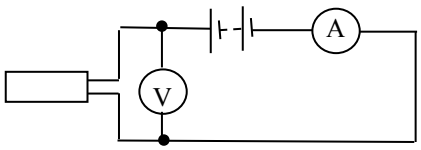
Unit 6: Practical Skills in Physics II - Mark scheme

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) • Use of $\rho = \frac{m}{V}$ (1) • Density = 8.020 g cm^{-3} must be to 4 SF allow ecf from (b) (1) Example of calculation $V = \frac{4\pi 1.429^3 \text{ cm}^3}{3} = 12.223 \text{ cm}^3$ $\rho = \frac{98.00\text{g}}{12.223\text{cm}^3} = 8.018 \text{ g cm}^{-3}$	**3**
1(d)	• Calculates % uncertainty in diameter from (b) (1) • % uncertainty in density = 0.4 (accept 0.42 or 0.37 if half-range is used) (1) Example of calculation 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	**2**
	Total for Question 1	**7**

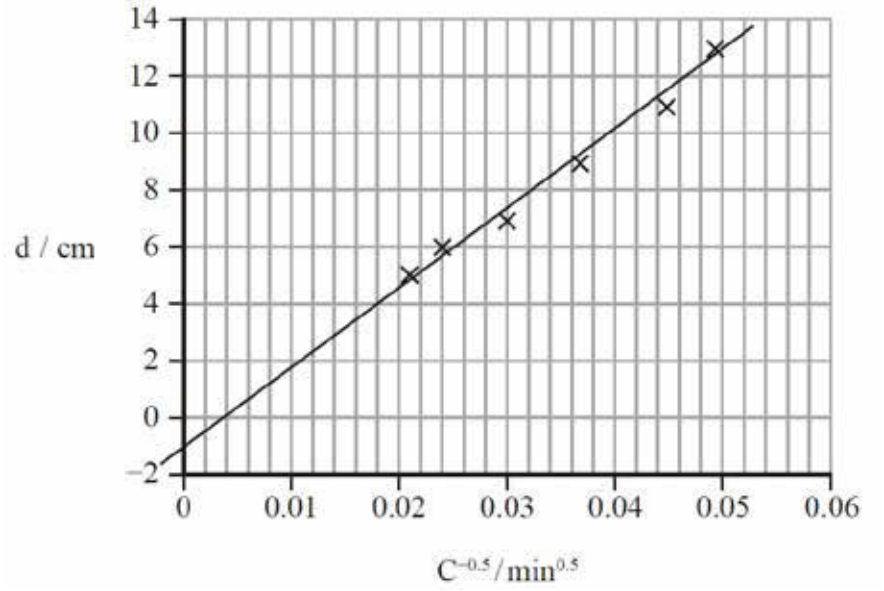
Question number	Answer	Mark
2(a)	• metre rule shown vertical with set square on floor (1)	**1**
2(b)(i)	• The resolution of the stopwatch is 0.01 seconds (1) • But there is a human reaction time when starting and stopping the stopwatch (1)	**2**
2(b)(ii)	• v = 0.59 m s^{-1} (1) Example of calculation $v = \frac{2h}{t} = 2 \times 0.885/3.0$ v = 0.59 m s^{-1}	**1**
2(b)(iii)	• Calculates value of momentum (1) Example of calculation 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) Example of calculation $\Delta p = 0.030 \times 9.81 \times 3.0$ = 0.88 kg m s^{-1}	**1**
2(c)(ii)	• External forces acting **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) • Measure the p.d., current and mass of block (and heater) (1) • Measure initial and final temperature and corresponding time interval (1) • Use of $E = VIt$ (1) • Use of $c = \Delta E / m\,\Delta\theta$ (1) <u>Example of circuit</u>  	5
3(b)	• Not all energy from the heater is supplied to the block **Or** some energy transferred to/from surroundings (1) • 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) • There are no repeat readings (1)	**2**
4(a)(ii)	Any **two** from • Distance between coils (1) • Potential difference (across first coil) power supply (1) • 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) • 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) • 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)
• Place thick aluminium/thin lead between source and detector
Or Distance greater than 25 cm between source and detector (1)
• Count rate detected above background (1)</td><td>3</td></tr>
<tr><td>5(b)</td><td>Any two from
• Point source away from people (1)
• Invert source within lead container (1)
• Use tongs to handle source (1)
• 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)
• Subtract background count (1)
• Count rate $C^{-1/2}$ to at least 3SF (1)
• Axes labelled for suitable graph and with correct units (1)
• Suitable scales (1)
• Points plotted (1)
• Line of best fit (1)

<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>
</table>

		
5(d)(ii)	• Use of large triangle to determine gradient (1) • k = 280 (allow 260 – 300) (1) • Unit: cm $min^{-0.5}$ (1) • x (y intercept) = 1.0 cm (allow 0.6 – 1.2) (1) <u>Example of calculation</u> (10.0 – 0)/(0.040 – 0.004) = 280 cm $min^{-0.5}$	**4**
	Total for Question 5	**18**