Marks

Question 16 (continued)

(a) Outline TWO changes that could be made to the experimental procedure that would improve its accuracy. **2**

Allow the pendulum to swing for 10 cycles, measure the time for 10 periods and then divide by 10 to get average time.

Use a larger θ, so the extremities of the motion can be more easily seen and hence, timed.

(b) Compare Kim's and Ali's methods of calculating g and identify the better approach. **3**

Ali's method by calculating g from a line of best fit is more able to filter spurious noise in the data, whereas Kim's method, by calculating the mean is more affected by outliers in the data, therefore Ali's method is better. Alis method also eliminates systematic error, whereas Kim's does not. Gradient unaffected by a shift up or down the graph.

(c) Calculate the value of g from the line of best fit on Ali's graph. **3**

$T = 2\pi\sqrt{\frac{L}{g}}$

$\frac{T}{2\pi} = \sqrt{\frac{L}{g}}$

$\frac{L}{g} = \frac{T^2}{4\pi^2}$

$\frac{g}{L} = \frac{4\pi^2}{T^2}$

$g = \frac{4\pi^2 L}{T^2}$

$\frac{L}{T^2} = \frac{0.24}{0.975} = 0.246153846\ldots$ (since 0,0 is a point)

$g = 4\pi^2 \times 0.246153846\ldots$

$= 9.7\ ms^{-2}$ (to 1dp)

(which is closer to the known figure of $9.8 ms^{-2}$ – demonstrating the greater validity of this result and method of calculation)

End of Question 16