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

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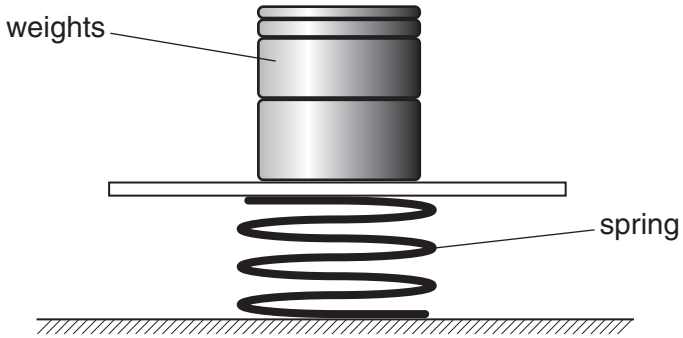

Fig. 2.1

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

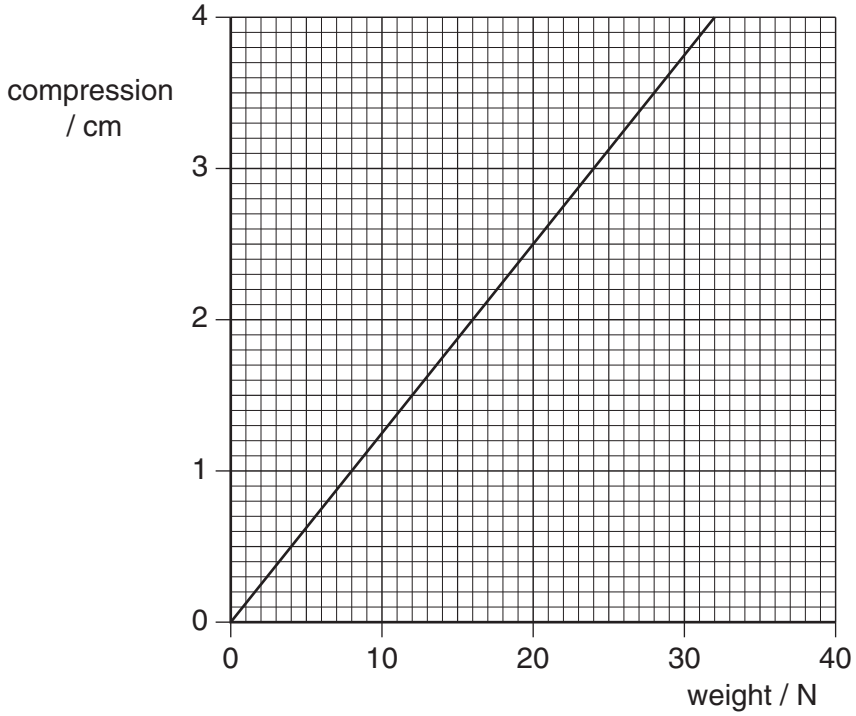

Fig. 2.2

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.

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[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.

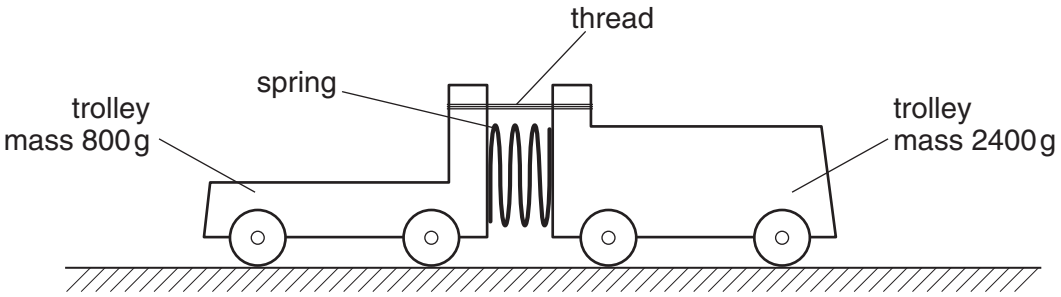

Fig. 2.3

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.

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