Simple pendulum assessment

Students will perform measurements of the non-linear relationship between a simple pendulum's length and period. They will use their data to obtain a value for the gravitational acceleration.

Resources:

- A weight
- String
- Stop watch
- Measuring tape
- Retort stand

Theory

The period of a simple pendulum is given by the equation:

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

Where T is the period, L is the pendulum length (from pivot to centre of mass), and g is the gravitational acceleration on earth ($9.81 m/s^2$). This equation is valid for small angles of displacement. A detailed description of this theory is available in the Level 3 Physics Study Guide.

Students will:

Plan and conduct an investigation to obtain an experimental value for the acceleration due to gravity (g).

Your investigation should include:

- Aim
- Variables (independent, dependant, control)
- Hypothesis
- Method
- Results
- Conclusion
- Evaluation.

REMEMBER: EVERY MEASUREMENT MADE MUST HAVE AN UNCERTAINTY.
MAKE SURE ALL YOUR CALCULATIONS ARE INCLUDED IN YOUR REPORT.

Questions to consider:

1. How does your experimental value for the gravitational acceleration compare to the expected value?
2. What were the major sources of uncertainty in your measurements?
3. How might you reduce the uncertainty in your value for the gravitational acceleration?

Check list:

- The aim of the investigation is clearly stated.
- A reasonable hypothesis predicting the nature of the relationship is made, and justified using physics theory.
- A range of control variables are identified, and strategies for controlling them are given.
- Uncertainties for all measurements are given.
- At least 2 techniques are used to improve accuracy (e.g. repeated measurements).
- Uncertainties for all calculated values are given.
- All graphs are correctly ladled, including titles, axis labels , and units.
- Error bars are correctly drawn for all points.
- Error lines are correctly drawn.
- Value for the gradient with uncertainty determined correctly, and stated with correct rounding.
- Mathematical relationship between independent and dependant variables , and gradient is stated.
- Value for the gravitational acceleration with uncertainty is given.
- Experimental results are compared with theoretical results.
- A judgement is made as to whether experimental results agree with theory, within uncertainty.
- An attempt is made to explain any discrepancies between experimental and theoretical results.
- Any problems encountered with the experimental procedure are discussed and possible solutions given.
- Discuss the limitations of the physics theory (e.g. friction, why the equation is only valid for small angles).