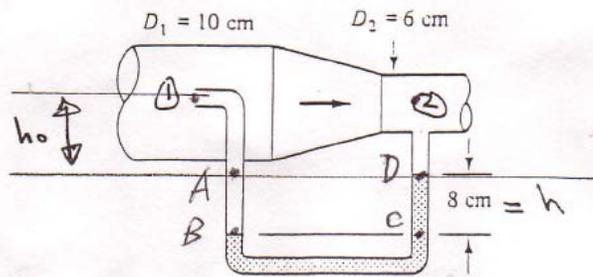V. In the figure, the flowing fluid is air ($\rho g = 12$ N/m^3) and the manometer fluid is Meriam red oil, SG = 0.827. Assuming no losses, compute the flow rate in cubic meters per second.

$D_1 = 10$ cm $\qquad D_2 = 6$ cm

8 cm $= h$

Continuity: $\qquad A_1 V_1 = A_2 V_2 = Q$ $\qquad\qquad 2\frac{1}{3}$

Bernoulli: $\qquad P_1 + \frac{1}{2}\rho_a V_1^2 = P_2 + \frac{1}{2}\rho V_2^2$ $\qquad\qquad 2\frac{1}{3}$

$$P_1 - P_2 = \frac{1}{2}\rho_a V_2^2$$

Manometer: $\quad P_1 + h_0 \gamma_a + h\gamma_a - h\gamma_m - h_0\gamma_a = P_2 \qquad 2\frac{1}{3}$

$$P_1 - P_2 = h g (\rho_m - \rho_a)$$

$$= h(\gamma_m - \gamma_a)$$

$$= .08 (9790 \times .827 - 12) = 647 \text{ N/m}^2$$

$$V_2 = \left[\frac{2(P_1 - P_2)}{\rho_a} \right]^{1/2} = 32.5 \text{ m/s}$$

$$Q = A_2 V_2 = .092 \text{ m}^3/s$$