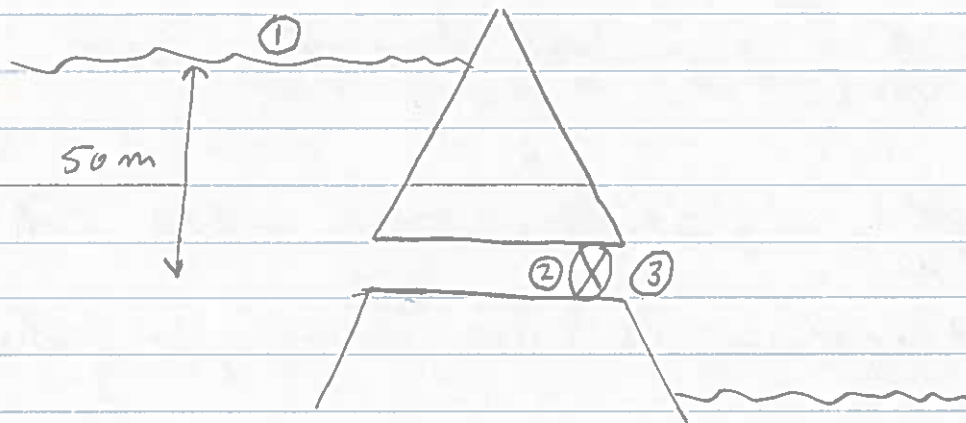


①

A



Bernoulli between ① and ②

$$\underbrace{\frac{P_1}{\rho}}_{=0} + \underbrace{\frac{1}{2}v_1^2}_{=0} + gh_1 = \frac{P_2}{\rho} + \frac{1}{2}v_2^2 + \underbrace{gh_2}_{=0}$$

$$\frac{P_2}{\rho} = gh_1 - \frac{1}{2}v_2^2$$

$$Q_v \text{ of each pipe: } \frac{471}{15} \text{ m}^3/\text{s}$$

$$Q_v = v \cdot A = v \cdot \frac{\pi}{4} D^2 \quad v = 10 \text{ m/s}$$

$$P_2 = 10^3 (500 - 50) = 4.5 \cdot 10^5 \text{ Pa}$$

B Extended Bernoulli between ① and ③

Ideal Turbine:  $v_2 = v_3$  (But  $P_2 \neq P_3$ )

$$0 = -\underbrace{\phi}_{=0} \left[ \underbrace{\frac{P_3 - P_1}{\rho}}_{=0} + \frac{1}{2} \underbrace{(v_3^2 - v_1^2)}_{=0} + g \underbrace{(h_3 - h_1)}_{=0} \right] + \underbrace{\phi}_w - \underbrace{\phi}_{m} \underbrace{e}_{5k} \quad = 0$$

$$-\dot{\phi}_m \left[ \frac{1}{2} v_3^2 - g h_1 \right] + \dot{\phi}_w = 0$$

$$\dot{\phi}_w = -471 \cdot 10^3 \times 450 = -212 \text{ GW}$$

Negative because energy is extracted

Friction Loss is  $\dot{\phi}_m \cdot e_{FR}$

$$e_{FR} = 4f \frac{1}{2} v^2 \cdot \frac{L}{D}$$

$$= 0,0001 \times 50 \times \frac{100 \times 15}{2} = 3,75$$

$$\text{Total Loss} : 471 \cdot 10^3 \times 3,75 = 1,8 \text{ GW}$$

Loss is  $< 1\%$  of power generated

2

$$A(x) = f(A_0, x, v, D_A)$$

$$\frac{\text{kg}}{\text{m}^3} = \left(\frac{\text{kg}}{\text{m}^3}\right)^a \text{m}^b \left(\frac{\text{m}}{\text{s}}\right)^c \left(\frac{\text{m}^2}{\text{s}}\right)^d$$

$$\text{kg} : 1 = a \quad a = 1$$

$$\text{s} : 0 = -c - d \quad d = -c$$

$$\text{m} : -3 = -3a + b + c + 2d \quad b = c$$

$$A(x) = K A_0 x^c v^c D_A^{-c}$$

$$= K A_0 \left(\frac{x \cdot v}{D_A}\right)^c$$

$$\frac{A(x)}{A_0} = f\left(\frac{x \cdot v}{D_A}\right) = f(Pe)$$

B Diffusion:  $-D_A \frac{dA}{dx}$  in positive x

Convection:  $-v \cdot A$  in negative x

Steady-state:  $0 = -D_A \frac{dA}{dx} - v \cdot A$

$$\frac{dA}{dx} = -\frac{v \cdot A}{D_A}$$

$$\frac{A(x)}{A_0} = \exp\left(\frac{-v \cdot x}{D_A}\right)$$

C In general  $\frac{C(x)}{C_0} = f\left(\frac{x \cdot v}{D_c}\right)$

$$\frac{A(x)}{A_0} = \frac{B(x')}{B_0} = \frac{1}{10}$$

$$\frac{x}{D_A} = \frac{x'}{D_B}$$

$$x' = x \frac{D_B}{D_A} = 0.5 \times 0.2 = 0.1 \text{ m}$$

3

$$A \quad 36 \cdot 10^3 = 500 \times 6 \times (T_{\text{Room}} - 10)$$

$$T_{\text{Room}} = 22^\circ\text{C}$$

$$B \quad \text{Total heat exchange surface} = 2 \times 6 = 24 \text{ m}^2$$

$$\Phi_w = 50 \times 24 \times 12 = 14.4 \text{ kW}$$

$$C \quad V \cdot c_p \cdot \rho \frac{dT}{dt} = U \cdot A (T_{\text{Room}} - T)$$

$$\int_{10}^{16} \frac{dT}{(T_{\text{Room}} - T)} = \frac{U \cdot A}{V c_p \rho} \int_0^t dt$$

$$\ln \left( \frac{22-10}{22-16} \right) = \frac{50 \times 24}{8 \times 3 \times 4200 \times 10^3} \cdot t$$

$$V = 2^3 \times 3 \text{ m}^3$$

$$t = 76.2 \text{ hr}$$

The first part of the document discusses the importance of maintaining accurate records. It highlights the need for consistency and thoroughness in data collection. The second section focuses on the analysis of the collected data, emphasizing the use of statistical methods to identify trends and patterns.

In the third section, the author discusses the implications of the findings. It is noted that the results suggest a significant correlation between the variables studied. This finding has important implications for the field of research and may lead to further investigations.

The final section of the document provides a conclusion and recommendations. The author suggests that future studies should explore the relationship between the variables in greater depth. It is also recommended that the findings be applied in practical settings to improve outcomes.