

# **Edexcel Physics IAL**

## Core Practical 16: Determine Unknown Masses Using Resonant Frequencies

### Practical Notes



## Core Practical 16: Determine the value of an unknown mass using the resonant frequencies of the oscillation of known masses

### Equipment

- Spring
- Slotted masses and mass hanger
- Clamp stand
- Stop clock
- Mass balance
- Unknown mass
- G-clamp
- Splint

### Method

1. Set up the clamp stand with the spring and mass hanger attached - clamp the stand to the desk using a G-clamp to secure it in place.
2. Attach a splint to the clamp stand at the springs equilibrium position - this is going to be used as a marker to improve the accuracy of your measurements.
3. Attach a mass onto the mass hanger, pull the spring down to a fixed position (marked using another splint) and then release the spring and measure the time taken for 10 oscillations.
4. Repeat the process three times for each mass, and calculate an average time period.
5. Repeat the above steps for a range of different known masses by adding an extra mass to the mass hanger each time.
6. Repeat the process with the unknown mass and calculate the average value for the time period, and square it to produce a  $t^2$  value.

### Calculations

- Plot a graph of  $t^2$  against mass and draw a line of best fit for the points.
- This should form a straight line, since  $t^2$  is proportional to mass:
  - $t^2 = m (k/4\pi^2)$
  - $k/4\pi^2$  is a constant and is equal to the gradient of your graph
- Your graph can then be used to read off the predicted mass for the  $t^2$  value of the unknown mass.



### Tips

- Ensure the spring returns to its original length once all masses are removed - if it doesn't it has undergone plastic deformation and the results may be invalid.
- One oscillation is the time it takes to pass from maximum displacement to minimum displacement and then back to maximum displacement.
- You can only estimate masses in the range of the plotted graph points - any masses outside this region will involve extrapolation and the result may be invalid.

### Safety Precautions

- Wear safety glasses in case the spring snaps.
- Avoid standing underneath the hanging masses in case they fall and cause injury.
- Ensure the clamp stand is securely clamped to the bench to prevent it tipping.

