

- 1 A hollow tube contains some sand. When placed in a liquid, the tube floats upright as shown in Fig. 1.1.

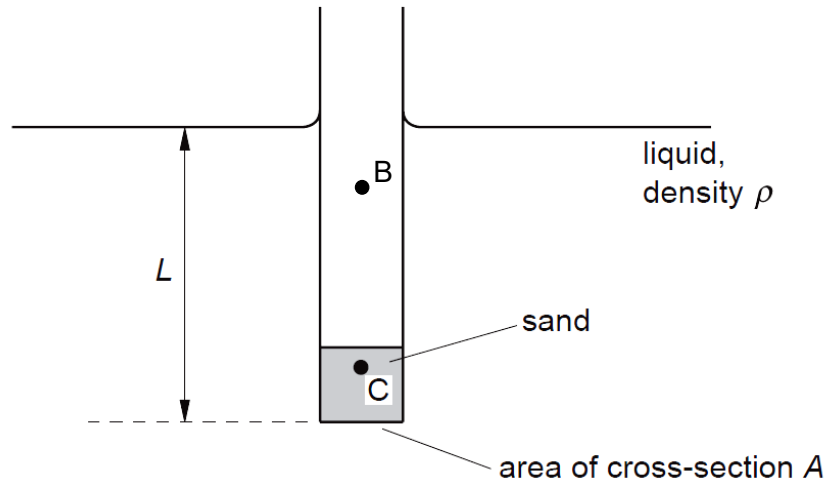


Fig. 1.1

The centre of mass of the tube and the sand is at C.

The centre of buoyancy of the tube, which is the point at which upthrust on the tube may be considered to act, is at B.

- (a) On Fig. 1.1, draw labelled arrows to represent the forces acting on the system of the tube and the sand. [1]
- (b) When placed in water of density  $0.99 \text{ g cm}^{-3}$ , the length  $L$  is  $12.1 \text{ cm}$ . The tube is then transferred to a liquid of density  $1.11 \text{ g cm}^{-3}$ . Calculate the change in the submerged length.

change in length = .....cm [3]

- (c) (i) Explain why, when the tube is tilted at a small angle, it returns to the upright position.

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..... [1]

- (ii) The tube is now displaced vertically and then released. It undergoes vertical oscillations.

Describe the restoring force that gives rise to the oscillations.

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..... [2]

[Total: 7]

