

September 14, 2016

NAME _____

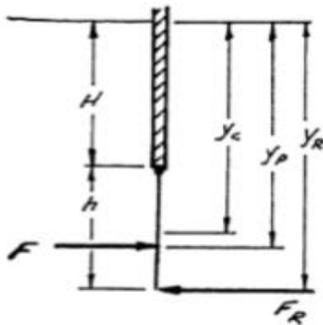
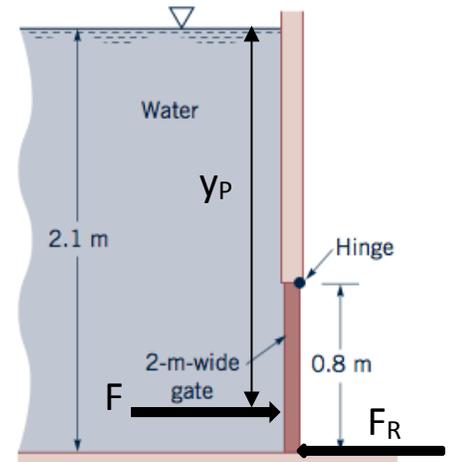
Quiz 2. A rectangular gate is held in place by a Force (F_R) shown in Figure.

$$(I_{xc} = \frac{bh^3}{12}, \gamma = 9.8 \text{ kN/m}^3).$$

- Determine the magnitude of hydrostatic force (F) on the gate.
- Determine the location (y_p) of the hydrostatic force (F) on the gate.
- Determine the magnitude of the force (F_R) that must be applied to the bottom of the gate to keep the gate closed.

Note: Attendance (+2 points), Format (+1 points)

Solution:



a)

$$F = p_c \cdot A = (\gamma \cdot h_c) \cdot A \quad (+2 \text{ points})$$

$$h_c = 2.1 \text{ m} - 0.4 \text{ m} = 1.7 \text{ m} \quad (+0.5 \text{ point})$$

$$F = \left(9.80 \frac{\text{kN}}{\text{m}^3}\right) (1.7 \text{ m})(2 \text{ m} \times 0.8 \text{ m}) = 26.7 \text{ kN} \quad (+0.5 \text{ point})$$

b)

$$y_p = y_c + \frac{I_{xc}}{y_c A} = y_c + \frac{bh^3}{12y_c A} \quad (+2 \text{ points})$$

$$y_p = 1.7 \text{ m} + \frac{2 \text{ m} \times 0.8^3 \text{ m}^3}{12 \times 1.7 \text{ m} \times (2 \text{ m} \times 0.8 \text{ m})} = 1.73 \text{ m} \quad (+0.5 \text{ point})$$

c)

$$\sum M_{\text{hinge}} = 0: F_R h - F(y_p - H) = 0 \quad (+1 \text{ point})$$

$$F_R = \frac{F(y_p - H)}{h} = \frac{2.67 \text{ kN} \times (1.733 - 1.3) \text{ m}}{0.8 \text{ m}} = 14.4 \text{ kN} \quad (+0.5 \text{ point})$$