

- 3 A cylindrical tube, containing some sand, floats upright in a liquid of density ρ , as shown in Fig. 3.1.

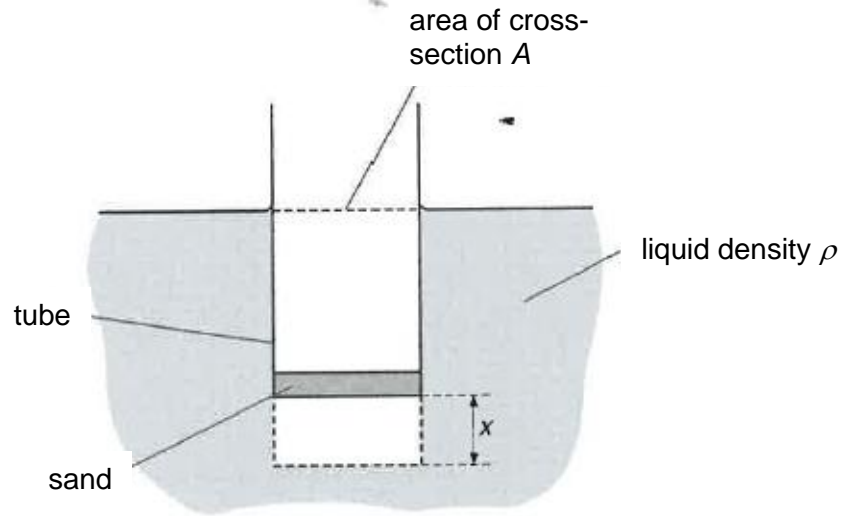


Fig. 3.1

The tube has a uniform cross-sectional area A . The total mass of the tube and sand is M .

The tube is displaced vertically downwards and then released. The tube oscillates vertically.

For a displacement x , the acceleration a of the tube is given by the expression

$$a = - \left(\frac{\rho A g}{M} \right) x$$

where g is the acceleration of free fall.

- (a) Explain why the expression leads to the conclusion that the tube is performing simple harmonic motion.

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..... [3]

- (b) The mass M of the tube and sand is 130 g. The area of cross-section A of the tube is 5.3 cm^2 . Calculate the frequency of oscillation of the tube when floating in a liquid of density ρ of $1.2 \times 10^3 \text{ kg m}^{-3}$.

frequency = Hz [2]