

57. (a) Bernoulli's equation gives $p_A = p_B + \frac{1}{2}\rho_{\text{air}}v^2$. But $\Delta p = p_A - p_B = \rho gh$ in order to balance the pressure in the two arms of the U-tube. Thus $\rho gh = \frac{1}{2}\rho_{\text{air}}v^2$, or

$$v = \sqrt{\frac{2\rho gh}{\rho_{\text{air}}}}.$$

- (b) The plane's speed relative to the air is

$$v = \sqrt{\frac{2\rho gh}{\rho_{\text{air}}}} = \sqrt{\frac{2 \left(810 \text{ kg/m}^3\right) (9.8 \text{ m/s}^2) (0.260 \text{ m})}{1.03 \text{ kg/m}^3}} = 63.3 \text{ m/s}.$$