9 **(b)** A uniform rod, of length 1.5 m and weight W, is freely hinged at a point P.
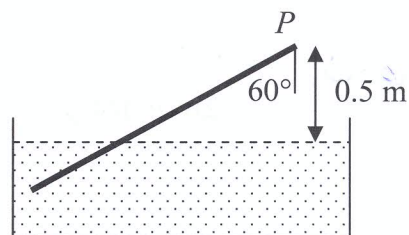
The rod is free to move about a horizontal axis through P.
The other end of the rod is immersed in water.

The point P is 0.5 m above the surface of the water.

The rod is in equilibrium and is inclined at an angle of 60° to the vertical.

Find **(i)** the relative density of the rod

(ii) the reaction at the hinge in terms of W.

(i) length of immersed part $= x$

$$(1.5 - x)\cos 60 = \frac{1}{2}$$

$$\Rightarrow x = \frac{1}{2}$$

moments about P :

$$B\left(\frac{5}{4}\right)\sin 60 = W\left(\frac{3}{4}\right)\sin 60$$

and $$B = \frac{\frac{1}{3}W(1)}{s} = \frac{W}{3s}$$

$$\frac{5W}{3s} = 3W$$

$$s = \frac{5}{9}$$

(ii) $$B = \frac{W}{3s} = \frac{3W}{5}$$

$$B + R = W$$

$$\frac{3W}{5} + R = W$$

$$\Rightarrow R = \frac{2W}{5}$$

5

5

5

5

5

25

Page 19