

- 3 (a) State Hooke's law.

[1]

- (b) The variation of the applied force with the extension for a sample of a material is shown in Fig. 3.1.

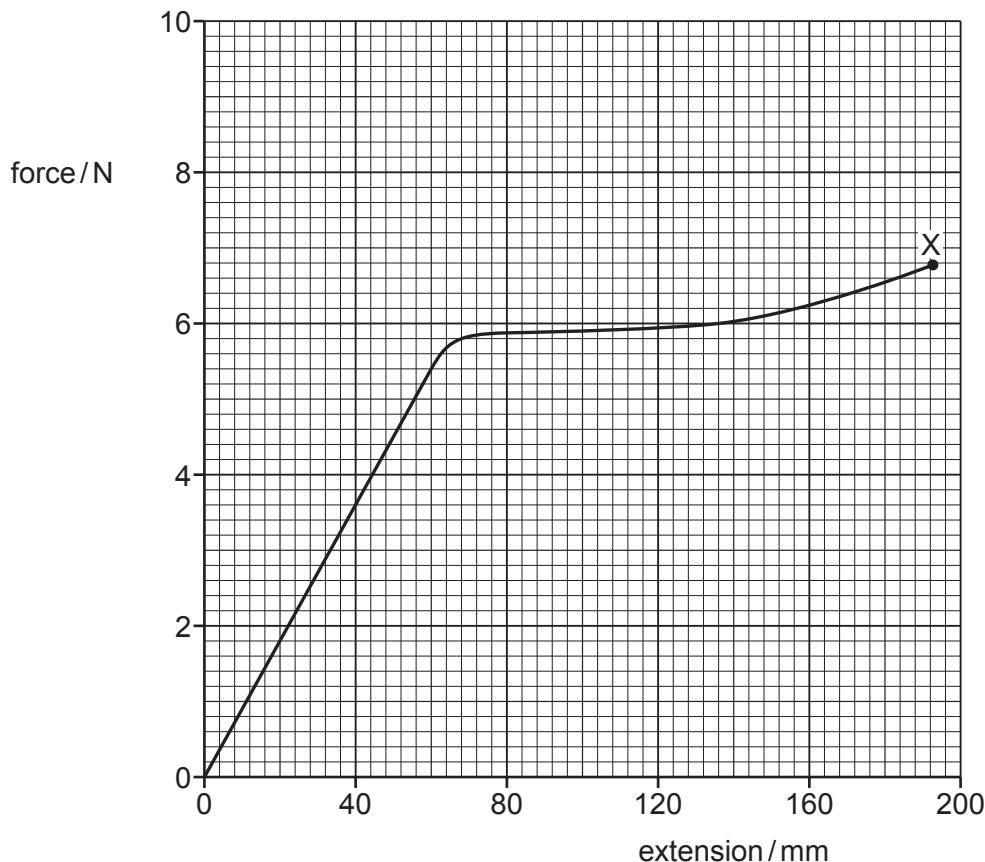


Fig. 3.1

The sample behaves elastically up to an extension of 80 mm and breaks at point X.

- (i) On the line in Fig. 3.1, draw a cross (x) to show the limit of proportionality. Label this cross with the letter P. [1]
- (ii) On the line in Fig. 3.1, draw a cross (x) to show the elastic limit. Label this cross with the letter E. [1]

- (c) The sample in (b) has a cross-sectional area of 0.40 mm^2 and an initial length of 3.2 m .

For deformations within the limit of proportionality of the sample, determine:

- (i) the spring constant of the sample

$$\text{spring constant} = \dots \text{ N m}^{-1} [2]$$

- (ii) the Young modulus of the material from which the sample is made.

$$\text{Young modulus} = \dots \text{ Pa} [3]$$

- (d) Determine an estimate of the work done on the sample as it is extended from zero extension to its breaking point. Explain your reasoning.

$$\text{work done} = \dots \text{ J} [2]$$

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- (e) A second sample of the same material has a larger cross-sectional area than the original sample but the same initial length. The two samples are each deformed with the limit of proportionality.

State and explain qualitatively how the spring constant of the second sample compares with that of the original sample.

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[2]

[Total: 12]