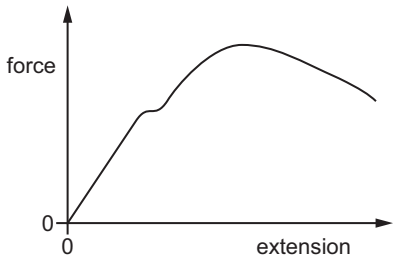
21 The force–extension graph for a metal wire is shown.



Which quantity is represented by the area under the graph?

A power transferred to the wire

B temperature increase in the wire

C time taken for the wire to extend

D work done on the wire

22 A wire of length L_0 is attached at one end to a fixed point. A tensile force is applied to the other end so that the wire extends and has a new length L_1.

What is the strain of the wire?

A $\left(\frac{L_1}{L_0}\right) - 1$ **B** $L_1 - L_0$ **C** $\left(\frac{L_1}{L_0}\right) + 1$ **D** $L_1 + L_0$

17 What is the definition of strain?

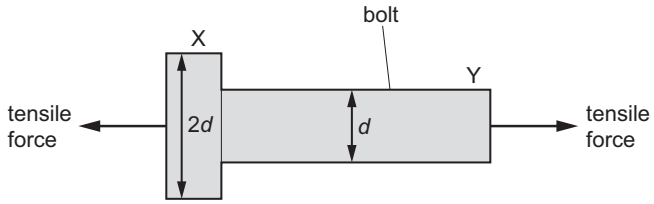
A extension per unit cross-sectional area

B extension per unit original length

C force per unit cross-sectional area

D force per unit extension

20 A bolt is subjected to a tensile force, as shown.

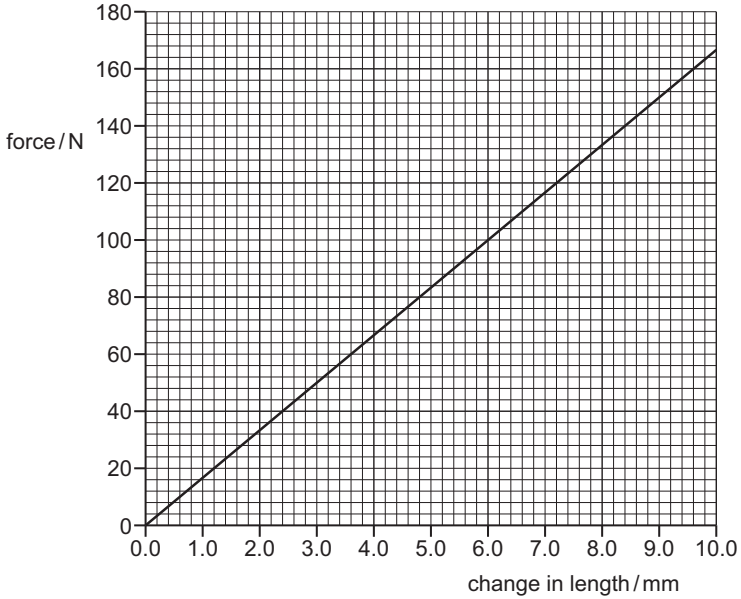


The bolt has a circular cross-section. At end X, the diameter is $2d$. At end Y, the diameter is d.

What is the ratio $\frac{\text{stress at Y}}{\text{stress at X}}$?

A 0.25 **B** 0.50 **C** 2.0 **D** 4.0

21 The graph shows the relationship between force acting on a compression spring and change in length of the spring.



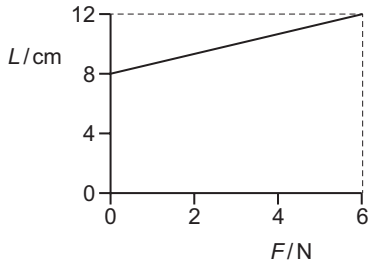
One of these springs is placed in each corner of a horizontal square plate. The axis of each spring is in a vertical direction. These four springs support a total load of 160 N.

What is the total elastic potential energy stored in the four springs?

A 0.048 J **B** 0.19 J **C** 0.38 J **D** 0.77 J

20 A spring is fixed at one end. The length L of the spring is increased by applying a tensile force F to the other end.

The graph shows the variation of L with F.



What is the elastic potential energy of the spring when F is 6.0 N?

A 0.12 J **B** 0.24 J **C** 0.36 J **D** 0.60 J

21 A wire has an unstretched length of 2.00 m.

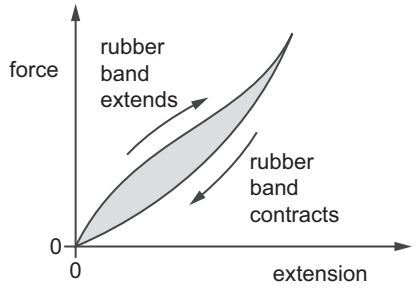
A stress of 1.6×10^5 Pa is applied to the wire, and the new length of the wire is 2.10 m.

The wire obeys Hooke's law.

What is the Young modulus of the wire?

A 8.0×10^3 Pa **B** 7.8×10^4 Pa **C** 1.5×10^5 Pa **D** 3.2×10^6 Pa

23 The diagram shows a force–extension graph for a rubber band as the band is extended and then the stretching force is decreased to zero.



What can be deduced from the graph?

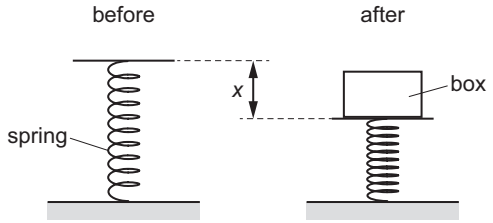
A The rubber band does **not** return to its original length when the force is decreased to zero.

B The rubber band obeys Hooke's law for the extensions shown.

C The rubber band remains elastic for the extensions shown.

D The shaded area represents the work done in extending the rubber band.

21 A platform is supported by a spring. A box is placed onto the platform. The diagram shows the spring before and after the box is placed onto it.



What is the term for the quantity marked as x?

A compression

B load

C strain

D stress

22 A copper wire has length 1.7 m and uniform diameter 0.64 mm.

The Young modulus of copper is 1.2×10^{11} Pa.

What is the spring constant of the wire?

A $2.3 \times 10^{4}\,\text{N m}^{-1}$

B $9.1 \times 10^{4}\,\text{N m}^{-1}$

C $4.5 \times 10^{7}\,\text{N m}^{-1}$

D $7.1 \times 10^{7}\,\text{N m}^{-1}$