

PHY 2130 Homework solutions Assignment 9

9.14 Let the weight of the car be W . Then, each tire supports $\frac{W}{4}$,

and the gauge pressure is $P = \frac{F}{A} = \frac{W}{4A}$.

$$\text{Thus, } W = 4AP = 4(0.024 \text{ m}^2)(2.0 \times 10^5 \text{ Pa}) = \boxed{1.9 \times 10^4 \text{ N}}$$

9.18 The needed gauge pressure is

$$\begin{aligned} P_{\text{gauge}} &= P - P_0 = \rho gh \\ &= \left(10^3 \frac{\text{kg}}{\text{m}^3}\right) \left(9.80 \frac{\text{m}}{\text{s}^2}\right) (1200 \text{ ft}) \left(\frac{1 \text{ m}}{3.281 \text{ ft}}\right) = \boxed{3.58 \times 10^6 \text{ Pa}} \end{aligned}$$

9.19 The density of the solution is $\rho = 1.02 \rho_{\text{water}} = 1.02 \times 10^3 \text{ kg/m}^3$. The gauge pressure of the fluid at the level of the needle must equal the gauge pressure in the vein, so $P_{\text{gauge}} = \rho gh = 1.33 \times 10^4 \text{ Pa}$, and

$$h = \frac{P_{\text{gauge}}}{\rho g} = \frac{1.33 \times 10^4 \text{ Pa}}{(1.02 \times 10^3 \text{ kg/m}^3)(9.80 \text{ m/s}^2)} = \boxed{1.33 \text{ m}}$$

9.27 The boat sinks until the weight of the additional water displaced equals the weight of the truck. Thus,

$$\begin{aligned} W_{\text{truck}} &= [\rho_{\text{water}} (\Delta V)]g \\ &= \left(10^3 \frac{\text{kg}}{\text{m}^3}\right) [(4.00 \text{ m})(6.00 \text{ m})(4.00 \times 10^{-2} \text{ m})] \left(9.80 \frac{\text{m}}{\text{s}^2}\right), \end{aligned}$$

or $W_{\text{truck}} = 9.41 \times 10^3 \text{ N} = \boxed{9.41 \text{ kN}}$