PHY2811 (2009) Group C

Test 1 solution **(wrong unit ⇒ - 1 mark)**

(1) (a) $\frac{\delta a}{a} = \frac{\delta x}{x} = \left(\frac{0.05}{7.35}\right) = 0.68\%$ or 0.7% (5 marks)

(b) $\frac{\delta a}{a} = \sqrt{\left(\frac{\delta x}{x}\right)^2 + 2^2\left(\frac{\delta t}{t}\right)^2} = 3.4\%$ or 3%

$a = 1.633$ cm/s^2 $\Rightarrow \delta a = 0.056$ or 0.06 cm/s^2 (10 marks)

(2) $40.4 \times 0.5\% + 0.2 = 0.4$ mV (10 marks)

(3) (a) $(2.10 \pm 0.10) \times 10^4$ or $(2.1 \pm 0.1) \times 10^4$ (5 marks)

(b) 14.25 ± 0.12 (5 marks)

(c) $10.84 \pm 2.9\%$ or 10.84 ± 0.31 (5 marks)

(4) Measure several periods to minimize the human error. (4 marks)

The mass moves faster at the average position (or equilibrium position). Use that position for the start & stop of the timing. (1 mark)

(5) (a) For a linear graph, we should plot L vs. $1/f$ since f can be measured accurately.

$L = \frac{C}{f}$ (10 marks)

$1/L$ vs f is OK but not the best as L may be subject to a systematic error.

f vs. $1/L$ (-5 marks)

(b) Linear least square fit for L vs. $1/f$: slope = 4165 ± 45 or $(4.17 \pm 0.05) \times 10^3 = C$

$\therefore C = 4165 \pm 45$ or $(4.17 \pm 0.05) \times 10^3$ cm/s (35 marks)

Note: This part (b) is to test whether the student knows how to do linear least square fit. So even if the student uses other linear plots, we let them get the full marks if the procedure is OK.

Many students plotted f vs $1/L$ & obtained $C = 4085 \pm 34$ cm/s.

(c) Error of L: instrument error = 0.5 mm (5 marks)

human error: judgment of the start & end points. (a random error) (5 marks)