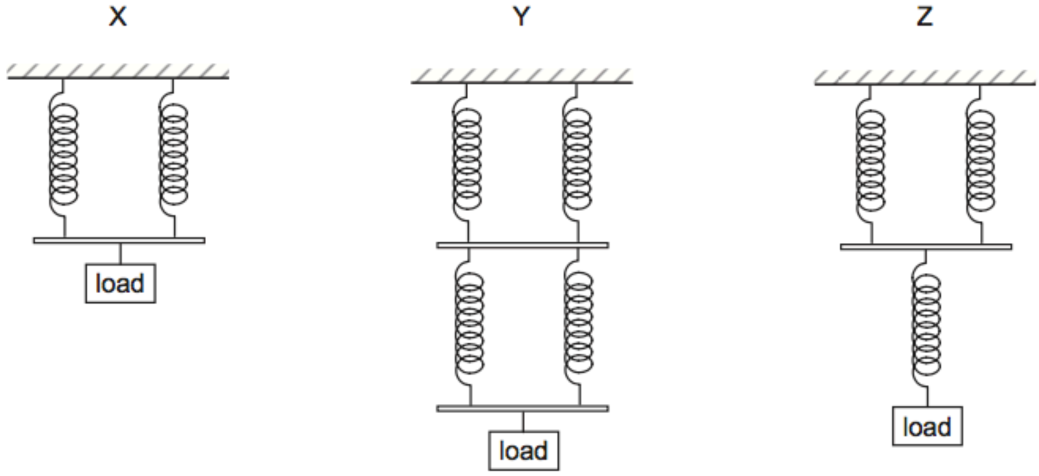
1)

A number of similar springs, each having the same spring constant, are joined in three arrangements X, Y and Z. The same load is applied to each.

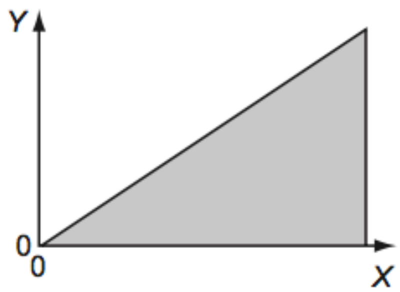


What is the order of increasing extension for these arrangements?

	smallest	→	largest
A	X	Y	Z
B	Z	X	Y
C	Z	Y	X
D	Y	X	Z

2)

The graph shown was plotted in an experiment on a metal wire.



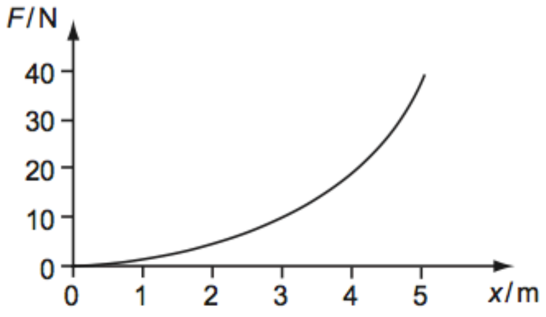
The shaded area represents the total strain energy stored in stretching the wire.

How should the axes be labelled?

	Y	*X*
A	force	extension
B	mass	extension
C	strain	energy
D	stress	strain

3)

The force F required to extend a sample of rubber by a distance x is found to vary as shown.



The energy stored in the rubber for an extension of 5 m is

A less than 100 J.

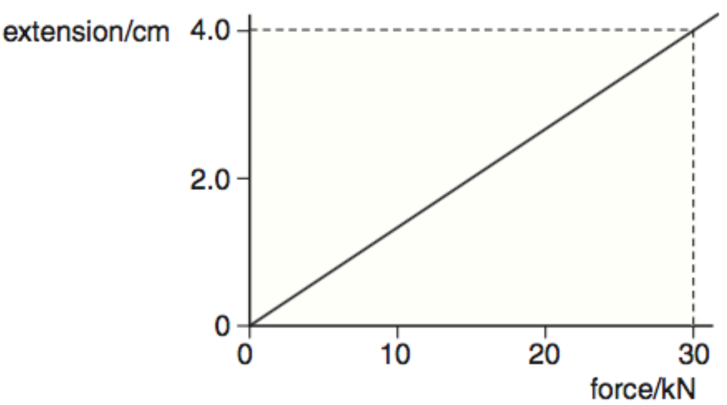
B 100 J.

C between 100 J and 200 J.

D more than 200 J.

4)

The graph shows how the extension of a spring varies with the force used to stretch it.



What is the strain energy stored in the spring when the extension is 4.0 cm?

A 60 J **B** 120 J **C** 600 J **D** 1200 J

5)

Two springs P and Q both obey Hooke's law. They have spring constants $2k$ and k respectively.

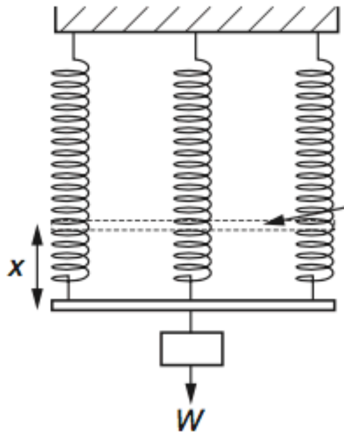
The springs are stretched, separately, by a force that is gradually increased from zero up to a certain maximum value, the same for each spring. The work done in stretching spring P is W_P, and the work done in stretching spring Q is W_Q.

How is W_P related to W_Q?

A $W_P = \frac{1}{4}W_Q$ **B** $W_P = \frac{1}{2}W_Q$ **C** $W_P = 2W_Q$ **D** $W_P = 4W_Q$

6)

A beam, the weight of which may be neglected, is supported by three identical springs. When a weight W is hung from the middle of the beam, the extension of each spring is x.



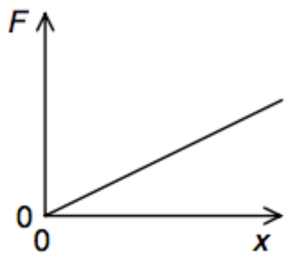
The middle spring and the weight are removed.

What is the extension when a weight of $2W$ is hung from the middle of the beam?

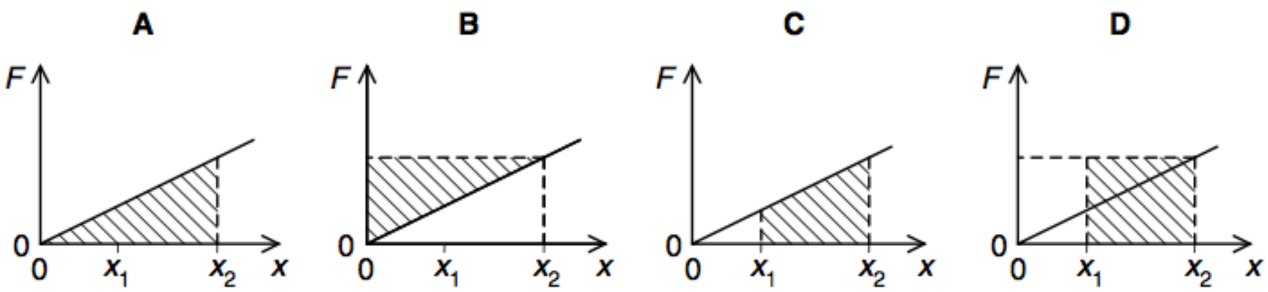
A $\frac{3x}{2}$ **B** $\frac{4x}{3}$ **C** $2x$ **D** $3x$

7)

The variation of the extension x of a spring with applied force F is shown.

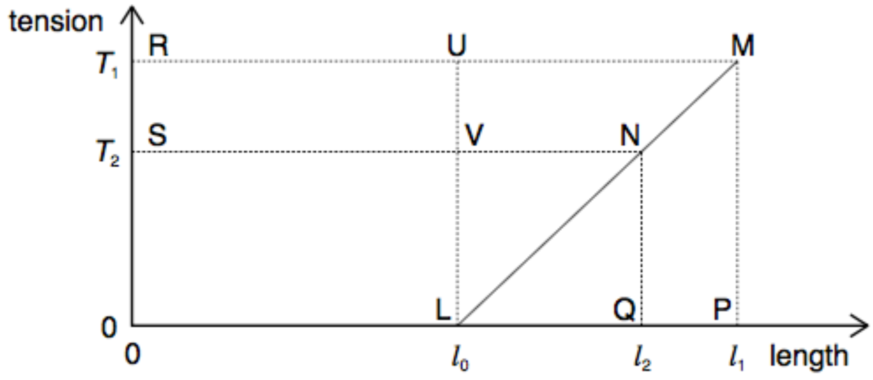


Which shaded area represents the work done when the extension is increased from x_1 to x_2?



8)

The tension in a spring of natural length l_0 is first increased from zero to T_1, causing the length to increase to l_1. The tension is then reduced to T_2, causing the length to decrease to l_2 (as shown).



Which area of the graph represents the work done by the spring during this reduction in length?

A MLP **B** MNQP **C** MNSR **D** MPLU

9)

A spring having spring constant k hangs vertically from a fixed point. A load of weight L, when hung from the spring, causes an extension e. The elastic limit of the spring is not exceeded.

(a) State

(i) what is meant by an *elastic deformation*,

....

....

.... [2]

(ii) the relation between k, L and e.

.... [1]

(b) Some identical springs, each with spring constant *k*, are arranged as shown in Fig. 4.1.

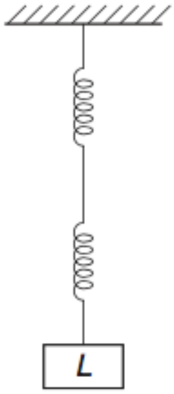
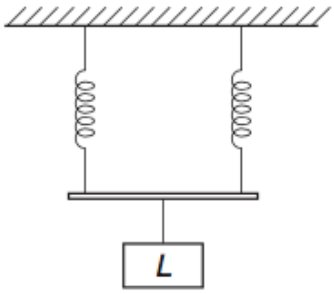
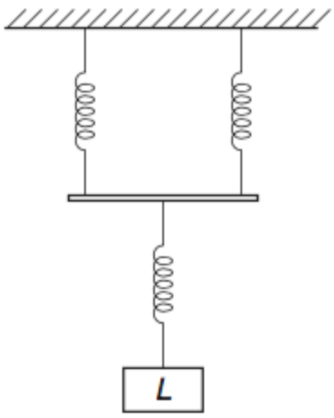
arrangement	total extension	spring constant of arrangement
	....	....
	....	....
	....	....

Fig. 4.1

The load on each of the arrangements is *L*.

For each arrangement in Fig. 4.1, complete the table by determining

(i) the total extension in terms of *e*,

(ii) the spring constant in terms of *k*.

[5]

10)

A spring is placed on a flat surface and different weights are placed on it, as shown in Fig. 2.1.

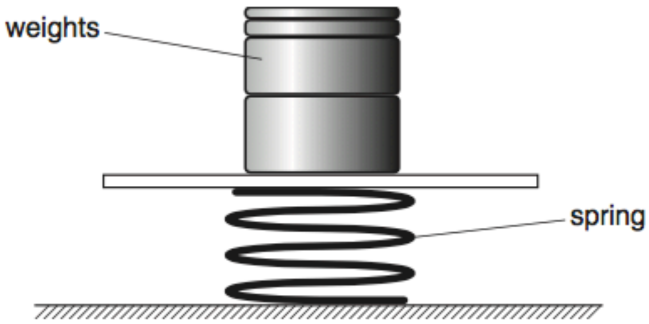


Fig. 2.1

The variation with weight of the compression of the spring is shown in Fig. 2.2.

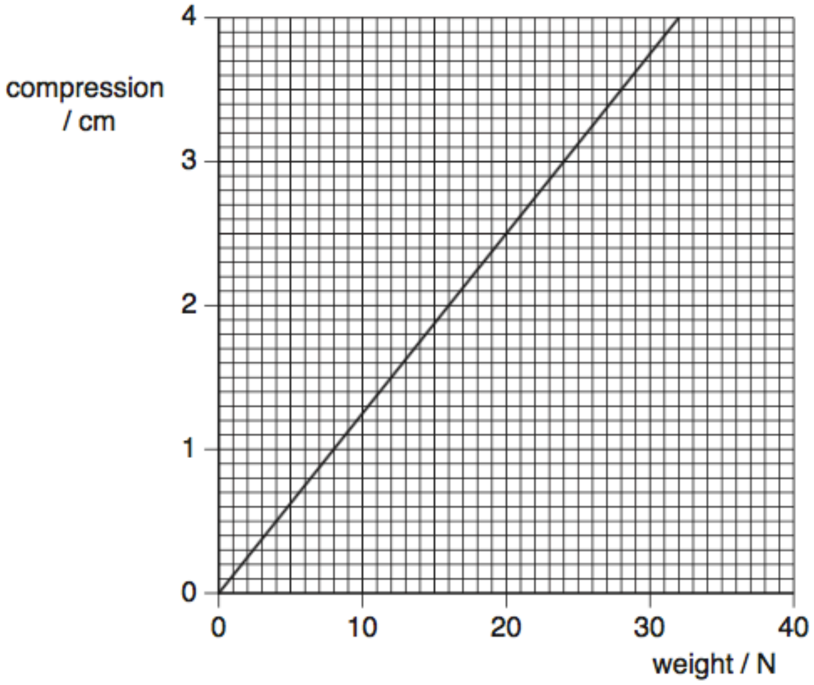


Fig. 2.2

The elastic limit of the spring has not been exceeded.

(a) **(i)** Determine the spring constant *k* of the spring.

k = ... $N m^{-1}$ [2]

(ii) Deduce that the strain energy stored in the spring is 0.49 J for a compression of 3.5 cm.

[2]

(b) Two trolleys, of masses 800 g and 2400 g, are free to move on a horizontal table. The spring in **(a)** is placed between the trolleys and the trolleys are tied together using thread so that the compression of the spring is 3.5 cm, as shown in Fig. 2.3.

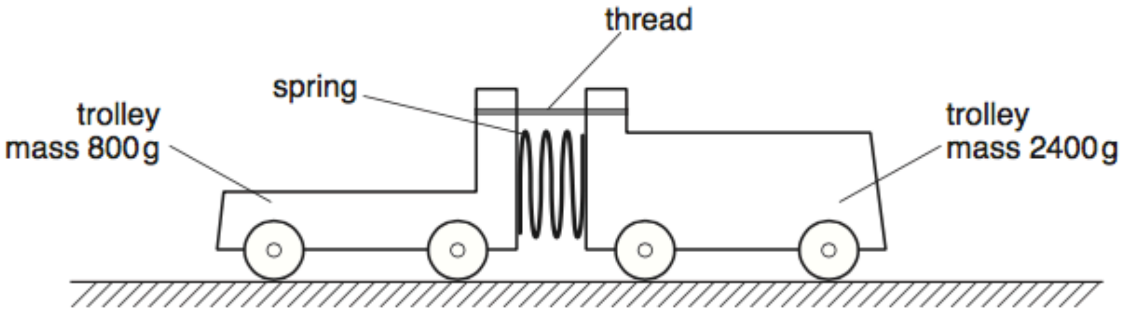


Fig. 2.3

Initially, the trolleys are not moving.
The thread is then cut and the trolleys move apart.

(i) Deduce that the ratio

$$\frac{\text{speed of trolley of mass 800 g}}{\text{speed of trolley of mass 2400 g}}$$

is equal to 3.0.

[2]

(ii) Use the answers in **(a)(ii)** and **(b)(i)** to calculate the speed of the trolley of mass 800 g.

speed = ... $m\,s^{-1}$ [3]