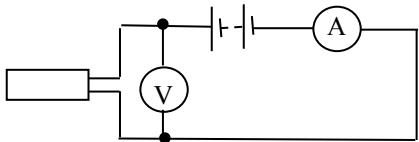


Unit 6: Practical Skills in Physics II - Mark scheme

Question number	Answer	Mark
1(a)	<ul style="list-style-type: none"> 2.860 (1) 	1
1(b)	<ul style="list-style-type: none"> 2.858 cm (four sig figs. Allow ecf from (a)) (1) 	1
1(c)	<ul style="list-style-type: none"> 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) <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"> Calculates % uncertainty in diameter from (b) (1) % uncertainty in density = 0.4 (accept 0.42 or 0.37 if half-range is used) (1) <p><u>Example of calculation</u></p> <p>Uncertainty in diameter = 2.858-2.854 = 0.004</p> <p>% uncertainty in diameter = 0.004/2.858 × 100 = 0.14%</p> <p>% uncertainty in volume and density = 3 × 0.14 = 0.42</p>	2
	Total for Question 1	7

Question number	Answer	Mark
2(a)	<ul style="list-style-type: none"> metre rule shown vertical with set square on floor (1) 	1
2(b)(i)	<ul style="list-style-type: none"> 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)	<ul style="list-style-type: none"> $v = 0.59 \text{ m s}^{-1}$ (1) <p><u>Example of calculation</u> $v = \frac{2h}{t} = 2 \times 0.885/3.0$ $v = 0.59 \text{ m s}^{-1}$</p>	1
2(b)(iii)	<ul style="list-style-type: none"> Calculates value of momentum (1) <p><u>Example of calculation</u> $P = 0.96 \text{ kg} \times 0.59 \text{ m s}^{-1} = 0.57 \text{ kg m s}^{-1}$</p>	1
2(c)(i)	<ul style="list-style-type: none"> Momentum = 0.88 kg m s^{-1} (1) <p><u>Example of calculation</u> $\Delta p = 0.030 \times 9.81 \times 3.0$ $= 0.88 \text{ kg m s}^{-1}$</p>	1
2(c)(ii)	<ul style="list-style-type: none"> External forces acting (1) Or friction acting 	1
	Total for Question 2	7

Question number	Answer	Mark
3(a)	<ul style="list-style-type: none"> • 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) <p><u>Example of circuit</u></p> 	5
3(b)	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • Distance between coils (1) • Potential difference (across first coil) power supply (1) • Frequency of ac supply (1) 	2
4(a)(iii)	<ul style="list-style-type: none"> • 0.01 V (1) 	1
4(a)(iv)	<ul style="list-style-type: none"> • Because the final digit fluctuates (1) 	1
4(a)(v)	<ul style="list-style-type: none"> • Would need to take some repeat readings (1) • Consider how close together in value (1) 	2
4(b)	<ul style="list-style-type: none"> • There is a value of V when $t = 0$ (1) 	1
4(c)	<ul style="list-style-type: none"> • Plot $\ln V$ against t (1) • Should be a straight-line graph if the relationship is exponential (1) 	2
	Total for Question 4	11

Question number	Answer	Mark																																																	
5(a)	<ul style="list-style-type: none">Record background count (rate) (1)Place thick aluminium/thin lead between source and detector (1)Or Distance greater than 25 cm between source and detector (1)Count rate detected above background (1)	3																																																	
5(b)	Any two from <ul style="list-style-type: none">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)	2																																																	
5(c)(i)	<ul style="list-style-type: none">The count is a large number for small distances so percentage errors will be smaller (1)	1																																																	
5(c)(ii)	<ul style="list-style-type: none">There is a larger variation in count over smaller distances (1)	1																																																	
5(d)(i)	<ul style="list-style-type: none">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) <p><u>Example of table</u></p> <table><tr><th>d / cm</th><th>Count</th><th>Time for count / s</th><th>$C \text{ min}^{-1}$</th><th>C-background min^{-1}</th><th>$C^{0.5} / \text{min}^{-0.5}$</th><th>$C^{-0.5} / \text{min}^{0.5}$</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>	d / cm	Count	Time for count / s	$C \text{ min}^{-1}$	C-background 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
d / cm	Count	Time for count / s	$C \text{ min}^{-1}$	C-background 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																																													

	<p style="text-align: center;">d / cm</p> <p style="text-align: center;">$C^{-0.5} / \text{min}^{0.5}$</p>	
5(d)(ii)	<ul style="list-style-type: none"> • Use of large triangle to determine gradient (1) • $k = 280$ (allow 260 – 300) (1) • Unit: $\text{cm min}^{-0.5}$ (1) • x (y intercept) = 1.0 cm (allow 0.6 – 1.2) (1) <p><u>Example of calculation</u> $(10.0 - 0)/(0.040 - 0.004) = 280 \text{ cm min}^{-0.5}$</p>	4
	Total for Question 5	18