3 A tube, closed at one end, has a uniform area of cross-section. The tube contains some sand so that the tube floats upright in a liquid, as shown in Fig. 3.1.

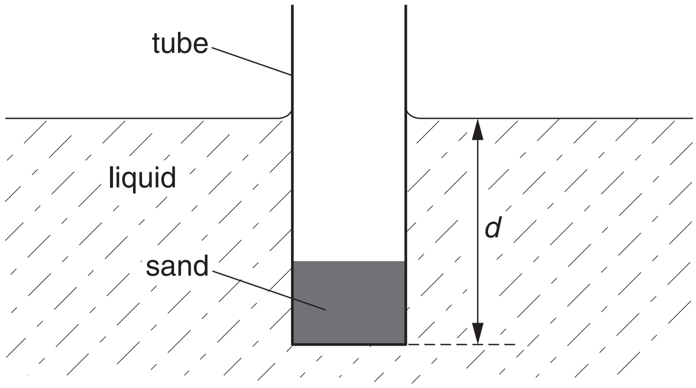

Fig. 3.1

When the tube is at rest, the depth d of immersion of the base of the tube is 16 cm.
The tube is displaced vertically and then released.
The variation with time t of the depth d of the base of the tube is shown in Fig. 3.2.

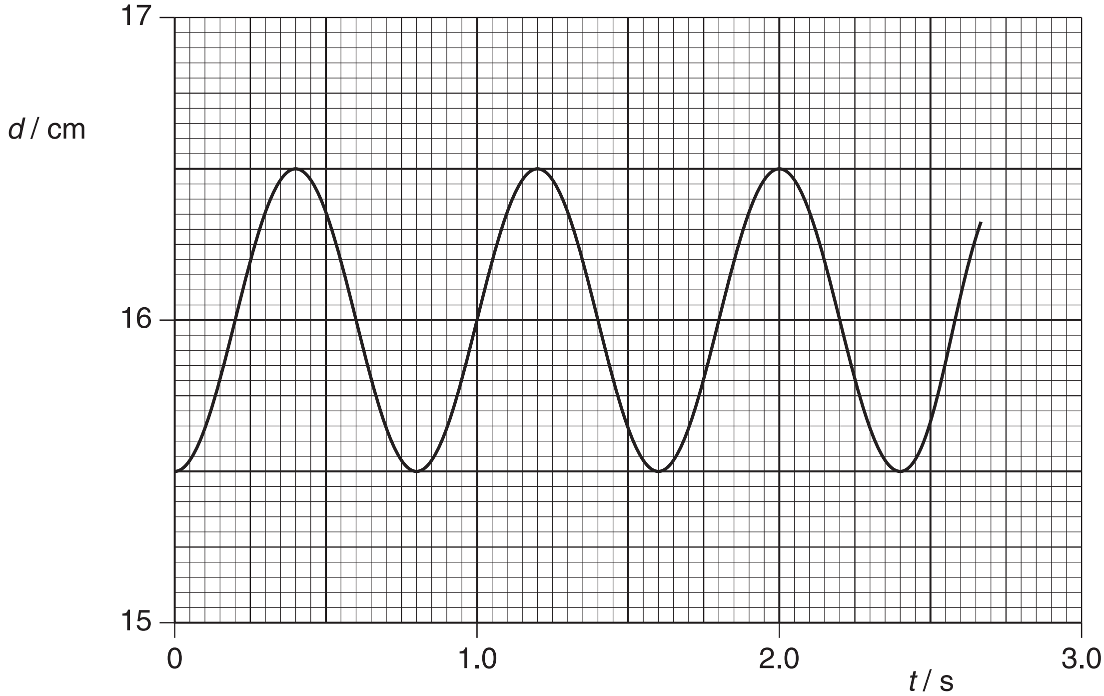

Fig. 3.2

(a) Use Fig. 3.2 to determine, for the oscillations of the tube,

(i) the amplitude,

amplitude = ... cm [1]

(ii) the period.

period = ... s [1]

For Examiner's Use

(b) (i) Calculate the vertical speed of the tube at a point where the depth d is 16.2 cm.

speed = ... cm s^{-1} [3]

(ii) State **one** other depth d where the speed will be equal to that calculated in **(i)**.

d = ... cm [1]

(c) (i) Explain what is meant by *damping*.

....

....

....

....[2]

(ii) The liquid in **(b)** is now cooled so that, although the density is unchanged, there is friction between the liquid and the tube as it oscillates. Having been displaced, the tube completes approximately 10 oscillations before coming to rest.
On Fig. 3.2, draw a line to show the variation with time t of depth d for the first 2.5 s of the motion. [3]