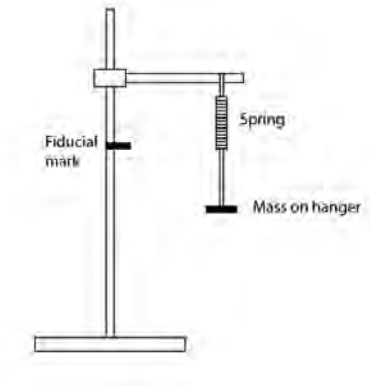
Edexcel Physics A Level

Core Practical 16

Determine the value of an unknown mass using the Resonant Frequencies of the Oscillation of known masses

Method



- Hang a number of masses to the end of the spring
- Extend the spring up to the position of the fiducial marker, release it and start the stopwatch
- Measure time for 10 oscillations; use fiducial mark on clamp stand to improve accuracy
- Find time period for the oscillation of a given mass by dividing time by 10
- Repeat process several times and find mean time period
- Vary the number of masses and record the time period for each condition
- Plot T^2 (y axis) against mass and draw line of best fit with equation

$\omega = \sqrt{\frac{k}{m}}$. As $\frac{\omega}{2\pi} = f$ and $f = \frac{1}{t}$

substituting the latter two equations into the former gives the relationship between t^2 and m

$t^2 = m\left(\frac{k}{4\pi^2}\right)$ and therefore t^2 is proportional to m, with a constant of $\left(\frac{k}{4\pi^2}\right)$

- Attach an unknown mass to the end of the spring and record the time period for this oscillating mass
- Use the T^2 against mass graph to calculate the value of mass

Safety

- Clamp stand to the desk to prevent it falling
- Do not overload spring so it does not break and cause harm
- Energies involved are low due to low masses - but falling masses can still cause harm

Evaluation

- Finding time for 10 oscillations then dividing by 10 reduces the percentage uncertainty on each time
- Make the fiducial mark at the equilibrium position as the mass has the lowest acceleration at this point so it is the easiest to see
- Double uncertainty in time period due to T^2
- Springs in series: add spring constants
- Improvements: use Vernier motion tracker and data logger to find a more accurate value for time period - removes human error altogether and parallax error from fiducial mark