2025 Phy Prelim Practical P3_NHHS_suggested marking scheme

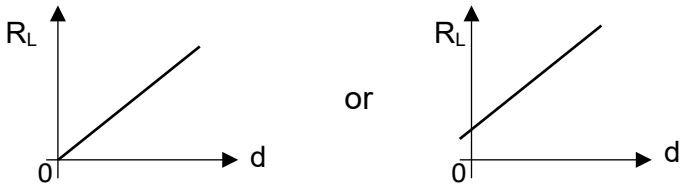
Question			suggested answer	marks
1	(a)	(i)	*L, W* and *H* recorded to 1 dp and correct units sample data : 12.5 cm x 6.6 cm x 2.0 cm (blocks differ)	1
		(ii)	Base on (ai) correct working, significant figures and units Volume = 12.5 x 6.6 x 2.0 = 165 cm^3 = 170 cm^3 (if 2 sf) Density = 416/170 = **2.5 g/cm^3 (2 sf)** {actual density of glass block is about 2.2 to 2.8 g/cm^3}	 1 1
	(b)	(i)	*i* recorded to the nearest degree 40 °	1
		(ii)	Recorded to the nearest degree with the correct units (eg. θ = 101°) Recorded to the nearest 0.1 cm with the correct units (eg. x = 1.0 cm)	1 1
	(c)		Points P_3 and P_4 marked as far away as possible Ensure the block is placed accurately on the given rectangle Ensure light source with slit is placed close to the glass block.	1,1
	(d)		Difficult to place the incident ray accurately on the line drawn (40°) Difficult to locate the exact centre of the emergent ray to draw the points Ambient light makes it difficult to locate emergent ray.	1,1

Question			suggested answer	marks
2	(b)	(i)	*d* value recorded with unit to nearest 0.1 cm	1
		(ii)	It is difficult to make ruler vertical It is difficult to access the centre of lamp / filament / judge where the filament is / ruler is too far from lamp	1
	(c)	(i)	Sensible value for V_S with 2 dp precision (range from 4.00 V to 4.45 V)	1
		(ii)	Sensible value for V_{AB} with 2 dp precision (eg V_{AB} = 2.20 V)	1
		(iii)	$I = \frac{V_{AB}}{R}$ $I = \frac{2.20}{470} = \mathbf{0.00468}\boldsymbol{A}$ (or 4.7mA)	1
		(iv)	$V_L = V_S - V_{AB} = 4.35 - 2.20 = 2.15V$ $R_L = \frac{V_L}{I}$ $R_L = \frac{2.15}{0.00468} = \mathbf{459\ \Omega\ (3\ sf)}$	1

	(c)	***Marking points***	

		• constant variables: (need 2)
		  • *surrounding light intensity*
		  • *value V_s* constant
		  • *R = 470 Ω*
		  • *Brightness of bulb*
			1

		• description of procedures:
		  • *d as* independent variable and record V_{AB}
		  • calculate I and calculate V_L
		  • *to calculate R_L (dependent variable)*
			1

		• vary *d* to get at least 5 sets of R_L	
		• plot a suitable graph: Plot R_L against d	1
			1
		• ϒ is ½ of the gradient of the graph	1

Question			suggested answer		marks
3	(a)	Any two from: - Weights placed on the base of each retort stand - Bosses are attached as low as possible - d is not too large / the spring is not too stretched - The orientation of the base of the retort stands (facing away)			1,1
	(b)	(i)	*38.0 cm ± 4.0 cm*		1
		(ii)	Correct calculation of $L^2 / 100$ using candidate's value **with unit** and **appropriate sf**	correct calculation unit & sf	1
	(c)	(i)	• Measure time for 10 oscillations and divide this by 10 • Wait for oscillations to stabilise before starting the timing • Count oscillations as the rod moves at its fastest in the same directions (through the resting point / centre of oscillation)		1
		(ii)	Correct calculation of an accurate value of T (need to show averaging)		1
			with **unit** and **appropriate sf**		1
		(iii)	Correct calculation of T^2 using candidate's value with unit and **appropriate sf**		1

(d)

- table with proper headers and unit (for L, $\frac{L^2}{100}$, T and T^2) — 1
- at least 5 sets of data with correct trend (L down, T down) — 1
- all values of L recorded to nearest 1dp in cm and T recorded to 1 or 2 dp in s. — 1
- correct calculation of $L^2/100$ and T^2 to **appropriate sf** — 1

sample data:

L/cm	$\frac{L^2}{100}/cm^2$	t_1 /s	t_2 / s	t_{ave} / s	T / s	T^2 / s^2
38.0	14.4	11.56	11.55	11.56	1.16	1.34
35.0	12.3	11.28	11.18	11.23	1.12	1.26
30.0	9.0	10.50	10.47	10.49	1.05	1.10
25.0	6.3	9.81	9.91	9.86	0.99	0.97
20.0	4.0	9.38	9.28	9.33	0.93	0.87
15.0	2.3	8.84	8.81	8.83	0.88	0.78
10.0	1.0	8.60	8.53	8.57	0.86	0.73
5.0	0.3	8.28	8.30	8.29	0.83	0.69

(e)

- axes labelled with headers + units and correct orientation — 1
- suitable scale, not based on 3, 6, 7 etc with plotted data occupying >= half the page in both directions — 1
- all points plotted correctly (points must be =< ½ small square from the correct position) — 1
- best fit line and fine crosses — 1

(f)

Constant G

- gradient:
  - use of *gradient triangle* that uses more than half the drawn line — G — 1
  - correct calculation of gradient — correct sf — 1

(g) — 1

Either:
(Yes, likely to be curved line)

- The best fit line is more likely a curved line than a straight line for my data - a smooth curve can be drawn for the plotted points

(No, more likely to be straight line)

- the increase in T^2 gets smaller;
- the points are all evenly spread about the best fit line
- the graph shows that T^2 increases by the same amount for equal increases in L^2 / 100 so the line should be straight

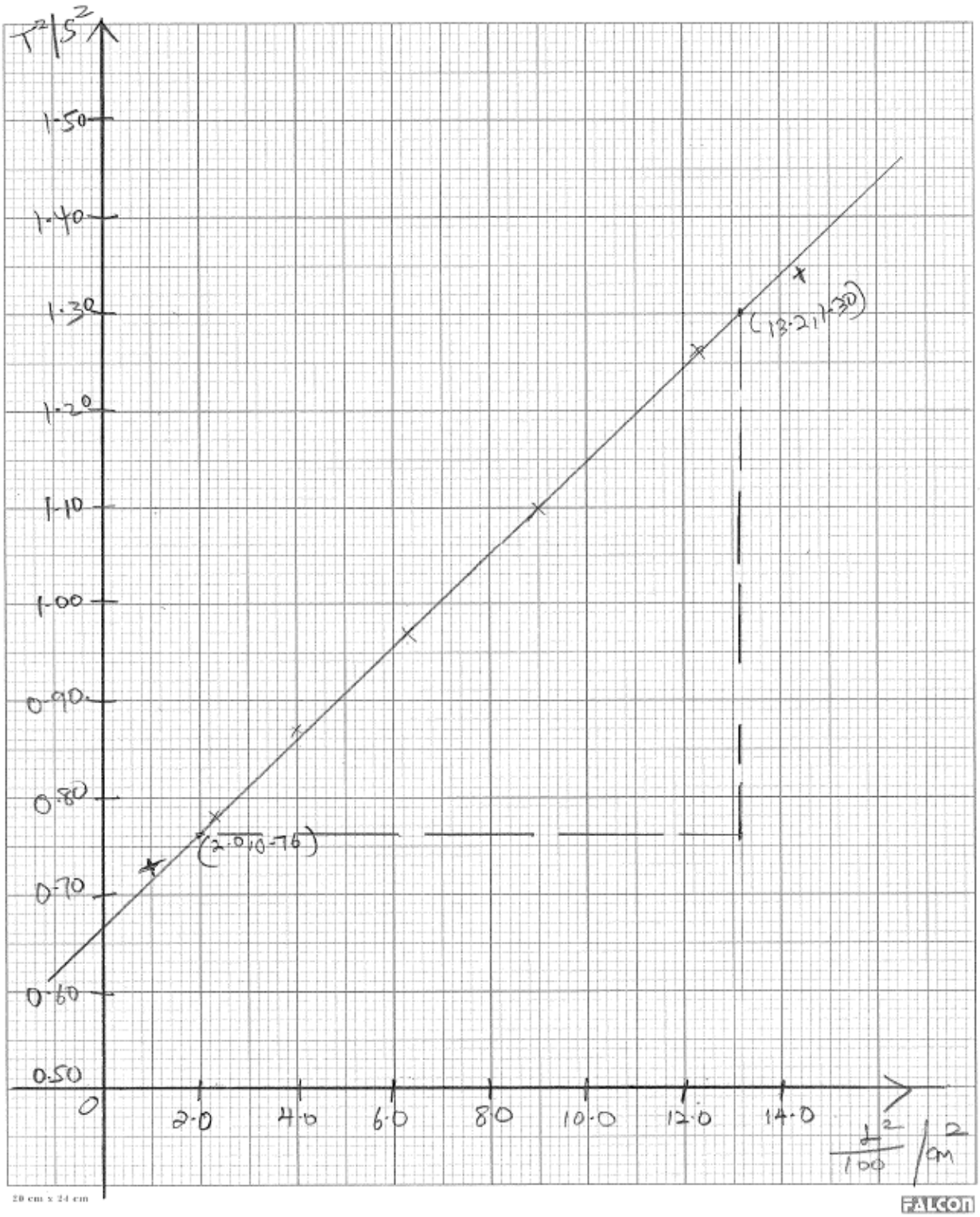
(h) — 1

Either
(Yes, measurement of L is more accurate when L is large)

- reaction time is a smaller proportion of the total time when L is large
- it's easier to judge the end of the swing when it is moving slower
- or points are closer to best fit line at large L;

or
(No measurement of L is more accurate when L is small)

- reaction time is the same
- points are closer to best fit line at smaller L;


T²/s²
1·50
1·40
1·30
1·20
1·10
1·00
0·90
0·80
0·70
0·60
0·50
0
2·0
4·0
6·0
8·0
10·0
12·0
14·0
(13·2, 1·30)
(2·0, 0·76)
L²/100 / m
20 cm x 24 cm
FALCON