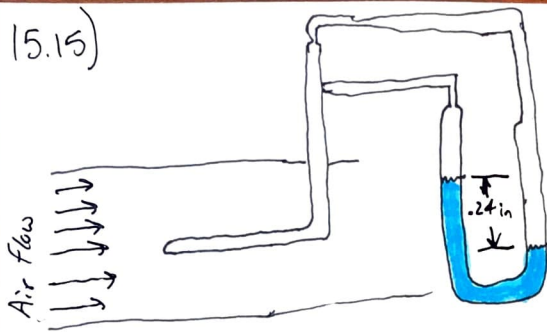


15.15)



Given

$$T = 50^{\circ}\text{C}$$

$$h = .24 \text{ in} = .02 \text{ ft}$$

$$\gamma = .078 \frac{\text{lb}}{\text{ft}^3} (\text{Air at } 50^{\circ}\text{C})$$

$$\gamma_g = 62.4 \frac{\text{lb}}{\text{ft}^3} (\text{water at } 50^{\circ}\text{C})$$

$$g = 32.2 \frac{\text{ft}}{\text{s}^2}$$

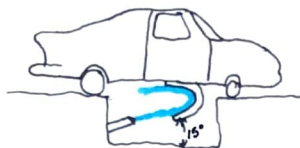
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$$V = \sqrt{2gh(\gamma_g - \gamma)\gamma}$$

$$\therefore v = \sqrt{2(32.2)(.02)((62.4) - (.078))(.078)} \Rightarrow \cancel{2.50 \frac{\text{ft}}{\text{s}}}$$

$$\Rightarrow v = 32.08 \frac{\text{ft}}{\text{s}}$$

16.20)



Given

$$v = 30 \text{ m/s}$$

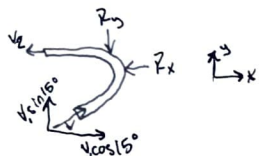
$$D = 200 \text{ mm} = 0.2 \text{ m}$$

$$A = \frac{\pi D^2}{4} = \frac{\pi (0.2)^2}{4} = 0.0314 \text{ m}^2$$

$$Q = VA = 30(0.0314) = 0.942 \text{ m}^3/\text{s}$$

$$\rho = 1000 \text{ kg/m}^3$$

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a) Stationary

$$R_x = \rho Q (v_{2x} - v_{1x})$$

$$\therefore R_x = 1000(0.942)(-30 - 30 \cos 15)$$

$$R_x = -55,557.064 \text{ N or } -55.56 \text{ kN}$$

$$\therefore F_x = 55,557.064 \text{ N or } 55.56 \text{ kN}$$

$$R_y = \rho Q (v_{2y} - v_{1y})$$

$$\therefore R_y = 1000(0.942)(0 - 30 \sin 15)$$

$$R_y = -7,314.23 \text{ N or } -7.314 \text{ kN}$$

$$\therefore F_y = 7,314.23 \text{ N or } 7.314 \text{ kN}$$

b) Moving Car

$$v_c = 12 \text{ m/s}$$

$$v_x = v \cos 15^\circ = 30 \cos 15^\circ = 28.98 \text{ m/s}$$

$$v_y = v \sin 15^\circ = 30 \sin 15^\circ = 7.76 \text{ m/s}$$

$$v'_x = v_x - v_c = 28.98 - 12 = 16.98 \text{ m/s}$$

$$v_R = \sqrt{(v'_x)^2 + (v_y)^2} = \sqrt{(16.98)^2 + (7.76)^2} = 18.67 \text{ m/s}$$

$$\dot{m} = \rho A v_R = 1000(0.0314)(18.67) = 586.24 \text{ kg/s}$$

$$\alpha = \tan^{-1}\left(\frac{v_y}{v'_x}\right) = \tan^{-1}\left(\frac{7.76}{16.98}\right) = 24.56^\circ$$

$$\beta = \alpha - \theta = 24.56 - 15 = 9.56^\circ$$

$$v_e = v_R \cos \beta = 18.67 \cos 9.56 = 18.41 \text{ m/s}$$

$$R_x = \dot{m}(v_e - v'_x) = 586.24(-18.41 + 16.98)$$

$$\therefore R_x = -838.3 \text{ N or } -0.84 \text{ kN}$$

$$F_x = 838.3 \text{ N or } 0.84 \text{ kN}$$

$$R_y = \dot{m}(v_e - v_y) = 586.24(0 - 7.76)$$

$$\therefore R_y = -4,549.22 \text{ N or } -4.55 \text{ kN}$$

$$F_y = 4,549.22 \text{ N or } 4.55 \text{ kN}$$