Marking Scheme for 2020 Prelim Physics Paper 3

1(b) Time measurement for at least 5 oscillations AND taking average [1]

T = 2.24 s (accept either 1 dp OR 2 dp) [1]

(cii) t = 22.41 s (accept either dp OR 2 dp) [1]

[t > 10 s]

[-1m for any inaccuracy in precision and unit in (b) & (cii)]

(ciii) Energy lost to the surrounding due to air resistance / friction. [1]

(d) Constant variable(s) – *H* / angle of swing / amplitude kept 10 to 12 cm
Independent variable – mass *m* of pendulum bob. [1]

1. Set the apparatus as shown in the diagram (Fig. 1.1)
2. Suspend a pendulum bob of 100 g, move the bob to align with the 12 cm mark on the card as shown in Fig. 1.2
3. Release the pendulum bob. Measure and record the time *t* for the amplitude of the pendulum to decrease from 12 cm to 10 cm. [1]
4. Repeat step 3. Take average of the two readings for *t*. [1]
5. Repeat step 2 to 4 for 5 more different sets of readings by varying *m*. [1]
6. Plot a graph of *t* against *m*. [1]
7. Shows a sketch of the graph with best-fit line that passes through origin] [1]

2 (ai) l_o = 2.0 cm to 3.0 cm [1]

(aii) l_s = 7.5 to 8.5 cm [1]

e_o = 4.5 cm to 6.5 cm

[correct calculation for e_o] [1]

[-1m for any inaccuracy in precision and unit in both ai and aii]

(b) k = 0.26 Ncm^{-1}

[correct calculation of k] [1]

[-1m for any inaccuracy in unit]

(ci) & (cii) correct calculation for e_1 and e_2 [1] each

(d) F_1 = 0.90 N [1]
F_2 = 2.0 N [1]
[correct calculation for both F with correct significant figures]
[accept ecf of e in calculation of F]

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

3 (a)(i)& (ii) correct precision with unit [1] each

(b) correct calculation with unit [1]

(c) correct calculation with unit [1]

(d) (i) correct precision with unit [1]

(ii) correct calculation with unit [1] each

(e)

At least 5 sets of data with correct trend, V_{AB} decreases as d increases [1]
Table with quantities d, V_{AB}, V_L, I and R_L with correct units [1]
Range of d of at least 5 cm [1]
Correct precision for d, V_{AB}, V_L, I [1]
Correct calculation of R_L [1]
Correct sf for R_L [1]

(f) Axes labelled with units and correct orientation
(allow ecf from wrong unit in table but not no unit) [1]

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. [1]

All points plotted correctly (points must be less than or equal to ½ small square from the correct position. [1]

Best-fit line (curve) [1]

(g) (i) correct calculation with unit [1]

(ii) correct calculation with unit [1]

(iii) The gradient of the graph becomes less steep as d increases. [1]

(h) For large values of d, the change in values of V_{AB} is less than 0.1 V as d increases. Hence the voltmeter's precision is too small to measure the changes in values of of V_{AB} accurately. [1]

(Saying that the precision of the voltmeter is too small is merely stating the reason and does not explain why.)