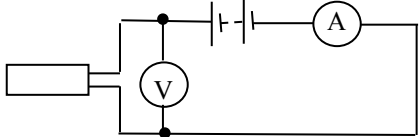


## Unit 6: Practical Skills in Physics II - Mark scheme

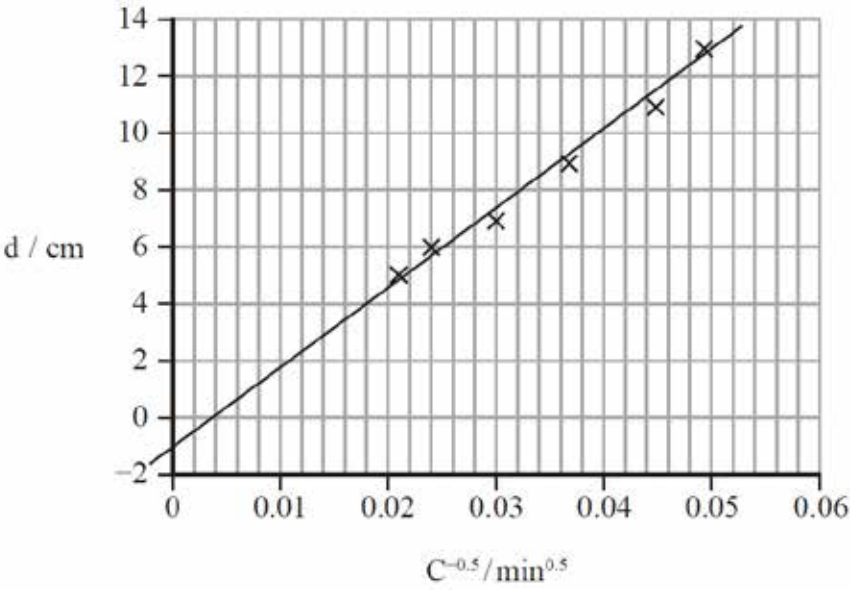
Question number	Answer	Mark
1(a)	• 2.860 (1)	1
1(b)	• 2.858 cm (four sig figs. Allow ecf from (a)) (1)	1
1(c)	<ul style="list-style-type: none"> <li>• Use of <math>V = \frac{4\pi r^3}{3}</math> (1)</li> <li>• Use of <math>\rho = \frac{m}{V}</math> (1)</li> <li>• Density = 8.020 g cm<sup>-3</sup> must be to 4 SF allow ecf from (b) (1)</li> </ul> <p><u>Example of calculation</u></p> $V = \frac{4\pi 1.429^3 \text{ cm}^3}{3} = 12.223 \text{ cm}^3$ $\rho = \frac{98.00\text{g}}{12.223\text{cm}^3} = 8.018 \text{ g cm}^{-3}$	3
1(d)	<ul style="list-style-type: none"> <li>• Calculates % uncertainty in diameter from (b) (1)</li> <li>• % uncertainty in density = 0.4 (accept 0.42 or 0.37 if half-range is used) (1)</li> </ul> <p><u>Example of calculation</u></p> <p>Uncertainty in diameter = 2.858-2.854 = 0.004            % uncertainty in diameter = 0.004/2.858 × 100 = 0.14%            % uncertainty in volume and density = 3 × 0.14 = 0.42</p>	2
	<b>Total for Question 1</b>	<b>7</b>

Question number	Answer	Mark
2(a)	<ul style="list-style-type: none"> <li>metre rule shown vertical with set square on floor</li> </ul>	(1) <b>1</b>
2(b)(i)	<ul style="list-style-type: none"> <li>The resolution of the stopwatch is 0.01 seconds</li> <li>But there is a human reaction time when starting and stopping the stopwatch</li> </ul>	(1) <b>2</b> (1)
2(b)(ii)	<ul style="list-style-type: none"> <li><math>v = 0.59 \text{ m s}^{-1}</math></li> </ul> <p><u>Example of calculation</u>  <math>v = \frac{2h}{t} = 2 \times 0.885/3.0</math>  <math>v = 0.59 \text{ m s}^{-1}</math></p>	(1) <b>1</b>
2(b)(iii)	<ul style="list-style-type: none"> <li>Calculates value of momentum</li> </ul> <p><u>Example of calculation</u>  <math>P = 0.96 \text{ kg} \times 0.59 \text{ m s}^{-1} = 0.57 \text{ kg m s}^{-1}</math></p>	(1) <b>1</b>
2(c)(i)	<ul style="list-style-type: none"> <li>Momentum = <math>0.88 \text{ kg m s}^{-1}</math></li> </ul> <p><u>Example of calculation</u>  <math>\Delta p = 0.030 \times 9.81 \times 3.0</math>  <math>= 0.88 \text{ kg m s}^{-1}</math></p>	(1) <b>1</b>
2(c)(ii)	<ul style="list-style-type: none"> <li>External forces acting</li> <li>Or friction acting</li> </ul>	(1) <b>1</b>
	<b>Total for Question 2</b>	<b>7</b>

Question number	Answer	Mark
3(a)	<ul style="list-style-type: none"> <li>• Circuit showing power supply unit (psu), heater, ammeter in series and voltmeter in parallel with heater (1)</li> <li>• Measure the p.d., current and mass of block (and heater) (1)</li> <li>• Measure initial and final temperature and corresponding time interval (1)</li> <li>• Use of <math>E = VIt</math> (1)</li> <li>• Use of <math>c = \Delta E / m \Delta\theta</math> (1)</li> </ul> <p><u>Example of circuit</u></p> 	5
3(b)	<ul style="list-style-type: none"> <li>• Not all energy from the heater is supplied to the block <b>Or</b> some energy transferred to/from surroundings (1)</li> <li>• energy transfer to cancels/equals energy transfer from the surroundings (by using same temperature difference below/above surroundings) (1)</li> </ul>	2
<b>Total for Question 3</b>		7

Question number	Answer	Mark
4(a)(i)	<ul style="list-style-type: none"> <li>• 3.5 mm should have the same number of SF as other values in column (1)</li> <li>• There are no repeat readings (1)</li> </ul>	2
4(a)(ii)	Any <b>two</b> from <ul style="list-style-type: none"> <li>• Distance between coils (1)</li> <li>• Potential difference (across first coil) power supply (1)</li> <li>• Frequency of ac supply (1)</li> </ul>	2
4(a)(iii)	<ul style="list-style-type: none"> <li>• 0.01 V (1)</li> </ul>	1
4(a)(iv)	<ul style="list-style-type: none"> <li>• Because the final digit fluctuates (1)</li> </ul>	1
4(a)(v)	<ul style="list-style-type: none"> <li>• Would need to take some repeat readings (1)</li> <li>• Consider how close together in value (1)</li> </ul>	2
4(b)	<ul style="list-style-type: none"> <li>• There is a value of <math>V</math> when <math>t = 0</math> (1)</li> </ul>	1
4(c)	<ul style="list-style-type: none"> <li>• Plot <math>\ln V</math> against <math>t</math> (1)</li> <li>• Should be a straight-line graph if the relationship is exponential (1)</li> </ul>	2
	<b>Total for Question 4</b>	<b>11</b>

Question number	Answer	Mark																																																	
5(a)	<ul style="list-style-type: none"> <li>Record background count (rate) (1)</li> <li>Place thick aluminium/thin lead between source and detector (1)</li> <li><b>Or</b> Distance greater than 25 cm between source and detector (1)</li> <li>Count rate detected above background (1)</li> </ul>	3																																																	
5(b)	Any <b>two</b> from <ul style="list-style-type: none"> <li>Point source away from people (1)</li> <li>Invert source within lead container (1)</li> <li>Use tongs to handle source (1)</li> <li>Use tongs to handle lead sheets/ensure source held (1)</li> </ul>	2																																																	
5(c)(i)	<ul style="list-style-type: none"> <li>The count is a large number for small distances so percentage errors will be smaller (1)</li> </ul>	1																																																	
5(c)(ii)	<ul style="list-style-type: none"> <li>There is a larger variation in count over smaller distances (1)</li> </ul>	1																																																	
5(d)(i)	<ul style="list-style-type: none"> <li>Calculates count rate per minute or per second or per 30 s (1)</li> <li>Subtract background count (1)</li> <li>Count rate <math>C^{-1/2}</math> to at least 3SF (1)</li> <li>Axes labelled for suitable graph and with correct units (1)</li> <li>Suitable scales (1)</li> <li>Points plotted (1)</li> <li>Line of best fit (1)</li> </ul> <p><u>Example of table</u></p> <table border="1"> <thead> <tr> <th><math>d / \text{cm}</math></th> <th>Count</th> <th>Time for count / s</th> <th><math>C \text{ min}^{-1}</math></th> <th>C-background <math>\text{min}^{-1}</math></th> <th><math>C^{0.5} / \text{min}^{-0.5}</math></th> <th><math>C^{-0.5} / \text{min}^{0.5}</math></th> </tr> </thead> <tbody> <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> </tbody> </table>	$d / \text{cm}$	Count	Time for count / s	$C \text{ min}^{-1}$	C-background $\text{min}^{-1}$	$C^{0.5} / \text{min}^{-0.5}$	$C^{-0.5} / \text{min}^{0.5}$	5	1163	30	2326	2268	47.62352	0.0210	6	897	30	1794	1736	41.66533	0.0240	7	586	30	1172	1114	33.37664	0.0300	9	793	60	793	735	27.11088	0.0369	11	559	60	559	501	22.38303	0.0447	13	469	60	469	411	20.27313	0.0493	7
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<b>5(d)(ii)</b>	<ul style="list-style-type: none"> <li>• Use of large triangle to determine gradient (1)</li> <li>• <math>k = 280</math> (allow 260 – 300) (1)</li> <li>• Unit: <math>\text{cm min}^{-0.5}</math> (1)</li> <li>• x (y intercept) = 1.0 cm (allow 0.6 – 1.2) (1)</li> </ul> <p><u>Example of calculation</u>  <math>(10.0 - 0)/(0.040 - 0.004) = 280 \text{ cm min}^{-0.5}</math></p>	<b>4</b>
	<b>Total for Question 5</b>	<b>18</b>