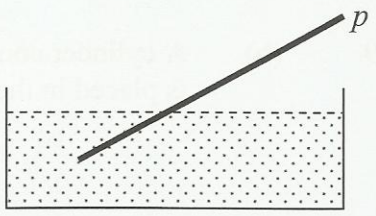
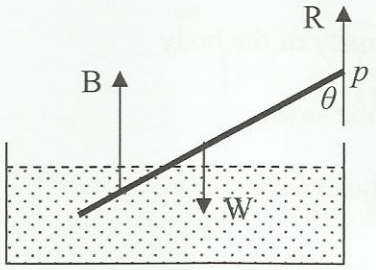
2008 **9.** **(a)** A uniform rod, of length 2 m and relative density $\frac{7}{9}$, is pivoted at one end p and is free to move about a horizontal axis through p. The other end of the rod is immersed in water.



The rod is in equilibrium and is inclined to the vertical as shown in the diagram.

Find the length of the immersed part of the rod.



Let the length of immersed part = ℓ

$$B = \frac{\frac{\ell}{2}W}{\frac{7}{9}} \text{ or } \frac{9\ell W}{14} \qquad 5$$

$$B\left(2-\frac{\ell}{2}\right)\sin\theta = W(1)\sin\theta \qquad 5$$

$$\frac{9\ell W}{14}\left(2-\frac{\ell}{2}\right) = W$$

$$9\ell^2 - 36\ell + 28 = 0$$

$$\Rightarrow \ell = 1.06 \text{ m.} \qquad 5$$

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