14.6: a) 
\[ D = \frac{M_{\text{sum}}}{V_{\text{sum}}} = \frac{1.99 \times 10^{30} \text{ kg}}{\frac{4}{3} \pi (6.96 \times 10^8 \text{ m})^3} = \frac{1.99 \times 10^{30} \text{ kg}}{1.412 \times 10^{27} \text{ m}^3} = 1.409 \times 10^3 \text{ kg/m}^3 \]

b) 
\[ D = \frac{1.99 \times 10^{30} \text{ kg}}{\frac{4}{3} \pi (2.00 \times 10^4 \text{ m})^3} = \frac{1.99 \times 10^{30} \text{ kg}}{3.351 \times 10^{13} \text{ m}^3} = 0.594 \times 10^{17} \text{ kg/m}^3 = 5.94 \times 10^{16} \text{ kg/m}^3 \]

14.10: a) The pressure used to find the area is the gauge pressure, and so the total area is
\[ \frac{(16.5 \times 10^3 \text{ N})}{(205 \times 10^3 \text{ Pa})} = 805 \text{ cm}^2. \]
b) With the extra weight, repeating the above calculation gives 1250 cm².

This problem on “mastering Physics” uses total pressure WHICH IS INCORRECT. To get the answer on homework you will need to use 31kPa but it is the “gauge pressure” which actually “lifts the truck”.

14.22: The buoyant force is \( B = 17.50 \text{ N} - 11.20 \text{ N} = 6.30 \text{ N} \), and
\[ V = \frac{B}{\rho_{\text{water}} g} = \frac{(6.30 \text{ N})}{(1.00 \times 10^3 \text{ kg/m}^3)(9.80 \text{ m/s}^2)} = 6.43 \times 10^{-4} \text{ m}^3. \]

The density is
\[ \rho = \frac{m}{V} = \frac{w/g}{B/\rho_{\text{water}} g} = \frac{w}{\rho_{\text{water}} g} B = (1.00 \times 10^3 \text{ kg/m}^3) \left( \frac{17.50}{6.30} \right) = 2.78 \times 10^3 \text{ kg/m}^3. \]

14.24: a) \( B = \rho_{\text{water}} g V = (1.00 \times 10^3 \text{ kg/m}^3)(9.80 \text{ m/s}^2)(0.650 \text{ m}^3) = 6370 \text{ N}. \)
b) \( m = \frac{w}{g} = \frac{B - F}{g} = \frac{6370 \text{ N} - 900 \text{ N}}{9.80 \text{ m/s}^2} = 558 \text{ kg}. \)
c) (See Exercise 14.23.) If the submerged volume is \( V' \),
\[ V' = \frac{w}{\rho_{\text{water}} g} \quad \text{and} \quad V' = \frac{w}{\rho_{\text{water}} g V} = \frac{5470 \text{ N}}{6370 \text{ N}} = 0.859 = 85.9\%. \]

14.34: a) From Eq. (14.18),
\[ v = \sqrt{2gh} = \sqrt{2(9.80 \text{ m/s}^2)(14.0 \text{ m})} = 16.6 \text{ m/s}. \]
b) \( vA = (16.57 \text{ m/s})(\pi(0.30 \times 10^{-2} \text{ m}^2)) = 4.69 \times 10^{-4} \text{ m}^3/\text{s}. \) Note that an extra figure was kept in the intermediate calculation.
From Eq. (14.17), with $y_1 = y_2$,

$$p_2 = p_1 + \frac{1}{2} \rho (v_1^2 - v_2^2) = p_1 + \frac{1}{2} \rho \left( v_1^2 - \frac{v_1^2}{4} \right) = p_1 + \frac{3}{8} \rho v_1^2$$

$$= 1.80 \times 10^4 \text{ Pa} + \frac{3}{8} \left( 1.00 \times 10^3 \text{ kg/m}^3 \right) \left( 2.50 \text{ m/s} \right)^2 = 2.03 \times 10^4 \text{ Pa},$$

where the continuity relation $v_2 = \frac{v_1}{2}$ has been used.