9.38

The pressure due to the water at the bottom of a pool of depth h is $P_i = \rho gh$, where ρ is the density of water. Thus from Eq. (9.3) we get the force $F_\perp$ due to the water exerted vertically on the bottom of the pool of area A:

$$\begin{aligned} F_\perp &= P_i A = \rho g h A \\ &= (1.00 \times 10^3\,\mathrm{kg/m^3})(9.81\,\mathrm{m/s^2})(3.0\,\mathrm{m})(5.0\,\mathrm{m} \times 10\,\mathrm{m}) \\ &= 1.5 \times 10^6\,\mathrm{N}. \end{aligned}$$

9.85

Consider an iceberg of volume V, whose weight is given by $F_W = \rho_{ice} g V$. If the volume of t submerged portion of the iceberg is V_f, then according to Eq. (9.9) the buoyant force exerted it by the sea water (of density ρ_f) is $F_B = \rho_f g V_f$. For the iceberg to be in mechanical equilibriu F_W and F_B must be equal: $F_W = \rho_{ice} g V = F_B = \rho_f g V_f$, which gives $V_f/V = \rho_{ice}/\rho_f$. T fraction of the volume of the iceberg submerged is V_f/V; hence the fraction of its volume th is visible (i.e. above the sea level) is given by

$$1 - \frac{V_f}{V} = 1 - \frac{\rho_{ice}}{\rho_f} = 1 - \frac{0.92 \times 10^3\,\mathrm{kg/m^3}}{1.025 \times 10^3\,\mathrm{kg/m^3}} = 0.10 = 10\%.$$

For fresh water, replace ρ_f with $\rho_W = 1.00 \times 10^3\,\mathrm{kg/m^3}$ in the formula above to obtain the ne value of the fraction. The answer is 8.0%.

9.118

Consider a tube of flow of the air which starts far from the building, where $P = P_A$ and $v =$ and ends up at the top of the roof (T), where $P = P_T$ and $v = v_T$. Apply Bernoulli's Equati $P_A = P_T + \frac{1}{2}\rho v_T^2$, where $\rho = 1.1\,\mathrm{kg/m^3}$ is the density of the air and $v_T = 50\,\mathrm{m/s}$ is the air spe Inside the building the air is not moving so the pressure at the bottom of the roof is just P_A. T net upward pressure exerted on the roof is then $\Delta P = P_A - P_T = P_A - (P_A - \frac{1}{2}\rho v_T^2) = \frac{1}{2}\rho$ which results in a upward lifting force F_l on the roof of area A:

$$F_l = A\Delta P = \frac{1}{2}A\rho v_T^2 = \frac{1}{2}(220\,\mathrm{m^2})(1.1\,\mathrm{kg/m^3})(50\,\mathrm{m/s})^2 = 3.0 \times 10^5\,\mathrm{N},$$

which is equivalent to 68×10^3 lb.

9.119

Apply Bernoulli's Equation to points 2 and 3: $P_2 + \frac{1}{2}\rho v_2^2 + \rho g y_2 = P_3 + \frac{1}{2}\rho v_3^2 + \rho g y_3$. Not that $v_2 = \sqrt{2gh}$ [see Problem (9.111)]. Also, $y_2 = 0$, $y_3 = y$, and $P_2 = P_3 = P_A$ (since th water at both locations are exposed to the air). Substitute these expressions into Bernoulli Equation to obtain

$$P_A + \frac{1}{2}\rho\left(\sqrt{2gh}\right)^2 = P_A + \frac{1}{2}\rho v_3^2 + \rho g y.$$

Solve for v_3: $v_3 = \sqrt{2g(h-y)}$. So obviously y cannot exceed h. This is expected fron conservation of mechanical energy between points 1 and 3. To express y in terms of v_2 and θ note that $v_3 = v_2\cos\theta = \sqrt{2g(h-y)}$, which we solve for y:

$$y = h - \frac{v_2^2\cos^2\theta}{2g} = \frac{v_2^2 - v_2^2\cos^2\theta}{2g} = \frac{v_2^2\sin^2\theta}{2g} = \frac{(2gh)\sin^2\theta}{2g} = h\sin^2\theta,$$

where we used $v_2^2 = 2gh$ and $1 - \cos^2\theta = \sin^2\theta$.