2 The tension in a 1.0 m wire varies with extension as shown in Fig. 2.1.

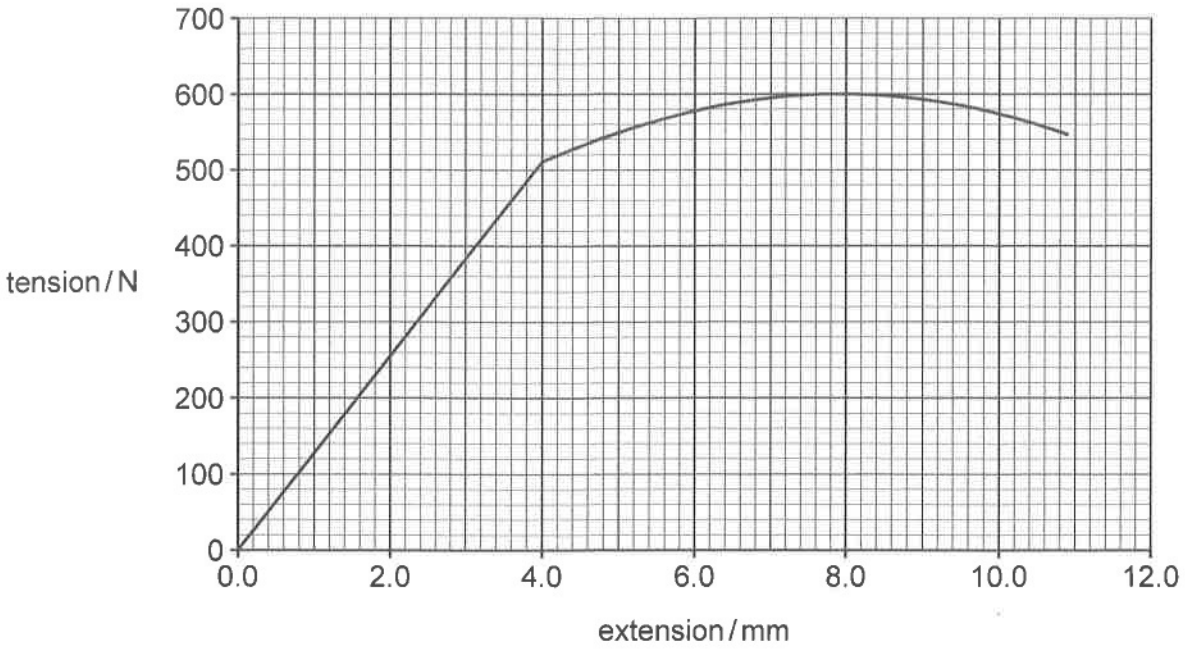

Fig. 2.1

(a) In the region where the wire obeys Hooke's law, calculate the force constant of the wire.

force constant = ... unit ..... [3]

(b) (i) Determine the work done in extending the wire to an extension of 4.0 mm.

work done = ... J [2]

(ii) State where this energy is now stored.

.....

.....

..... [1]

(c) A longer wire of the same material and thickness is used to make a cable for a crane. The cable is 120 m long.

(i) The force constant is inversely proportional to the length of the wire. Calculate the ratio:

$$\frac{\text{force constant of a single 120 m wire}}{\text{force constant of a single 1.0 m wire}}.$$

ratio = ... [1]

(ii) Ten wires which are each 120 m long are used, parallel to each other, to form the cable. For a cable of 10 wires, the load is equally distributed amongst the 10 wires.

Calculate the ratio:

$$\frac{\text{force constant of a 120 m cable}}{\text{force constant of a single 120 m wire}}.$$

ratio = ... [1]

(iii) Explain, in terms of the tension and extension, why a cable made of ten 120 m wires is used rather than a single 120 m wire.

.....

.....

..... [2]

[Total: 10]