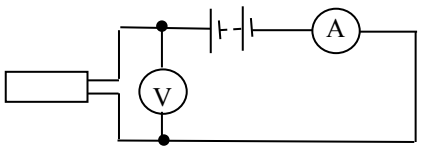
# Unit 6: Practical Skills in Physics II - Mark scheme

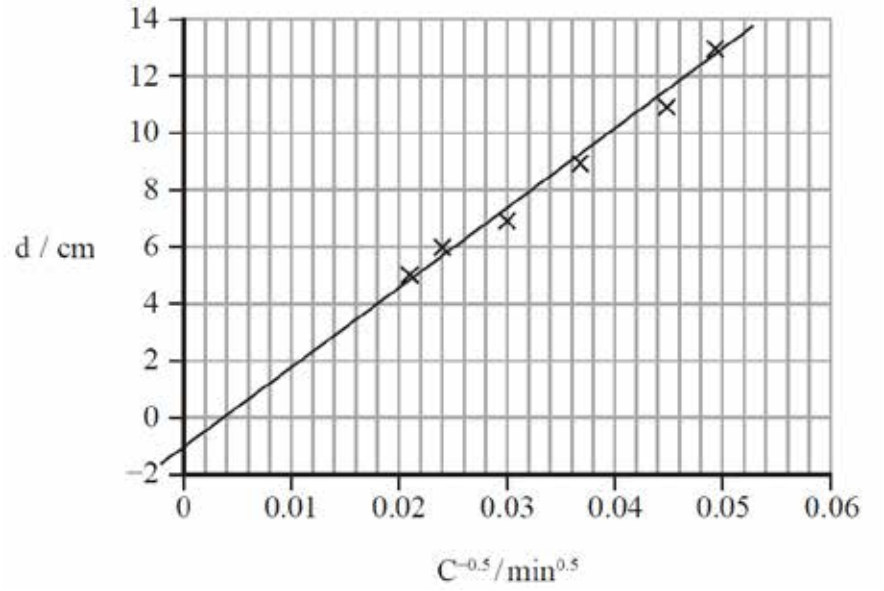
| Question number | Answer | Mark |
|---|---|---|
| **1(a)** | • 2.860 (1) | **1** |
| **1(b)** | • 2.858 cm (four sig figs. Allow ecf from (a)) (1) | **1** |
| **1(c)** | • Use of $V = \frac{4\pi r^3}{3}$ (1)<br>• Use of $\rho = \frac{m}{V}$ (1)<br>• Density = 8.020 g cm$^{-3}$ must be to 4 SF allow ecf from (b) (1)<br><br>Example of calculation<br>$V = \frac{4\pi 1.429^3 \text{ cm}^3}{3} = 12.223 \text{ cm}^3$<br>$\rho = \frac{98.00\text{g}}{12.223\text{cm}^3} = 8.018 \text{ g cm}^{-3}$ | **3** |
| **1(d)** | • Calculates % uncertainty in diameter from (b) (1)<br>• % uncertainty in density = 0.4 (accept 0.42 or 0.37 if half-range is used) (1)<br><br>Example of calculation<br>Uncertainty in diameter = 2.858-2.854 = 0.004<br>% uncertainty in diameter = 0.004/2.858 × 100 = 0.14%<br>% uncertainty in volume and density = 3 × 0.14 = 0.42 | **2** |
| | **Total for Question 1** | **7** |

| Question number | Answer | Mark |
|---|---|---|
| **2(a)** | • metre rule shown vertical with set square on floor (1) | **1** |
| **2(b)(i)** | • The resolution of the stopwatch is 0.01 seconds (1)<br>• But there is a human reaction time when starting and stopping the stopwatch (1) | **2** |
| **2(b)(ii)** | • v = 0.59 m $s^{-1}$ (1)<br><br>Example of calculation<br>$v = \frac{2h}{t} = 2 \times 0.885/3.0$<br>v = 0.59 m $s^{-1}$ | **1** |
| **2(b)(iii)** | • Calculates value of momentum (1)<br><br>Example of calculation<br>P = 0.96 kg × 0.59 m $s^{-1}$ = 0.57 kg m $s^{-1}$ | **1** |
| **2(c)(i)** | • Momentum = 0.88 kg m $s^{-1}$ (1)<br><br>Example of calculation<br>$\Delta p = 0.030 \times 9.81 \times 3.0$<br>= 0.88 kg m $s^{-1}$ | **1** |
| **2(c)(ii)** | • External forces acting<br>**Or** friction acting (1) | **1** |
| | **Total for Question 2** | **7** |

| Question number | Answer | Mark |
|---|---|---|
| 3(a) | • Circuit showing power supply unit (psu), heater, ammeter in series and voltmeter in parallel with heater (1)<br>• Measure the p.d., current and mass of block (and heater) (1)<br>• Measure initial and final temperature and corresponding time interval (1)<br>• Use of $E = VIt$ (1)<br>• Use of $c = \Delta E / m\,\Delta\theta$ (1)<br><br><u>Example of circuit</u><br><br> | 5 |
| 3(b) | • Not all energy from the heater is supplied to the block **Or** some energy transferred to/from surroundings (1)<br>• energy transfer to cancels/equals energy transfer from the surroundings (by using same temperature difference below/above surroundings) (1) | 2 |
| | **Total for Question 3** | 7 |

| Question number | Answer | Mark |
|---|---|---|
| **4(a)(i)** | • 3.5 mm should have the same number of SF as other values in column (1)<br>• There are no repeat readings (1) | **2** |
| **4(a)(ii)** | Any **two** from<br>• Distance between coils (1)<br>• Potential difference (across first coil) power supply (1)<br>• Frequency of ac supply (1) | **2** |
| **4(a)(iii)** | • 0.01 V (1) | **1** |
| **4(a)(iv)** | • Because the final digit fluctuates (1) | **1** |
| **4(a)(v)** | • Would need to take some repeat readings (1)<br>• Consider how close together in value (1) | **2** |
| **4(b)** | • There is a value of $V$ when $t = 0$ (1) | **1** |
| **4(c)** | • Plot ln $V$ against $t$ (1)<br>• Should be a straight-line graph if the relationship is exponential (1) | **2** |
| | **Total for Question 4** | **11** |

<table>
<tr><th>Question number</th><th>Answer</th><th>Mark</th></tr>
<tr><td>5(a)</td><td>• Record background count (rate) (1)<br>• Place thick aluminium/thin lead between source and detector<br>Or Distance greater than 25 cm between source and detector (1)<br>• Count rate detected above background (1)</td><td>3</td></tr>
<tr><td>5(b)</td><td>Any two from<br>• Point source away from people (1)<br>• Invert source within lead container (1)<br>• Use tongs to handle source (1)<br>• Use tongs to handle lead sheets/ensure source held (1)</td><td>2</td></tr>
<tr><td>5(c)(i)</td><td>• The count is a large number for small distances so percentage errors will be smaller (1)</td><td>1</td></tr>
<tr><td>5(c)(ii)</td><td>• There is a larger variation in count over smaller distances (1)</td><td>1</td></tr>
<tr><td>5(d)(i)</td><td>• Calculates count rate per minute or per second or per 30 s (1)<br>• Subtract background count (1)<br>• Count rate $C^{-1/2}$ to at least 3SF (1)<br>• Axes labelled for suitable graph and with correct units (1)<br>• Suitable scales (1)<br>• Points plotted (1)<br>• Line of best fit (1)<br><br><u>Example of table</u>
<table>
<tr><th>$d$ / cm</th><th>Count</th><th>Time for count / s</th><th>C min$^{-1}$</th><th>C-background min$^{-1}$</th><th>C$^{0.5}$ / min$^{-0.5}$</th><th>C$^{-0.5}$ /min$^{0.5}$</th></tr>
<tr><td>5</td><td>1163</td><td>30</td><td>2326</td><td>2268</td><td>47.62352</td><td>0.0210</td></tr>
<tr><td>6</td><td>897</td><td>30</td><td>1794</td><td>1736</td><td>41.66533</td><td>0.0240</td></tr>
<tr><td>7</td><td>586</td><td>30</td><td>1172</td><td>1114</td><td>33.37664</td><td>0.0300</td></tr>
<tr><td>9</td><td>793</td><td>60</td><td>793</td><td>735</td><td>27.11088</td><td>0.0369</td></tr>
<tr><td>11</td><td>559</td><td>60</td><td>559</td><td>501</td><td>22.38303</td><td>0.0447</td></tr>
<tr><td>13</td><td>469</td><td>60</td><td>469</td><td>411</td><td>20.27313</td><td>0.0493</td></tr>
</table></td><td>7</td></tr>
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| | | |
|---|---|---|
| |  | |
| **5(d)(ii)** | • Use of large triangle to determine gradient (1)<br>• k = 280 (allow 260 – 300) (1)<br>• Unit: cm $min^{-0.5}$ (1)<br>• x (y intercept) = 1.0 cm (allow 0.6 – 1.2) (1)<br><br><u>Example of calculation</u><br>(10.0 – 0)/(0.040 – 0.004) = 280 cm $min^{-0.5}$ | **4** |
| | **Total for Question 5** | **18** |