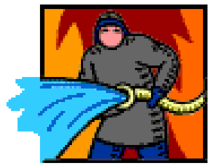
Name: ______________________________ Date: ____________

Bernoulli Equation Practice Worksheet

Answers

Problem 1



Water is flowing in a fire hose with a velocity of 1.0 m/s and a pressure of 200000 Pa. At the nozzle the pressure decreases to atmospheric pressure (101300 Pa), there is no change in height. Use the Bernoulli equation to calculate the velocity of the water exiting the nozzle. (Hint: The density of water is 1000 kg/m^3 and gravity *g* is 9.8 m/s^2. Pay attention to units!)]

Answer:

$$\frac{1}{2}\rho v_1^2 + \rho g h_1 + P_1 = \frac{1}{2}\rho v_2^2 + \rho g h_2 + P_2$$

Since the height does not change (h_1=h_2), the height term can be subtracted from both sides.

$$\frac{1}{2}\rho v_1^2 + P_1 = \frac{1}{2}\rho v_2^2 + P_2$$

Algebraically rearrange the equation to solve for v_2, and insert the numbers

$$\sqrt{\frac{2}{\rho}\left(\frac{1}{2}\rho v_1^2 + P_1 - P_2\right)} = v_2 = 14\ m/s$$

Problem 2

Through a refinery, fuel ethanol is flowing in a pipe at a velocity of 1 m/s and a pressure of 101300 Pa. The refinery needs the ethanol to be at a pressure of 2 atm (202600 Pa) on a lower level. How far must the pipe drop in height in order to achieve this pressure? Assume the velocity does not change. (Hint: Use the Bernoulli equation. The density of ethanol is 789 kg/m3 and gravity g is 9.8 m/s2. Pay attention to units!)

Answer:

$$\frac{1}{2}\rho v_1^2 + \rho g h_1 + P_1 = \frac{1}{2}\rho v_2^2 + \rho g h_2 + P_2$$

Since the velocity does not change (v_1=v_2), the velocity term can be subtracted from both sides

$$\rho g h_1 + P_1 = \rho g h_2 + P_2$$

Rearrange algebraically to solve for change in height

$$\frac{P_1 - P_2}{\rho g} = h_2 - h_1 = \Delta h = -13.1\ meters$$

13.1 meters lower.