10. We use Bernoulli's law to calculate the pressure.

$$P_1 + (1/2)\, d\, g\, v_1^2 + d\, g\, h_1 = P_2 + (1/2)\, d\, g\, v_2^2 + d\, g\, h_2$$

The pipe is horizontal, so $h_1 = h_2$, and we may cancel the third term on each side of the equation.

$$P_1 + (1/2)\, d\, g\, v_1^2 = P_2 + (1/2)\, d\, g\, v_2^2$$

We subtract the second term on the right hand side of the equation from both sides of the equation to obtain P_2 as

$$P_1 + (1/2)\, d\, g\, v_1^2 - (1/2)\, d\, g\, v_2^2 = P_2$$

Using the information supplied in the statement of the problem and the value of v_2 determined in Problem 9 we can solve the problem, but we must be careful to use proper units. Thus the pressure must be expressed in Pascal, not kiloPascal.

$$P_2 = (20 \times 10^3 \text{ Pa}) + (1/2)(1000 \text{ kg}/\text{m}^3)(9.8 \text{ m}/\text{s}^2)(0.3 \text{ m/s})^2 - (1/2)(1000 \text{ kg/m}^3)(9.8 \text{ m/s}^2)(1.2 \text{ m}/\text{s})^2$$

$$P_2 = (20{,}000 + 441 - 7056) \text{ Pa}$$

$$P_2 = 13{,}385 \text{ Pa} = 13.385 \text{ KiloPascal}$$

Note that the pressure is reduced in the constricted region, because the equation of continuity required higher velocity there, and Bernoulli's principle for a level pipe states that a region of higher velocity must have a lower pressure.