## Marking Scheme for 2019 Prelim Physics Paper 3

1(b)	Time measurement for at least 5 oscillations AND working to calculate T	[1]
	T = 2.24 s (accept either 1 dp OR 2 dp)	[1]
(cii) [-1m fo	t = 22.41 s (accept either dp OR 2 dp) [t > 10 s] or any inaccuracy in precision and unit in (b) & (cii)]	[1]
(ciii)	Energy lost to the surrounding due to <u>air resistance / friction</u> .	[1]
(d)	Constant variable(s) – $H$ / angle of swing / amplitude kept 10 to 12 cm Independent variable – mass $m$ of pendulum bob.	[1]
	<ol> <li>Set the apparatus as shown in the diagram (Fig. 1.1)</li> <li>Suspend a pendulum bob of 100 g, move the bob to align with the 12 cm mark or card as shown in Fig. 1.2</li> <li>Release the pendulum bob. Measure and record the time <i>t</i> for the amplitude of the time <i>t</i> for the amplitude of the time t for the</li></ol>	
	<ul> <li>pendulum to decrease from <u>12 cm to 10 cm</u>.</li> <li>4. Repeat step 3. <u>Take average</u> of the two readings for <i>t</i>.</li> <li>5. <u>Repeat step 2 to 4</u> for 5 more different sets of readings by varying <i>m</i>.</li> <li>6. Plot a graph of <i>t</i> against <i>m</i>.</li> </ul>	[1] [1] [1] [1]
	<ol> <li>Flor a graph of <u>ragainst m</u>.</li> <li>Shows a sketch of the graph with <u>best-fit line that passes through origin</u>]</li> </ol>	[1]
2 (ai)	$I_{\rm o}$ = 2.0 cm to 3.0 cm	[1]
(aii)	<i>I</i> <sub>s</sub> = 7.5 to 8.5 cm	[1]
	$e_{\rm o}$ = 4.5 cm to 6.5 cm	
	[correct calculation for $e_0$ ]	[1]
	[-1m for any inaccuracy in precision and unit in both ai and aii]	
(b)	$k = 0.26 \text{ Ncm}^{-1}$	
	[correct calculation of <i>k</i> ]	[1]
	[-1m for any inaccuracy in unit]	
(ci) 8	k (cii) correct calculation for $e_1$ and $e_2$	[1] each
(d)	$F_1 = 0.90 \text{ N}$ $F_2 = 2.0 \text{ N}$ [correct calculation for both F with correct significant figures] [accept ecf of e in calculation of F]	[1] [1]

(e) There is friction [1] between the pipe and the string [1].

- 3 (a) *I* = 0.20 to 0.35 A [correct precision with unit]
  - (b) V = 0.10 to 0.20 V [correct precision with unit]

(c)

x / cm	V / V
10.0	0.10
15.0	0.15
25.0	0.30
35.0	0.40
45.0	0.60
60.0	1.75
65.0	1.80
75.0	2.00
85.0	2.10
90.0	2.20

Include all 9 sets of data (x = 15 to 90 cm)	[1]
Include value of x and V from 3(b)	[1]
Correct headings and units	[1]
Correct precision for both x and V	[1]

(d) Axes labelled with units and correct orientation
 (allow ecf from wrong unit in table but not no unit)

Suitable scale, not based on 3, 6, 7 etc. with combined plotted data of the two lines occupying more than or greater than half the page in both directions.

x-axis atart with 0 and end with 100 cm	[1]	

All points plotted correctly (points must be less than or equal to  $\frac{1}{2}$  small square from the correct position. [1]

Best-fit line with labelling of graphs A and B [1]

## (e) & (f)

$$\begin{split} G_{A} &= 0.014 \ \text{Vcm}^{-1} \\ G_{B} &= 0.015 \ \text{Vcm}^{-1} \\ & \text{[Correct calculation of gradient } G_{A} \text{ and } G_{B}] \\ & \text{[Both the triangles uses more than half the individually drawn line]} \\ & \text{[1]} \end{split}$$

 $\begin{array}{ll} V_{A}=0 \ V \\ V_{B}=0.80 \ V \\ \left[V_{A} \ \text{and} \ V_{B} \ \text{read} \ \text{or} \ \text{determined correctly from graph}\right] & [1] \\ \left[G \ \text{calculated in 2 or 3 sf \& V read from one half of one of the smallest squares on the grid} \\ \text{with correct units}\right] & [1] \end{array}$ 

(g) Agreed. [1] The results obtained for both  $G_{\text{A}}$  and  $G_{\text{B}}$  are approximately the same. OR

Disagreed. [1] The results obtained for both  $G_A$  and  $G_B$  have great difference.[1] [answer will depend on the data of  $G_A$  and  $G_B$  from 3(e) & (f).

[1]

- (hi) L = 57 cm
   Correct calculation of L [1] with unit and correct number of sf based on the raw data [1]
- (hii) 1. The wire on the metre rule is not straight. This affects the accuracy of the readings of x.
  - [1] 2. As the switch is open only after the 10 readings are taken, there is overheating of the wire. This will affect the accuracy of the readings of V. [1]

(Answer should state the source of error **and** specify which reading is affected as a result of the error.)