Investigation of the force-extension relationship for rubber

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

THEORY

Rubber — an example of a polymer with weak cross bonds. Natural rubber is a polymer of the molecule iso-prene. It has weak van der Waals cross-bonds and only a few covalent (strong) cross-bonds.

APPARATUS

- Clamp and stand
- Metre rule (resolution ± 0.001 m)
- Optical pin (for use as a pointer if required)
- Rubber band of cross-section approximately 1 mm by 2 mm
- G-clamp to secure (if required)
- Micrometer (resolution ± 0.01 mm)
- 50 g mass holder plus a number of 50 g masses

EXPERIMENTAL METHOD

Hang a (cut) rubber band of (approximate) cross-section 1 mm by 2 mm vertically from a stand, boss and clamp. The base of the stand should be secured using a G-clamp. Hang a 50 gram mass holder from the band. Place a metre rule as close as possible to the mass holder. The length can be read using an optical pin attached to the base of the mass holder.

Measure the length, width and thickness of the rubber when it is supporting the 50 gram holder. Try to avoid squashing the rubber with the micrometer screw gauge.

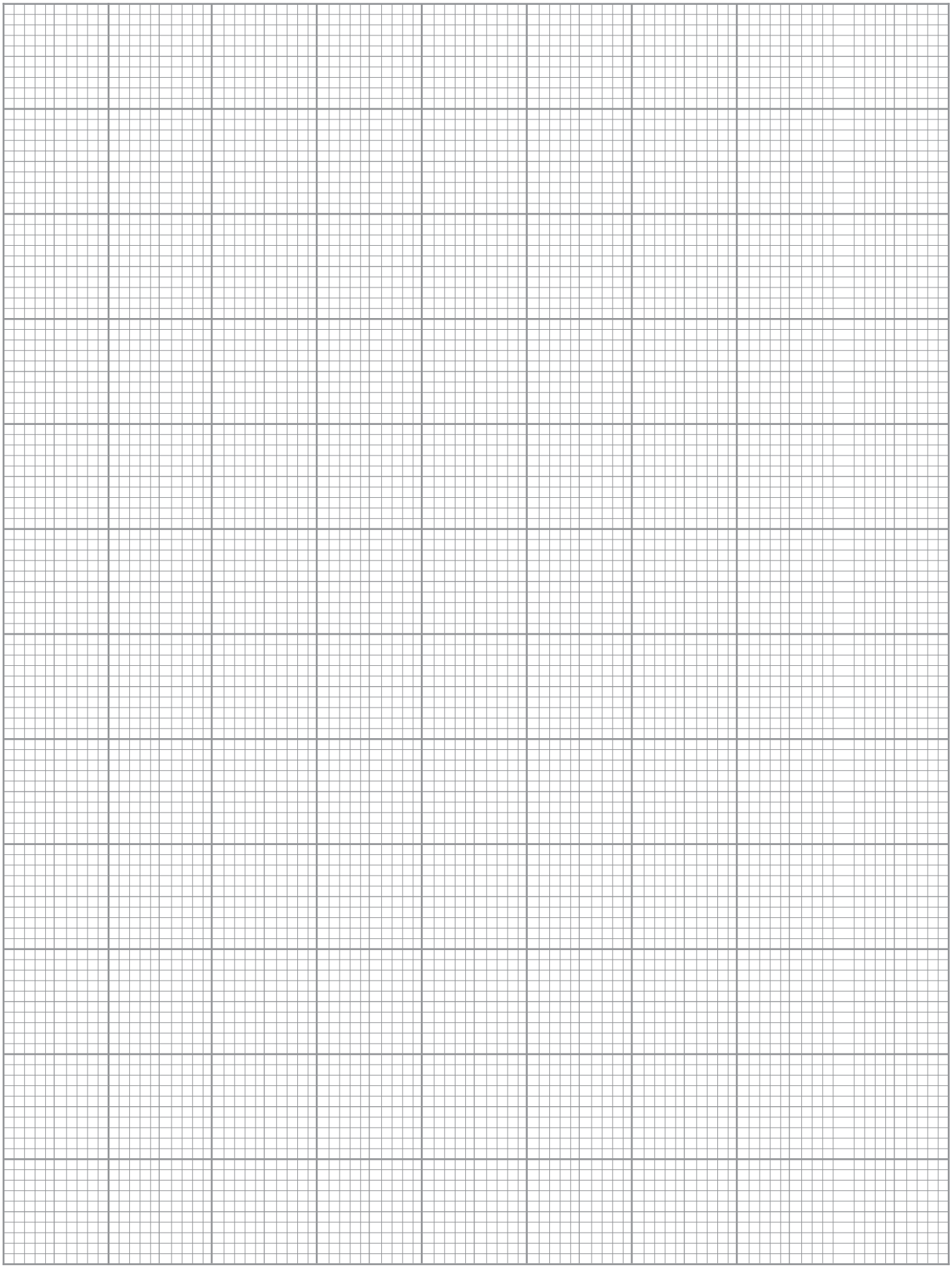
Increase the mass in 50 gram steps, measuring the extension each time. Continue until the band breaks.

Plot the force–extension curve and determine the Young modulus from the linear section.

SPACE FOR NOTES

TABLE OF RESULTS

GRAPH



QUESTIONS

1. Why is it important that the rubber band used has an appropriate width and thickness?

2. What safety precautions should be taken when using hanging masses?

3. What safety precautions should be taken to ensure the apparatus doesn't fall over?

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