

- 3 A sphere of radius 2.1 mm falls with terminal velocity through a liquid, as shown in Fig. 3.1.

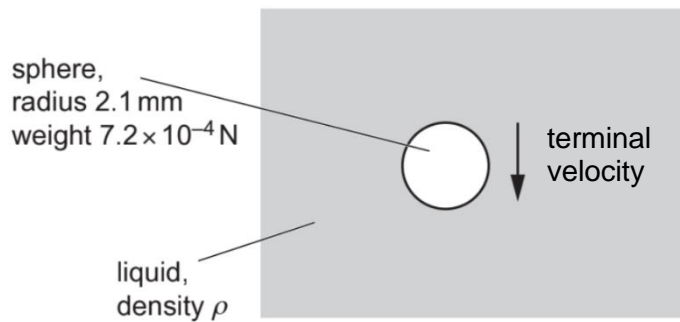


Fig. 3.1

Three forces act on the moving sphere. The weight, W , of the sphere is 7.2×10^{-4} N and the upthrust, U , acting, on it is 4.8×10^{-4} N. The viscous force, F_V , acting on the sphere is given by

$$F_V = krv$$

where r is the radius of the sphere, v is its velocity and k is a constant. The value of k is $17 \text{ kg m}^{-1} \text{ s}^{-1}$.

- (a) Calculate the density ρ of the liquid.

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

- (b) (i) On the sphere in Fig. 3.1, draw three arrows to show the weight, the upthrust and the viscous force. Label these arrows W , U and F_V respectively. [1]
- (ii) Determine the magnitude of the terminal velocity of the sphere.