

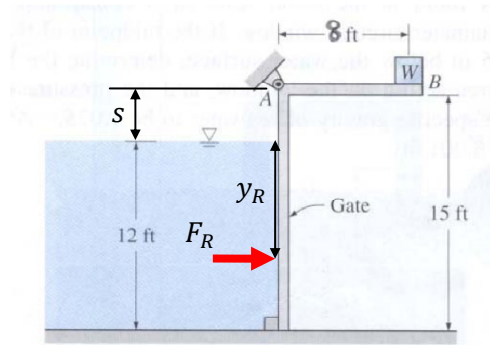
NAME _____

Fluids-ID _____

Quiz 2.

The flow of water from a reservoir is controlled by a 5-ft-wide L-shaped gate hinged at point A, as shown below. If it is desired that gate open when the water height is 12 ft, determine the mass of the required weight W.

(Hint: $y_R = \frac{I_{xc}}{y_c A} + y_c$; For a rectangle, $I_{xc} = \frac{ab^3}{12}$; For water, $\gamma = 62.4 \text{ lb/ft}^3$)



Solution:

The resultant hydrostatic force

$$F_R = \gamma h_c A$$

$$= \left(62.4 \frac{\text{lb}}{\text{ft}^3}\right) \left(\frac{12\text{ft}}{2}\right) (12\text{ft} \times 5\text{ft}) = 22,464 \text{ lb}$$

The center of pressure

$$y_R = \frac{I_{xc}}{y_c A} + y_c$$

$$= \frac{ab^3/12}{(b/2)(ab)} + \frac{b}{2} = \frac{2}{3}b = 8\text{ft}$$

Momentum equilibrium ($\sum M = 0$)

$$F_R(s + y_R) = W \overline{AB}$$

$$\therefore W = \frac{s + y_R}{\overline{AB}} F_R = \left(\frac{3\text{ft} + 8\text{ft}}{8\text{ft}}\right) (22,464 \text{ lb}) = 30,900 \text{ lb}$$