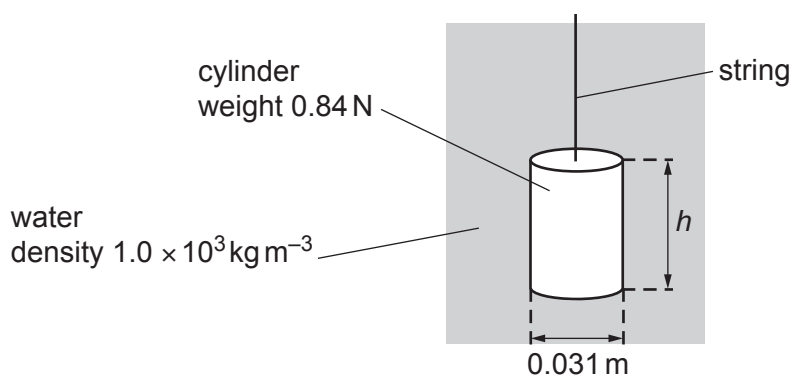


- 2 (a) A cylinder is suspended from the end of a string. The cylinder is stationary in water with the axis of the cylinder vertical, as shown in Fig. 2.1.



**Fig. 2.1** (not to scale)

The cylinder has weight  $0.84 \text{ N}$ , height  $h$  and a circular cross-section of diameter  $0.031 \text{ m}$ . The density of the water is  $1.0 \times 10^3 \text{ kg m}^{-3}$ . The difference between the pressures on the top and bottom faces of the cylinder is  $520 \text{ Pa}$ .

- (i) Calculate the height  $h$  of the cylinder.

$h = \dots\dots\dots \text{ m}$  [2]

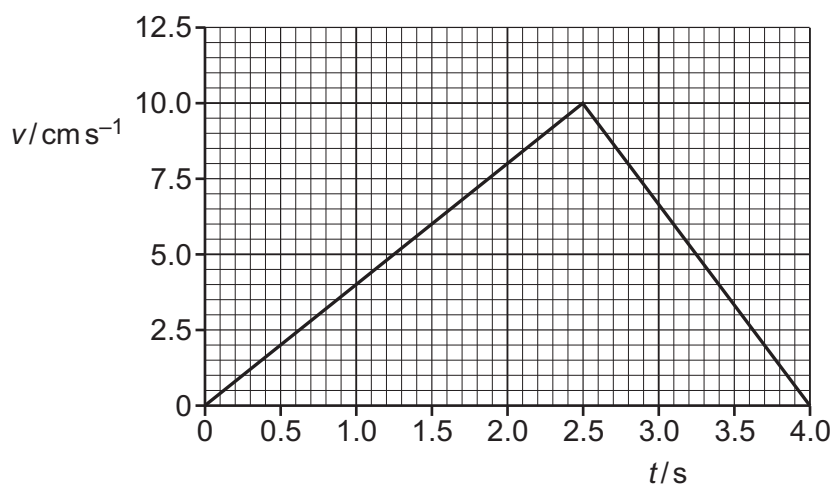
- (ii) Show that the upthrust acting on the cylinder is  $0.39 \text{ N}$ .

[2]

- (iii) Calculate the tension  $T$  in the string.

$T = \dots\dots\dots \text{ N}$  [1]

- (b) The string is now used to move the cylinder in (a) vertically upwards through the water. The variation with time  $t$  of the velocity  $v$  of the cylinder is shown in Fig. 2.2.



**Fig. 2.2**

- (i) Fig. 2.2 to determine the acceleration of the cylinder at time  $t = 2.0$  s.

acceleration = .....  $\text{ms}^{-2}$  [2]

- (ii) The top face of the cylinder is at a depth of 0.32 m below the surface of the water at time  $t = 0$ .

Fig. 2.2 to determine the depth of the top face below the surface of the water at time  $t = 4.0$  s.

depth = ..... m [2]

(c) The cylinder in (b) is released from the string at time  $t = 4.0\text{ s}$ . The cylinder falls, from rest, vertically downwards through the water. Assume that the upthrust acting on the cylinder remains constant as it falls.

(i) State the name of the force that acts on the cylinder when it is moving and does not act on the cylinder when it is stationary.

..... [1]

(ii) State and explain the variation, if any, of the acceleration of the cylinder as it falls downwards through the water.

.....

.....

..... [2]

[Total: 12]