Determination of Young Modulus of a metal in the form of a wire

Specification reference: AS Unit 1. 5 — Solids under stress

THEORY

Young modulus $E = \frac{\text{stress}}{\text{strain}}$ or $E = \frac{F/A}{x/l}$ rearranging $E = \frac{Fl}{xA}$

F = applied load

A = area of cross-section of the wire

x = extension

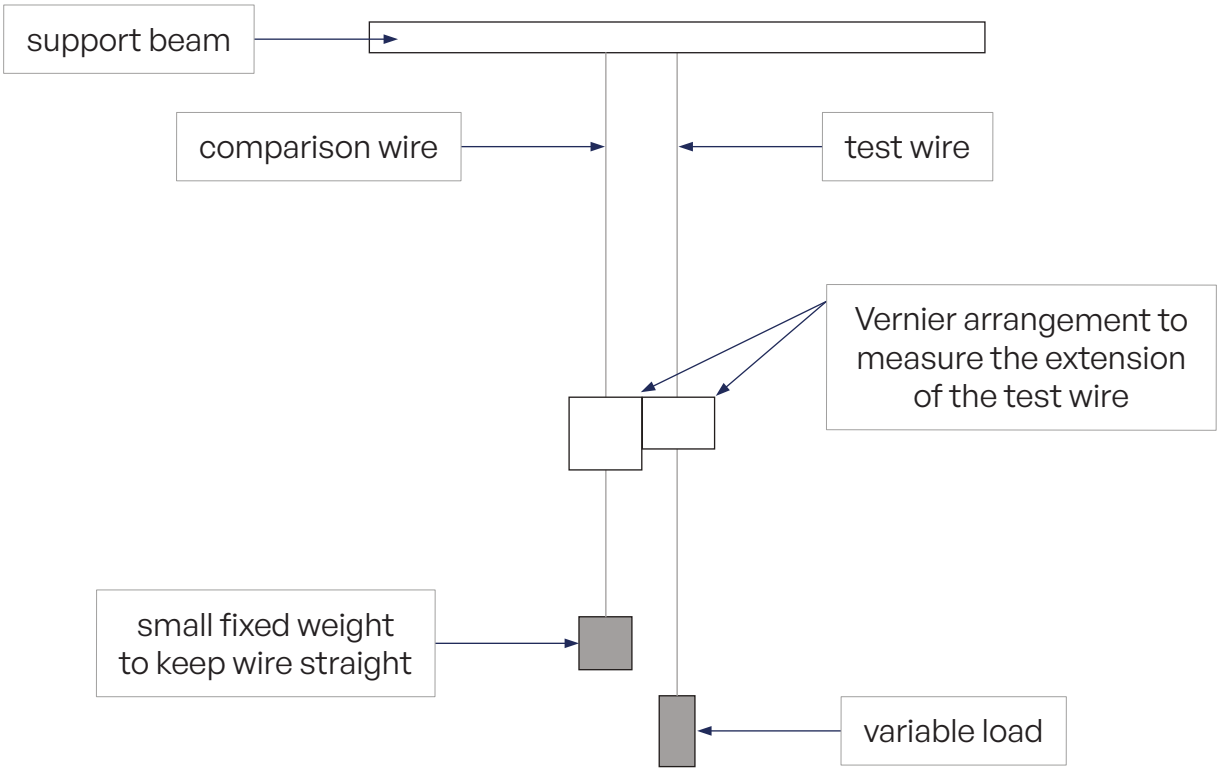
l = original length

If a graph of applied load, F (y-axis), is drawn against extension, x (x-axis), the gradient is $\frac{F}{x}$ and so:

$$E = \text{gradient} \times \frac{l}{A}$$

The original length l can be measured and the area of the wire found using $A = \pi r^2$ hence E can be determined.

APPARATUS



EXPERIMENTAL METHOD

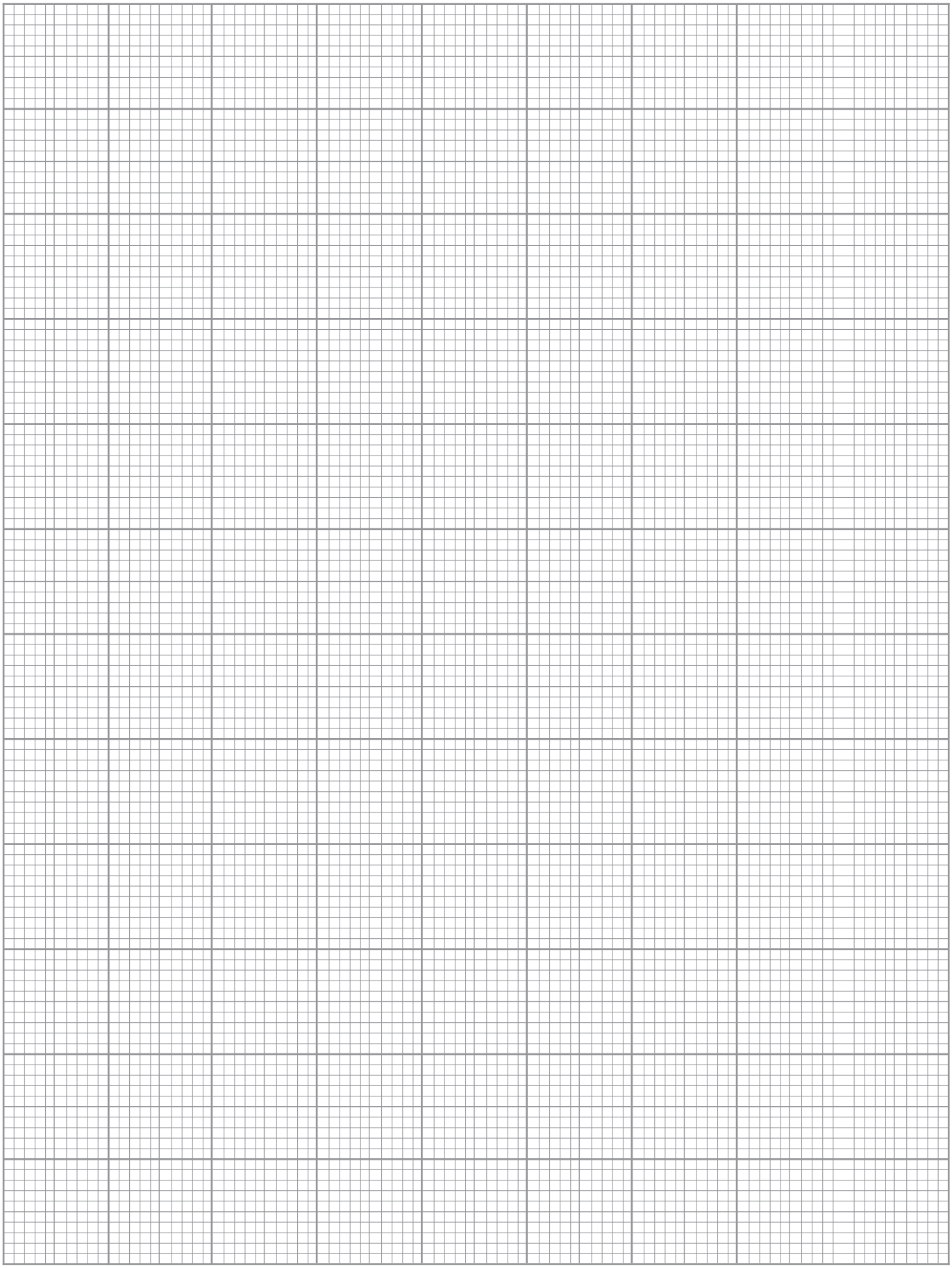
Hang two identical wires from a beam and attach a scale to the first wire and a small weight to keep it straight. Also put a small weight on the second wire to straighten it and a vernier scale linking with the scale on the comparison wire. Measure the original length, l, of the test wire and its diameter at various points along its length. Use this to calculate the mean cross-sectional area A.

Then place a load of 5 N on the test wire and find the extension, x. Repeat this in 5 N steps up to at least 50 N. Plot a graph of load (y-axis) against extension (x-axis) and calculate the gradient. Use this to find a value for the Young modulus.

SPACE FOR NOTES

TABLE OF RESULTS

GRAPH



QUESTIONS

1. How can the cross-sectional area of a thin wire be calculated?

2. What safety precautions should be taken when stretching thin wires?

3. Why should the temperature of the surroundings be kept constant when carrying out this experiment?

4. Suggest what has happened if the length of the wire doesn't return to its original length when unloaded.

DOWNLOADS

- Physics 3 2005 Q3
- Physics 6 2012 Experimental task
- Experiment Flashcards