

- 3 A spring is extended by a force. The variation with extension  $x$  of the force  $F$  is shown in Fig. 3.1.

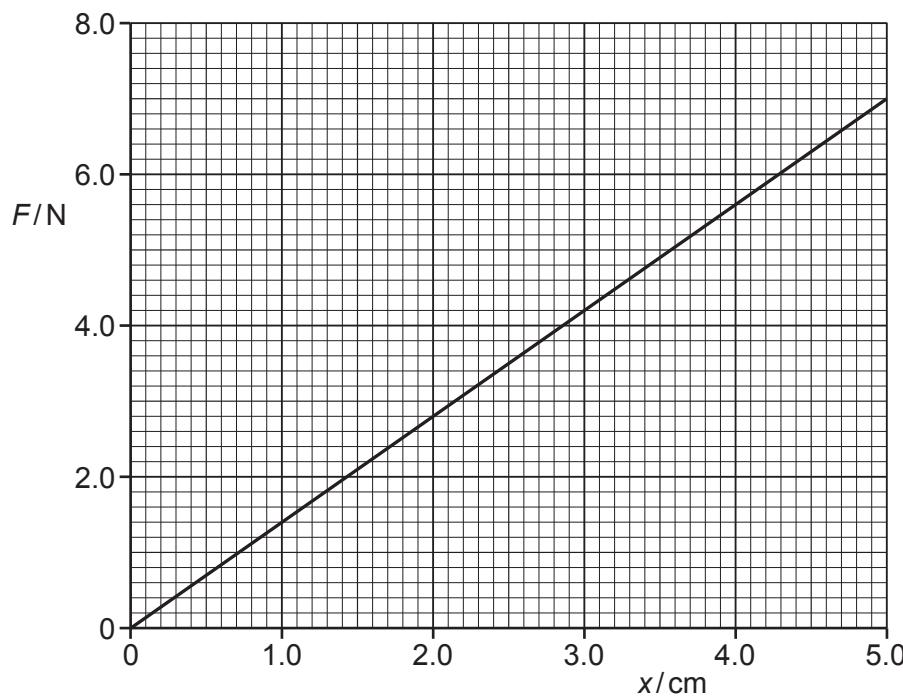


Fig. 3.1

- (a) State the name of the law that relates the force and extension of the spring shown in Fig. 3.1.

..... [1]

- (b) Determine:

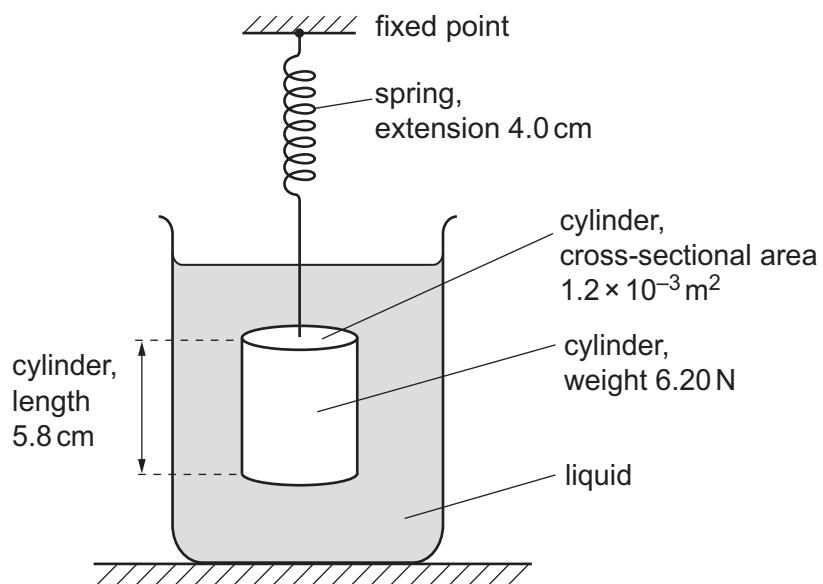
- (i) the spring constant, in  $\text{Nm}^{-1}$ , of the spring

spring constant = .....  $\text{Nm}^{-1}$  [2]

- (ii) the strain energy (elastic potential energy) in the spring when the extension is 4.0 cm.

strain energy = ..... J [2]

- (c) One end of the spring is attached to a fixed point. A cylinder that is submerged in a liquid is now suspended from the other end of the spring, as shown in Fig. 3.2.



**Fig. 3.2**

The cylinder has length 5.8 cm, cross-sectional area  $1.2 \times 10^{-3} \text{ m}^2$  and weight 6.20 N. The cylinder is in equilibrium when the extension of the spring is 4.0 cm.

- (i) Show that the upthrust acting on the cylinder is 0.60 N.

[1]

- (ii) Calculate the difference in pressure between the bottom face and the top face of the cylinder.

difference in pressure = ..... Pa [2]

- (iii) Calculate the density of the liquid.

$$\text{density} = \dots \text{ kg m}^{-3} \quad [2]$$

- (d) The liquid in (c) is replaced by another liquid of greater density.

State the effect, if any, of this change on:

- (i) the upthrust acting on the cylinder

..... [1]

- (ii) the extension of the spring.

..... [1]