

**Question #79952, Physics / Other**

In one section of a plumbing system the water's speed is 4m/s and the pressure is  $4.8 \times 10^4$  find the pressure at a second section that is 9m lower than the first one, of the pipe's diameter at the second section is twice the value of the first one

**Solution**

The Bernoulli equation:

$$p_1 + \frac{\rho v_1^2}{2} = p_2 + \frac{\rho v_2^2}{2} - \rho gh$$

We have:

$$A_1 v_1 = A_2 v_2$$

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

Thus,

$$p_2 = p_1 + \rho \left( gh + \frac{1}{2} (v_1^2 - v_2^2) \right)$$

$$p_2 = p_1 + \rho \left( gh + \frac{1}{2} \left( v_1^2 - \frac{1}{16} v_1^2 \right) \right) = p_1 + \rho \left( gh + \frac{15}{32} v_1^2 \right)$$

$$p_2 = 4.8 \cdot 10^4 + 1000 \left( 9.8(9) + \frac{15}{32} (4)^2 \right) = 1.4 \cdot 10^5 \text{ Pa.}$$

**Answer:  $1.4 \cdot 10^5 \text{ Pa}$ .**

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