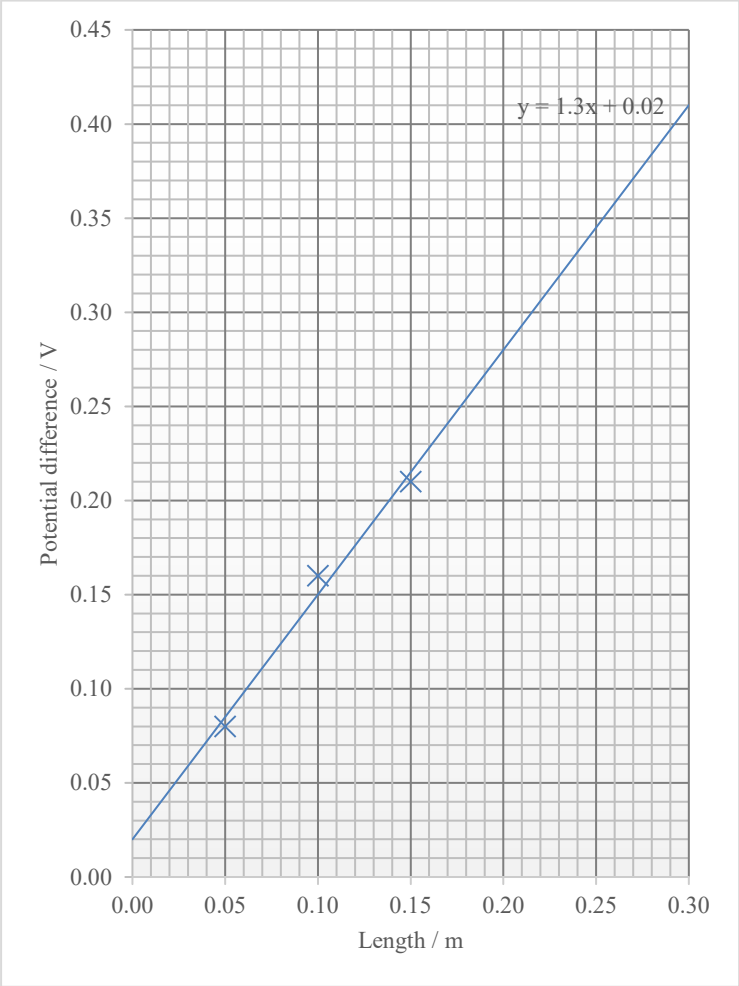
Mark Scheme (Results)

October 2019

Pearson Edexcel International Advanced Level
In Physics (WPH13) Paper 01
Practical Skills in Physics I

Question Number	Answer		Mark
1 (a)	• Reaction time **Or** timer not reset to zero	(1)	**(1)**
1 (b)(i)	Student – **2 marks** • Students' values of *t* are within a range of 0.16 s **Or** calculates mean *t* and difference to furthest value of *t* (0.11 s) **Or** calculates percentage uncertainty for the 5 values • Reaction time is comparable to the range **Or** difference between values can be explained by reaction time Teacher – **2 marks** • Range of the other 4 values is 0.04 s **Or** uncertainty of other 4 values is 0.02 s **Or** calculates percentage uncertainty for the other 4 values **Or** calculates percentage difference of student 4's value and the mean • Comparison between Student 4's value and the range/uncertainty of the other 4 values. **Or** the (percentage) difference between 0.75 and the other values is large	(1) (1) (1) (1)	**(4)**
1 (b)(ii)	• Attempt to calculate mean (using 4 or 5 values) • 0.89 s given to 2 s.f. (0.86 s if all 5 values used) Example of Calculation Mean time = (0.88 + 0.87 + 0.91 + 0.88) / 4 = 0.885 s	(1) (1)	**(2)**
1 (b)(iii)	• Use of half range (0.02 s) **Or** difference between mean and the value furthest from mean • Percentage uncertainty = 2 % Allow ecf of mean time from 1(b)(ii) Example of Calculation Percentage uncertainty = (0.02 / 0.89) × 100 % = 2.247 %	(1) (1)	**(2)**
1 (b)(iv)	• Use of $s = v\,t$ with $v = 330$ m s^{-1} • with a correct maximum time • Correct use of factor of 2 • Maximum distance value calculated Accept maximum time from table Allow ecf of mean and percentage uncertainty if calculating maximum time value Example of Calculation $s = 330$ m s^{-1} × (0.91 s ÷ 2) $s = 150.2$ m	(1) (1) (1) (1)	**(4)**
	Total for question 1		**13**

Question Number	Answer	Mark
2 (a)	• Measure the distance at which the plastic sphere lands with a ruler **Or** measure the launch angle with a protractor (1) • Repeat measurements (for each angle) and calculate the mean d (1) • Plot a graph of d and θ, and use to find θ for maximum d value **Or** continue changing θ until d decreases to find maximum (1) • Around the maximum d take measurements for smaller changes in angle (1)	**(4)**
2 (b)	**Max 2 from** • Parallax error when reading angle/distance (1) • Angle not zero when launcher is horizontal (1) • Air resistance on the plastic sphere so velocity reduces (1) • v not constant due to friction in the launcher tube (which depends upon angle) (1)	**(2)**
	Total for question 2	**6**

Question Number	Answer	Mark
3 (a)	• If the rod has uniform diameter it balances (horizontally) with the thread at 15 cm (1) • because the mass/moment of the rod either side of the thread is equal **Or** because the line of action of weight is through the pivot **Or** because the centre of mass would be at 15 cm (1) Accept "horizontal" as a description of the rod being balanced horizontally Accept "in the middle" as a description of 15 cm	**(2)**
3 (b)(i)	• value between 0.40 and 0.45 V (1)  	**(1)**
3 (b)(ii)	• Use of ratio of resistance = ratio of p.d. (1) **Or** Use of $V = IR$ with $R_{rod} = 0.070\ \Omega$ to calculate current • $V_{Terminal} = 1.6$ V (1) Allow ecf for use of their V value from 3(b)(i) <u>Example of Calculation</u> $V / V_T = R / R_T$ $V_T = (V \times R_T) / R$ $V_T = (0.41\ V \times 0.27\ \Omega) / 0.070\ \Omega = 1.58$ V	**(2)**
3 (c)	• Further readings would make the line of best fit more accurate (1) • Giving a more accurate value for the p.d. of the rod (at 30cm) (1)	**(2)**
	Total for question 3	**7**

Question Number	Answer		Mark
4 (a)	• Calculates $\frac{angle\ of\ rotation}{concentration\ of\ solution}$ for two pairs of values • Calculates $\frac{angle\ of\ rotation}{concentration\ of\ solution}$ for at least one other pair of values • Comparative statement consistent with their values Accept equivalent calculations of $\frac{concentration\ of\ solution}{angle\ of\ rotation}$ or $k = \frac{angle\ of\ rotation}{(concentration\ of\ solution \times depth\ of\ solution)}$	(1) (1) (1)	**(3)**
4 (b)	• Higher power lamp would have a heating effect on the solution **Or** Higher power lamp would increase the temperature of the solution • Heating would cause expansion of the sucrose solution **Or** heating would cause evaporation of the sucrose solution • Which would change the concentration/density (of sucrose solution)	(1) (1) (1)	**(3)**
4 (c)	• Comparison between $angle\ of\ rotation = k \times concentration\ of\ solution \times depth\ of\ solution$ and $y = mx\ (+c)$ • Plot a graph of *angle of rotation* and *concentration of solution* **Or** plot a graph of *angle of rotation* and *concentration of solution* × *depth of solution* • Correct method for calculating k for their graph described	(1) (1) (1)	**(3)**
	Total for question 4		**9**

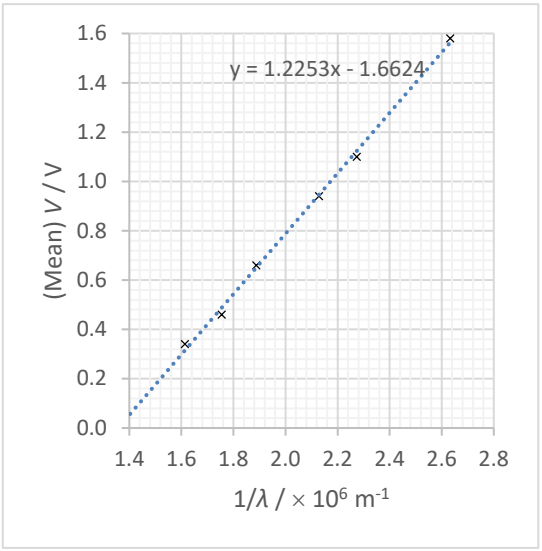
<table>
<tr><th>Question Number</th><th>Answer</th><th>Mark</th></tr>
<tr><td>5 (a)</td><td>
• Higher photon energy means higher frequency light
Or higher photon energy means using ultraviolet light (1)
• There is an increased risk when using ultraviolet light
Or using visible light is no/low risk (1)

Accept any named EM radiation with higher frequency than visible light
</td><td>(2)</td></tr>
<tr><td>5 (b)</td><td>
• Use of $W = VQ$
Or $W = eV$ (1)
• $W = (-)2.5 \times 10^{-19}$ J
Or $W = 1.58$ eV (1)

<u>Example of Calculation</u>
$W = 1.58\text{V} \times 1.6 \times 10^{-19}$ C
$W = 2.53 \times 10^{-19}$ J
</td><td>(2)</td></tr>
<tr><td>5 (c)(i)</td><td>
• Correct $1/\lambda$ values to 2 or 3 s.f. (1)
• Labels axes with quantities and units (1)
• Sensible scales (1)
• Plotting (2)
• Line of best fit (1)

<table>
<tr><th>λ / nm</th><th>$1/\lambda$ / $\times 10^6$ m^{-1}</th><th>Mean V / V</th></tr>
<tr><td>380</td><td>2.63</td><td>1.58</td></tr>
<tr><td>440</td><td>2.27</td><td>1.10</td></tr>
<tr><td>470</td><td>2.13</td><td>0.94</td></tr>
<tr><td>530</td><td>1.89</td><td>0.66</td></tr>
<tr><td>570</td><td>1.75</td><td>0.46</td></tr>
<tr><td>620</td><td>1.61</td><td>0.34</td></tr>
</table>

Accept $1/\lambda$ in nm^{-1} or pm^{-1} at this stage.



</td><td>(6)</td></tr>
<tr><td>5 (c)(ii)</td><td>
• Calculates gradient using large triangle (1)
• Use of $h = \frac{gradient \times e}{c}$ with their gradient (1)
• $h = (6.2 \text{ to } 7.0) \times 10^{-34}$ J s (1)

<u>Example of Calculation</u>
$gradient = \frac{1.4V - 0.2V}{(2.50 - 1.50) \times 10^6} = 1.2 \times 10^{-6}$ V m^{-1}
$h = \frac{1.2 \times 10^{-6} \times 1.6 \times 10^{-19}}{3.0 \times 10^8} = 6.4 \times 10^{-34}$ J s
</td><td>(3)</td></tr>
<tr><td>5 (d)</td><td>
Max two from
• Block out external light sources (1)
• Use a larger range of wavelengths/frequencies (1)
• Use filters with a narrower frequency band (1)
• Use LEDs of known frequency (1)
• Use more sensitive <u>ammeter</u> (1)
</td><td>(2)</td></tr>
<tr><td></td><td>Total for question 5</td><td>15</td></tr>
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