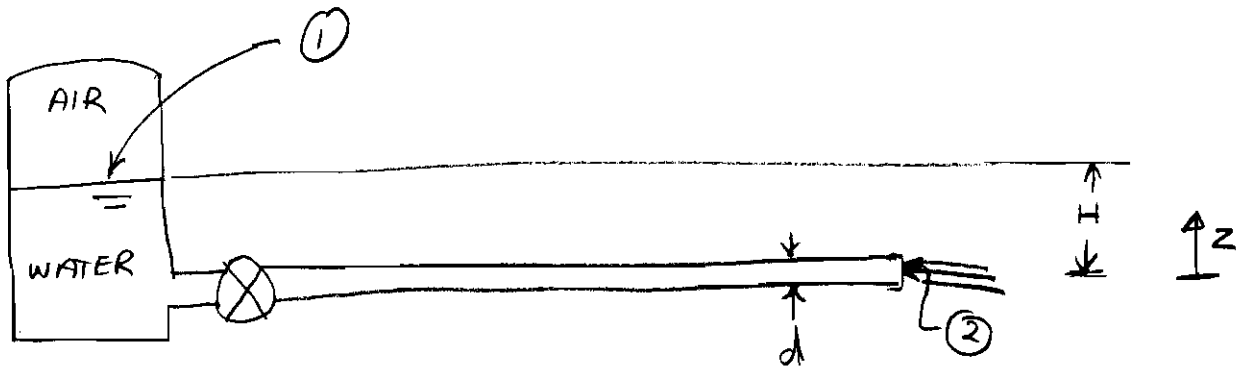
7.16



GIVEN: WATER FLOWS FROM A PRESSURIZED TANK AS SHOWN ABOVE.

$d = 1$ IN., $H = 10$ FT, AND $h_L = \frac{5V^2}{2g}$

A DISCHARGE OF $0.10 \frac{FT^3}{S}$ IS NEEDED.

FIND: THE PRESSURE IN THE TANK

SOLUTION: APPLY EXTENDED BERNOULLI EQUATION FROM ① TO ②

$$\frac{p_1}{\gamma} + \overbrace{z_1}^{H} + \alpha_1 \frac{\overbrace{V_1^2}^{0}}{2g} = \frac{\overbrace{p_2}^{0\ \text{GAGE}}}{\gamma} + \overbrace{z_2}^{0} + \alpha_2 \frac{V_2^2}{2g} + h_L$$

$\alpha_1 = \alpha_2 \approx 1$, TURBULENT PIPE FLOW

$V_1 \approx 0$ SERVOIR $\qquad V_2 = \frac{Q}{A} = \frac{4Q}{\pi d^2}$

$$p_1 = \left(\frac{V^2}{2g} + \frac{5V^2}{2g} - H\right)\gamma$$

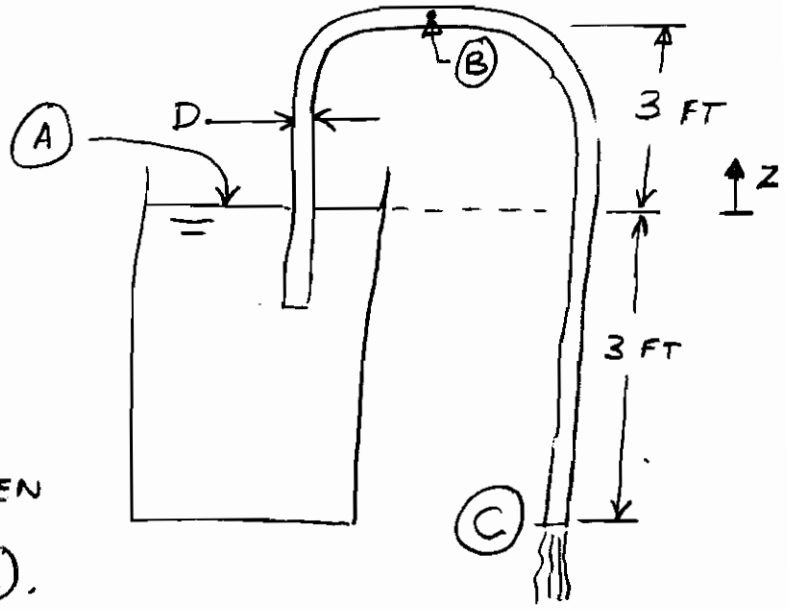
$$p_1 = 3\rho V^2 - \gamma H = 3\rho \frac{16Q^2}{\pi^2 d^4} - \gamma H$$

$$p_1 = 3(1.94)\frac{16(0.10)^2}{\pi^2 \left(\frac{1}{12}\right)^4} - (62.4)(10)$$

$$p_1 = 1956\ \text{PSFG} - 624\ \text{PSFG}$$

$$\boxed{p_1 = 1332\ \text{PSFG} = 9.25\ \text{PSIG}}$$

7.26 GIVEN:



THE SIPHON SHOWN HAS A DISCHARGE OF 2.80 CFS, D = 8 IN.

FIND: (1) HEAD LOSS BETWEEN RESERVOIR SURFACE AND (C).

(2) PRESSURE AT (B) IF $\frac{3}{4}$ OF THE HEAD LOSS OCCURS BETWEEN SURFACE AND (B).

SOLUTION: (1) APPLY PIPE FLOW ENERGY EQN. FROM (A) TO (C).

$$\frac{p_A}{\gamma}\,(0\ \text{GAGE}) + z_A\,(0) + \alpha_A \frac{V_A^2}{2g}\,(0) = h_{L1} + \frac{p_C}{\gamma}\,(0\ \text{GAGE}) + z_C + \alpha_C \frac{V_C^2}{2g}\,(1)$$

$$h_{L1} = -z_C - \frac{V_C^2}{2g} \qquad V_C = \frac{Q}{A_C} = \frac{4Q}{\pi D^2} = 8.02\ \frac{FT}{S}$$

$$h_{L1} = -z_C - \frac{8Q^2}{\pi^2 D^4 g} = -(-3\,FT) - \frac{8\left(2.8\ \frac{FT^3}{S}\right)^2}{\pi^2 \left(\frac{8}{12}\,FT\right)^4 \left(32.2\ \frac{FT}{S^2}\right)}$$

$$\boxed{h_{L1} = 2.00\ FT}$$

(2) $$0 = \frac{3}{4} h_{L1} + \frac{p_B}{\gamma} + z_B + \alpha_B \frac{V_B^2}{2g}\,(1)$$

$$p_B = -\gamma\left(\frac{3}{4} h_{L1} + z_B + \frac{V_B^2}{2g}\right) \qquad V_B = V_C = 8.02\ FT/S$$

$$p_B = -62.4\left[\frac{6}{4} + 3 + \frac{(8.02)^2}{64.4}\right] = -343\ PSFG$$

$$\boxed{p_B = -2.38\ PSIG}$$