

## Stage 1 Physics

## Practical Investigation: The Pendulum

**Purpose:** To investigate the effect of string length on the period of a pendulum.

**Equipment:**

- string
- lab weights
- stopwatch
- *any other equipment as required for the designed procedure*

**Phase 1: Design**

- A. Write a hypothesis for the relationship between the length and the period of the pendulum. This should be written in words and as a proportionality equation.
- B. Write a procedure for the investigation, clearly showing any variables that are being held constant. This should be detailed and specific (e.g. list the lengths to test).
- C. Draw a clearly labelled diagram showing how the equipment should be set up.
- D. Draw up a results table ready to be filled in when the procedure is performed.
- E. Hand in the designed investigation for checking.

Perform the investigation, recording results and any observations.

**Phase 2: Report**

- Results and Calculations (including a graph of the values hypothesised to be proportional)
- Manipulation and Collaboration (including care and safety precautions, and working together)
- Discussion (including analysis of results with discussions of possible sources of error, evaluation of the method and suggestions for improvements)
- Conclusion

**Phase 3: Problem Solving**

British physicist and army captain Henry Kater in 1817 conducted a pendulum experiment to measure acceleration due to gravity ( $g$ ). The results of his experiment showed that for a pendulum to have a period of  $T = 2.000$  seconds it would need a length of  $L = 0.9941$  m.

- A. Use the formula  $g = \frac{4\pi^2 L}{T^2}$  to calculate gravity in London where he performed his experiment.
- B. In Mexico City, gravity is only  $9.779 \text{ ms}^{-2}$ . Rearrange the formula and hence calculate the period of a  $0.9941$  m pendulum there.
- C. Pendulums are sometimes used to keep time in clocks. If you used a London pendulum clock in Mexico City, calculate how many minutes it would be out by after 24 hours.
- D. Clocks not giving the same time in different places due to the change in gravity is a problem. Suggest at least one solution to this problem, explaining clearly how it would help.