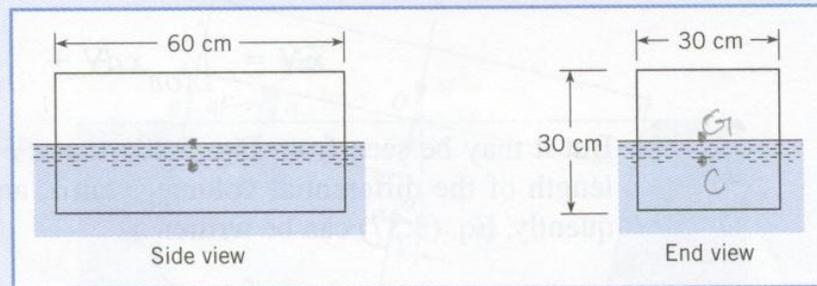


**example 3.15**

A block of wood 30 cm square in cross section and 60 cm long weighs 318 N. Will the block float with sides vertical as shown?



**Solution** First determine the depth of submergence of the block. This is calculated by applying the equation of equilibrium in the vertical direction.

$$\Sigma F_y = 0$$

$$-\text{weight} + \text{buoyant force} = 0$$

$$- 318 \text{ N} + 9810 \text{ N/m}^3 \times 0.30 \text{ m} \times 0.60 \text{ m} \times d = 0$$

$$d = 0.18 \text{ m} = 18 \text{ cm}$$

Determine whether the block is stable about the longitudinal axis:

$$\begin{aligned} GM &= \frac{I_{00}}{\nabla} - CG = \frac{\frac{1}{12} \times 60 \times 30^3}{18 \times 60 \times 30} - (15 - 9) \\ &= 4.167 - 6 = -1.833 \text{ cm} \end{aligned}$$

Because the metacentric height is negative, the block is not stable about the longitudinal axis. Thus a slight disturbance will make it tip. Next, check to see if the block is stable about the transverse axis:

$$GM = \frac{\frac{1}{12} \times 30 \times 60^3}{18 \times 30 \times 60} - 6 = 10.67 \text{ cm} \quad \triangleleft$$

The block is stable about the transverse axis and will float with the short sides vertical.