Answer on Question#39741, Physics, Other

A gardener wishes the water from his hose was able to reach flowers 3m away when he holds the nozzle horizontally at a height of 1m. He finds out that the water has a speed of 6.64 m/s when it leaves his hose. The nozzle of his hose has an inner diameter of 1.5 cm. The other end is connected to a pipe with an inner diameter of 2 cm. What must the pressure in the exit pipe be for the water from his hose to reach his flowers?

Solution

According to the conservation of mass law:

$$v_1 A_1 = v_2 A_2,$$

where v_1 - speed of water in the pipe, v_2 - speed of water in the hose, A_1 - inner area of pipe, A_2 - inner area of hose.

According to Bernoulli law:

$$P + \frac{\rho {v_1}^2}{2} = \frac{\rho {v_2}^2}{2},$$

where P - the pressure in the exit pipe, ρ - density of water.

$$P = \frac{\rho {v_2}^2}{2} - \frac{\rho {v_1}^2}{2} = \frac{\rho}{2}({v_2}^2 - {v_1}^2) = \frac{\rho {v_2}^2}{2}\left(1 - \left(\frac{A_2}{A_1}\right)^2\right) = \frac{\rho {v_2}^2}{2}\left(1 - \left(\frac{d_2}{d_1}\right)^4\right).$$

$$P = \frac{1000 \cdot 6.64^2}{2}\left(1 - \left(\frac{1.5}{2}\right)^4\right) = 15\ kPa.$$

Answer: $15\ kPa$.