A. (10 pts.) What is the gauge venous blood pressure at the position of the wrist?

\[ P_{\text{Gauge at Wrist}} = P_{\text{Gauge at Heart}} + P_{\text{Blood}} + gh_{\text{Heart above Wrist}} \]

\[ = 6.16 \times 10^3 \text{ N/m}^2 + (1.06 \times 10^3 \text{ kg/m}^3)(9.8 \text{ m/s}^2)(0.25 \text{ m}) \]

\[ = 8.74 \text{ kPa} \]

B. (11 pts.) The tube coming from the wrist is connected to a bottle of whole blood the patient needs in a transfusion. See above figure (b). What is the minimum height above the level of the heart at which the bottle must be held to deliver the blood to the patient? For fluid in bottle to be delivered to patient, \( P_{\text{Gauge at Wrist}} \) (or fluid) > \( P_{\text{Gauge at Heart}} \)

Thus \( h_{\text{min}} = \frac{P_{\text{Gauge from A}}}{\rho_{\text{Blood}}} = \frac{8.76 \times 10^3 \text{ N/m}^2}{1.06 \times 10^3 \text{ kg/m}^3(9.8 \text{ m/s}^2)} \)

\[ h_{\text{min}} = 0.843 \text{ m} \]

C. (12 pts.) Suppose the bottle of blood is held 1.00 m above the level of the heart. Assume the tube inserted in the wrist has a diameter of 2.80 mm. What is the velocity, \( v \), and flow rate of blood as it enters the wrist? You may also assume the rate at which the blood level in the bottle drops is very small.

\[ \text{Assume surface of blood} = \text{Patm} \quad \text{AND} \quad \text{Volume} = \frac{1}{2}Pv^2 \]

\[ v = \sqrt{\frac{2g(h - P_{\text{Gauge at Wrist}})}{\rho}} \]

\[ = \sqrt{2 \times 9.8 \times (0.843 - 0.25)} \times \frac{1.06 \times 10^3 \text{ kg/m}^3}{1.06 \times 10^3 \text{ kg/m}^3} \]

\[ = 1.74 \times 10^3 \text{ m/s} \]