Chapter 15   Problem 38 [†]

Given

$D_h = 10\ cm = 0.10\ m$

$D_n = 2.5\ cm = 0.025\ m$

$R = 15\ kg/s$

Solution

a) Find the flow speed in the hose.

Flow rate through a cylindrical hose is given by

$$R = \rho v A = \rho v \pi \left(\frac{D}{2}\right)^2$$

Solving for velocity gives

$$v = \frac{R}{\rho \pi \left(\frac{D}{2}\right)^2} = \frac{15\ kg/s}{(1.0 \times 10^3\ kg/m^3)\pi \left(\frac{0.10\ m}{2}\right)^2}$$

$$v = 1.91\ m/s$$

b) Find the flow speed in the nozzle.

Use the same formula as above except with the diameter of the nozzle.

$$v = \frac{R}{\rho \pi \left(\frac{D}{2}\right)^2} = \frac{15\ kg/s}{(1.0 \times 10^3\ kg/m^3)\pi \left(\frac{0.025\ m}{2}\right)^2}$$

$$v = 30.6\ m/s$$