

3.112

3.112 Water flows under the inclined sluice gate shown in Fig. P3.112. Determine the flowrate if the gate is 8 ft wide.

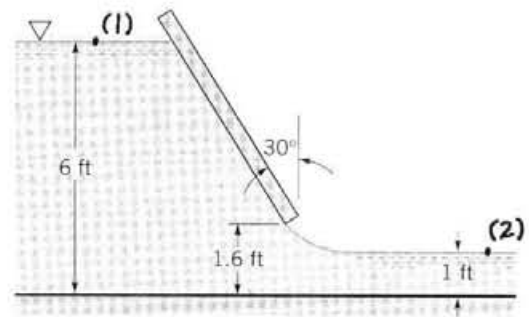


FIGURE P3.112

$$\frac{p_1}{\gamma} + \frac{V_1^2}{2g} + z_1 = \frac{p_2}{\gamma} + \frac{V_2^2}{2g} + z_2 \quad \text{where } p_1 = 0, p_2 = 0, z_1 = 6 \text{ ft, and } z_2 = 1 \text{ ft}$$

Thus,

$$\frac{V_1^2}{2g} + 6 \text{ ft} = \frac{V_2^2}{2g} + 1 \text{ ft} \quad (1)$$

But $A_1 V_1 = A_2 V_2$, or

$$V_2 = \frac{A_1}{A_2} V_1 = \frac{6 \text{ ft}}{1 \text{ ft}} V_1 = 6 V_1$$

Hence, Eq. (1) becomes

$$\frac{V_1^2}{2g} + 6 \text{ ft} = \frac{(6)^2 V_1^2}{2g} + 1 \text{ ft}$$

or

$$[6^2 - 1] V_1^2 = 2(32.2 \frac{\text{ft}}{\text{s}^2})(6 - 1) \text{ ft} \quad \text{or } V_1 = 3.03 \frac{\text{ft}}{\text{s}}$$

Hence,

$$Q = A_1 V_1 = 6 \text{ ft}(8 \text{ ft})(3.03 \frac{\text{ft}}{\text{s}}) = \underline{\underline{145 \frac{\text{ft}^3}{\text{s}}}}$$