Answer on Question #49289-Physics-Other

An IV bag is situated 1m above a patient and the density of the fluid in the bad is $\rho = 1020\frac{kg}{m^3}$. If the cross sectional area of the needle is $A = 1 \cdot 10^{-8}\ m^2$, what will be the flow rate of the fluid into the patient? Assume the IV bag is collapsible, so the external pressure at the bag is just atmospheric pressure and that the gauge pressure at the patients vein is $P_{gauge} = 1.30 \cdot 10^3\ Pa$.

Solution

According Bernoulli equation

$$P_{atm} + \rho g h = P_{gauge} + \frac{1}{2}\rho v^2.$$

The fluid velocity at vein is

$$v = \sqrt{2\left(\frac{P_{atm} - P_{gauge}}{\rho} + gh\right)}.$$

The flow rate of the fluid into the patient is

$$vA = A\sqrt{2\left(\frac{P_{atm} - P_{gauge}}{\rho} + gh\right)} = 1 \cdot 10^{-8}\sqrt{2\left(\frac{101.30 \cdot 10^3 - 1.30 \cdot 10^3}{1020} + 9.8 \cdot 1\right)} = 1.47 \cdot 10^{-7}\frac{m^3}{s}.$$