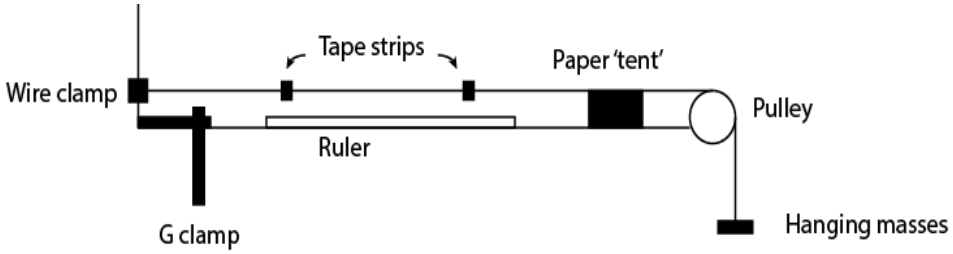
Edexcel Physics A Level

Core Practical 5

Determine the Young's Modulus of a Material

Method



- Using the micrometre screw gauge, measure the diameter of the wire (various points, 90° angles, make an average) – and hence find the radius, r, in mm and convert to metres
- Find cross sectional area, A, of wire in m^2:

$$A = \pi r^2$$

- Set up equipment as shown above; clamp wire such that it is taut
- Measure the distance between the two strips of paper tape; this is the original length, L
- Add 100g masses at a time, each time measuring the new distance between the paper tape
    - Calculate the force applied, F, as F = mass added x g
    - Calculate the extension, x, as x = new length – original length
- Repeat until the wire snaps
- Calculate stress and strain for each value of F and x:

$$Stress = \frac{F}{A}$$

$$\text{Strain} = \frac{x}{L}$$

- Plot stress (y-axis) against strain (x-axis), find gradient of straight line section to find Young Modulus

Safety

- Wire snaps and can recoil due to large amount of energy stored due to extension – wear safety glasses whenever wire is under tension
- Paper prevents wire from recoiling too much
- Place tray with carpet under the masses to catch the masses when the wire snaps and absorb energy upon impact with the floor
- Do not stand directly under the masses

Evaluation

- Use a large distance between the paper tape at the start, to reduce uncertainty
- Use a thick enough wire to ensure that a wide range of values is given before the wire fails (around 28SWG)
- Wait for necking to finish before taking final length measurements
- Area of the wire may not be constant so take several measures and find mean
- For more precise reading, use smaller masses
- Small extension hard to measure accurately; gives large percentage uncertainty
- use a reference marker to avoid parallax when measuring extension;