

Secondary 4 Express Preliminary Examination 2026
Physics 6091
Answer Keys and Marking Scheme

Question	Answer	Marks
1bi	MMO Draw a labelled diagram of the measuring cylinder with spheres and water • Indicate initial level • Indicate final level • Draw 5 marbles	1
1bii	MMO Record V_T to 1 dp in cm^3	1
1biii	ACE Correct calculation of average volume in the range $2.0 \pm 0.5 \text{ cm}^3$ 2 dp in cm^3	1 1
1biv	ACE • Water splashes out / to the side of the measuring cylinder. • Air bubbles trapped around the spheres. [reject parallel error]	1
1ci	MMO Record M_T to 1 dp in g	1
1cii	ACE Correct calculation of average mass to 1 dp in g	1
1d	ACE Correct calculation of density to 2 sf in g/cm^3	1
1f	ACE • To obtain a larger rise in water level to reduce reading error • To increase accuracy as each sphere may vary in size	1
1g	ACE • Slide the sphere along the side of measuring cylinder instead of dropping • Use larger sphere made of the same glass • Use burette to measure 30 cm^3 of water	1
2a	MMO Record L in the range $2.5 \text{ cm} \pm 0.1 \text{ cm}$	1
2c	MMO	

	Record d in the range 40.0 cm $\pm$ 0.5 cm Record x to 1 dp in cm	1 1
2d	ACE Aligning the extreme positions of the spring to the ruler is not exact	1
2d	P - Independent variable: d dependent variable: e constant variable: m, position of spring on metre rule, total length of metre rule <u>Procedure:</u> - Set up the apparatus as shown in Fig. 2.2. - Place the mass hanger the 40 cm mark from the metre rule and measure the distance d from end A. - Adjust the retort stand so that the spring is vertical. Measure the new length x of the spring. - Calculate the extension of the spring using $e = x - L$. - Repeat step 2 to 4 by varying the distance d along the metre rule for 5 more readings. - Record d, x and e in a table. - Plot a graph of e against d. - If the relationship is true, - To find k, determine the gradient of the graph. Then, calculate k using $k = \frac{mg}{\text{gradient}}$	1 1 1 1 1 1
3a	MMO d in the range 0.35 mm to 0.40 mm	1
3c	MMO V recorded to 0.05 V I recorded to 0.01 A	1

3d	ACE 1. Correct calculation of R to 2 sf with unit Ω 2. Correct calculation of y to 2 sf with unit Ω/m	1 1																																																												
3e	MMO At least 5 sets of reading, including values from (b) and (c) PDO table with quantities L, 1/L, V, I, R and y all quantities in table header with correct units PDO all values of L, V, I to correct precision PDO all values of 1/L, R, y to correct significant figures ACE correct calculation of y (using calculator values throughout) <table><tr><th>L/m</th><th>1/L / 1/m</th><th>V/V</th><th>I/A</th><th>R/Ω</th><th>y / Ω/m</th></tr><tr><td>0.100</td><td>10.0</td><td>0.75</td><td>0.13</td><td>5.8</td><td>58</td></tr><tr><td>0.200</td><td>5.00</td><td>0.85</td><td>0.13</td><td>6.5</td><td>33</td></tr><tr><td>0.300</td><td>3.33</td><td>1.00</td><td>0.13</td><td>7.7</td><td>26</td></tr><tr><td>0.400</td><td>2.50</td><td>1.15</td><td>0.13</td><td>8.8</td><td>22</td></tr><tr><td>0.500</td><td>2.00</td><td>1.25</td><td>0.13</td><td>9.6</td><td>19</td></tr><tr><td>0.600</td><td>1.67</td><td>1.40</td><td>0.13</td><td>11</td><td>18</td></tr><tr><td>0.700</td><td>1.43</td><td>1.55</td><td>0.13</td><td>12</td><td>17</td></tr><tr><td>0.800</td><td>1.25</td><td>1.70</td><td>0.13</td><td>13</td><td>16</td></tr><tr><td>0.900</td><td>1.11</td><td>1.90</td><td>0.13</td><td>15</td><td>16</td></tr></table>	L/m	1/L / 1/m	V/V	I/A	R/ Ω	y / Ω/m	0.100	10.0	0.75	0.13	5.8	58	0.200	5.00	0.85	0.13	6.5	33	0.300	3.33	1.00	0.13	7.7	26	0.400	2.50	1.15	0.13	8.8	22	0.500	2.00	1.25	0.13	9.6	19	0.600	1.67	1.40	0.13	11	18	0.700	1.43	1.55	0.13	12	17	0.800	1.25	1.70	0.13	13	16	0.900	1.11	1.90	0.13	15	16	1 1 1 1 1
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3f	PDO • Axes drawn and labelled with units and correct orientation (allow ecf from wrong unit in table but not no units) • Suitable scale (based on 1, 2 or 5) with plotted points occupying $\geq$ half the page in both directions • All points plotted correctly (points must be $\leq \frac{1}{2}$ small square from the correct position) • Best fit line and fine crosses	1 1 1 1																																																												
3gi	ACE • use of a triangle and labelled coordinates on graph that uses more than half the drawn line • correct calculation of gradient to correct s.f.	1 1																																																												

3gii	ACE y-intercept determined correctly from graph at $d = 0$ cm [accept using $y = mx + c$ method]	1
3giii	ACE • correct calculation of ρ to 2/3 sf (depends on students) with unit Ωm • range =	1
3h	ACE • Internal heating of wire leading to higher resistance as switch is closed throughout • Wire is not taut, increasing the actual length of L	1 1

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Prep List:

Question 1:

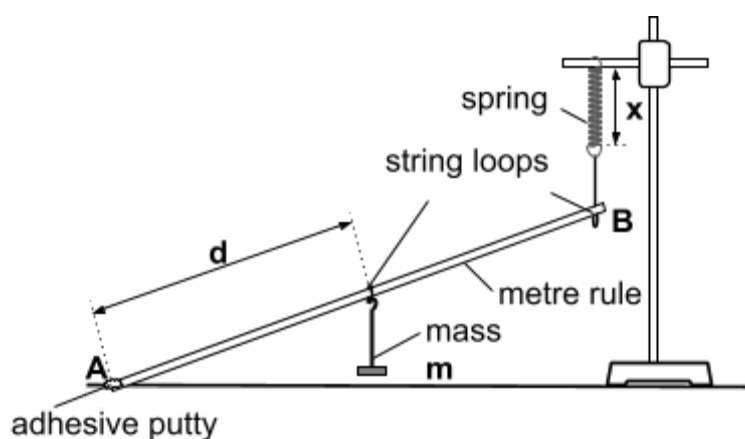
	Apparatus	Qty
1	Marbles	5
2	Plastic measuring cylinder (50 cm ³)	1
3	250 cm ³ beaker containing 200 cm ³ water	1
4	Plastic dropper	1
5	Card that writes “total mass of 5 glass spheres = ...”	1
6	Paper towels (in case of spillage)	A few

Note: Do not need to set up.

Question 2:

	Apparatus	Qty
1	2.5 cm spring with a string loop	1
2	30 cm ruler	1
3	Retort stand, boss and clamp	1
4	Metre rule with string loop	1
5	50 g mass attached to mass hanger (tape around)	1
6	Blu tack	1

Note: Do not need to set up.



Question 3:

	Apparatus	Qty
1	Resistance wire on metre rule	1
2	Digital micrometer screw gauge	1
3	3.0 V battery	1
4	Ammeter	1
5	Voltmeter	1
6	5 Ω resistor	1
7	Switch	1
8	Connecting wires	7

Note: Do not need to set up.

