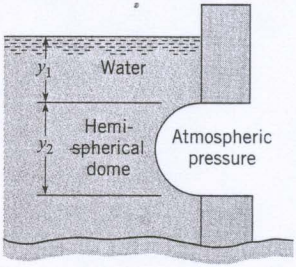
3.137 This dome (hemisphere) is located below the water surface as shown. Determine the magnitude and sign of the force components needed to hold the dome in place and the line of action of the horizontal component of force. Here $y_1 = 1$ m and $y_2 = 2$ m. Assume $T = 10°C$.



3.137 Information and assumptions

provided in problem statement

Find

magnitude and direction of force to hold dome in place.

Solution

$$F_H = (1+1)9,810 \times \pi \times (1)^2 = 61,640 \text{ N} = 61.64 \text{ kN}$$

61.64 kN force will act horizontally to the left to hold the dome in place.

$$(y_{cp} - \bar{y}) = I/\bar{y}A = (\pi \times 1^4/4)/(2 \times \pi \times 1^2) = 0.125 \text{ m}$$

The line of action lies 0.125 m below the center of curvature of the dome.

$$F_V = (1/2)(4\pi \times 1^3/3)9,810 = 20,550 \text{ N} = \underline{\underline{20.55 \text{ kN}}}$$

To be applied downward to hold the dome in place.