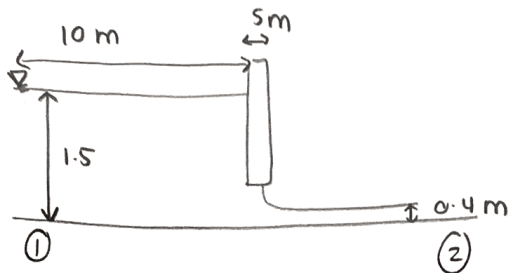


$$1) \Delta P = 1000 \times 9.8 (13.6 \times 1 - 1.5 \times 1 + 1.3 \times 0.8) \\ = 128772 \text{ Pa}$$

3)



$$E_1 = E_2$$

$$E_1 = \frac{Q^2}{2 \times 9.8 \times 5^2 \times (1.5)^2} + 1.5$$

$$E_2 = \frac{Q^2}{2 \times 9.8 \times 5^2 \times (0.4)^2} + 0.4$$

$$\frac{Q^2}{1102.5} + 1.5 = \frac{Q^2}{78.4} + 0.4$$

$$Q^2 = \frac{17640}{209} (1.5 - 0.4)$$

$$Q = 9.64 \text{ m}^3/\text{s}$$

$$5) Q = 0.20 \text{ m}^3/\text{s}$$

$$d_h = 0.1 \text{ m}$$

$$d_s = 0.5 \text{ m}$$

$$d_d = 0.3 \text{ m}$$

MEB to find  $P_1$

$$c) \frac{P_2 - P_1}{\rho} + \frac{1}{2} \Delta V^2 + g \Delta z + \cancel{W_s} + \cancel{P} = 0$$

$$\frac{101325 - P_1}{1000} + \frac{1}{2} \left( \frac{0.20}{\pi \times 0.1^2} - \frac{0.20}{\pi \times 0.3^2} \right) + (9.8 \times 5) = 0$$

$$P_1 = 161643 \text{ Pa}$$

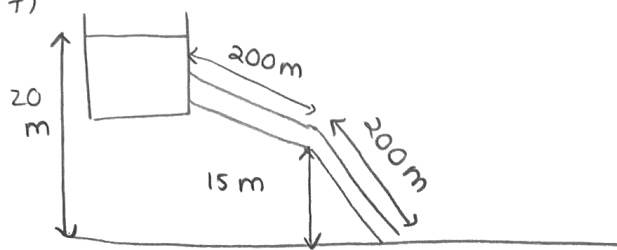
$$(ii) \frac{P_1 - P_0}{1000} + \frac{1}{2} \left( \frac{0.20}{\pi \times 0.3^2} - \frac{0.20}{\pi \times 0.5^2} \right) + 9.8 \times 1 - 5 \times 9.8 = 0$$

$$P_0 = 123348 \text{ Pa}$$

$$(iii) \frac{101325 - 1.1 \times 161643}{1000} + \frac{1}{2} \left( \frac{0.20}{\pi \times 0.1^2} - \frac{0.20}{\pi \times 0.3^2} \right) + 9.8 \times 5 + \frac{2 \times 0.025 \times L \times \left( \frac{0.20}{\pi \times 0.3^2} \right)^2}{0.3} = 0$$

$$L \approx 12 \text{ m}$$

7)



$$(i) \frac{P_1}{\rho} + \frac{1}{2} \Delta V^2 + g \Delta z + \frac{P_2}{\rho} + F = 0$$

$$P_1 = P_2 = P_{atm}$$

$$\frac{1}{2} \times (V_2^2) - 20 \times 9.8 + \frac{2 \times 0.03 \times 400 \times V_2^2}{0.25} = 0$$

$$V_2^2 = 2.03 \text{ m}^2/\text{s}^2$$

$$V_2 = 1.43 \text{ m/s}$$

$$Q = VA$$

$$= 1.43 \text{ m/s} \times \pi \times \frac{0.25^2}{4} \text{ m}^2$$

$$= 0.07 \text{ m}^3/\text{s} //$$