Sec 3 Physics Practical 05
Simple Pendulum
Marking Scheme

Record of **L**, t_1, t_2, **<t>**, **T** and T^2

- Neat table drawn with the headings and units (**L/cm**, t_1**/s** t_2**/s**, **<t>/s**, **T/s** and T^2/s^2)
- At least 6 sets of evenly spread readings of **L** taken with **L** between 30 and 100 cm (inclusive of 100 cm) with minimum range of 50 cm.
- **L** tabulated to 1 d.p in cm / 3 d.p in m; t_1, t_2, **<t>** in 1 or 2 d.p in s
- **T** and T^2 calculated correctly and tabulated to correct s.f.

Graph

- **S**: Suitable scales used.
- **P**: All points correctly plotted (give allowance of 1 error).
- **L**: Best fitted line passing through the origin.
- **A**: Axes correct (T^2 on y-axis and **L** on x-axis); axes correctly labelled (with suitable units) from origin with values labelled at regular intervals on both axes.

Conclusion

T^2 is directly proportional to **L**. (straight line passing through origin or close to origin)

Questions

1 From your graph, what is the length of the pendulum which will give a period of 1.5 s?

Given T=1.5 s, read off the length L from the graph when $T^2 = 1.5^2 = 2.25\ s^2$.
$L \approx 0.57 \pm 0.1$ m

2 State and explain **two** significant sources of error in this experiment.

- There could be human judgment error in judging when the pendulum has completed exactly one complete oscillation
  - This may cause error in finding the period of oscillation

- The thread used for the pendulum is elastic OR can be stretched.
  - This may affect the accuracy of the length of pendulum measured.

Not acceptable!

- *Air currents in the laboratory may affect the oscillation of the pendulum. This may affect the accuracy of the timings measured.*
  - ***You are expected to ensure no air currents (switched off fan, closed windows)!***
- *The pendulum swing may not be steady or occur in an elliptical path. This may affect the accuracy of the timings measured.*
  - ***You are expected to use only steady oscillations in a vertical plane!***
- *Blame a faulty/imperfect instrument/equipment*

3 State and explain **two** other precautions you took in this experiment to reduce the errors mentioned above.

- The pendulum bob was allowed to swing freely for several oscillations before starting to take readings.
  - This ensured that the oscillation was regular OR this ensured the oscillations occurred steadily in a vertical plane, allowing more precise measurements of the period

- The length of the pendulum was measured after suspending it from the split cork.
  - This is to take into account any changes in length due to the extension of the string under tension.

Not acceptable!

- *The fans were switched off during the experiment.*
  - *This allowed the pendulum to oscillate steadily, allowing more precise measurements of the period*
  - ***This is an expected procedure for a proper experiment.***
- *The retort stand was positioned behind the pendulum swing when viewed from the front.*
  - *This served as a reference line to count the number of swings accurately.*
  - ***This is already mentioned in the procedure. Otherwise, it would be acceptable.***
- *Repeat measurements & take average.*
  - ***This is part of standard procedure to reduce random errors, not a precaution.***

4 Given that $T = 2\pi\sqrt{\frac{L}{g}}$,

(a) explain clearly how you can determine the acceleration due to gravity *g* from the graph.

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

Square the equation on both sides and rearrange to obtain the form Y = mX + c

From the graph of T^2 against L plotted, gradient of the graph = m = $\frac{4\pi^2}{g}$.

acceleration due to gravitational g = $\frac{4\pi^2}{\text{gradient}}$

(b) Using your graph, determine the value of *g*.

Hence, calculate g.