

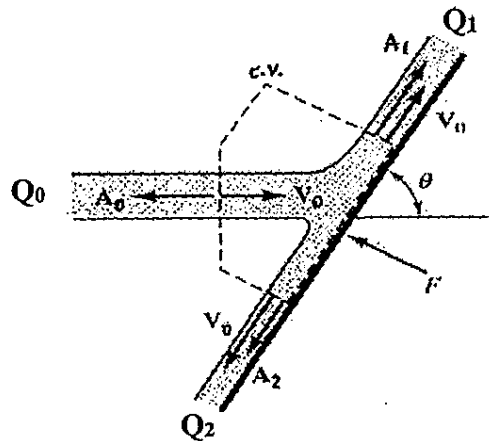
※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. The power P required to run a stirred tank varies with turbine diameter D , rotational speed n , fluid density ρ , viscosity μ , acceleration of gravity g and unit conversion factor g_c . Please generate a set of appropriate dimensionless groups by dimensional analysis. (20%)

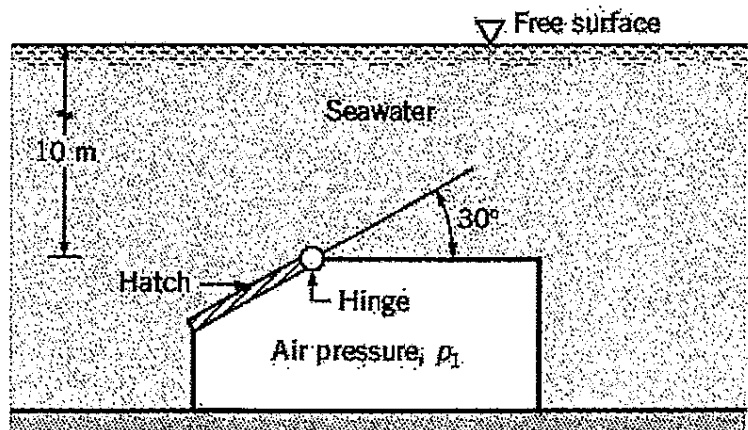
2. Fluid (volume flow rate = Q_0 , density = ρ) issues from a long slot and strikes against a smooth inclined flat plate. Neglecting losses due to impact.

(a) Determine the division of flow rate (Q_1 and Q_2) (as a function of Q_0 and θ). (10%)

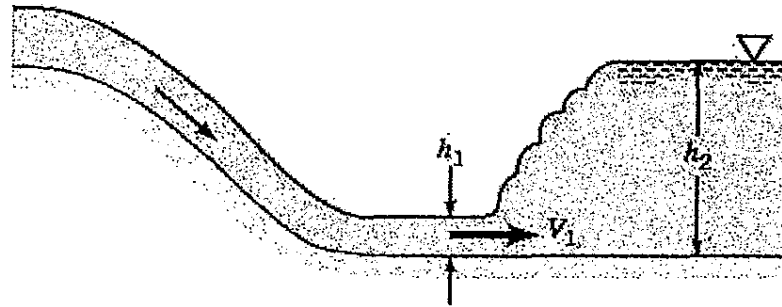
(b) the force exerted on the plate (F). (10%)



3. A structure is attached to the ocean floor as shown. A 2 m diameter hatch is located in an inclined wall and hinged on one edge. Determine the minimum air pressure (P_1) within the container that will open the hatch. Neglect the weight of the hatch and the friction in the hinge. ($\rho_{\text{sea water}} = 1030 \text{ kg/m}^3$) (20%)



4. Near the downstream end of a river spillway, a hydraulic jump often forms, as shown below. The velocity of the channel flow is reduced abruptly across the jump. (a) Please derive the expression for h_2 as a function of h_1 and V_1 . (10%) (b) Derive the expression for energy loss as a function of h_1 and h_2 . (10%)



5. Water ($\rho_{\text{water}} = 1000 \text{ kg/m}^3$, $\mu = 10^{-3} \text{ N}\cdot\text{s/m}^2$) at 15°C flows from basement to the second floor through the 4.5 cm diameter commercial steel pipe ($\epsilon = 0.045 \text{ mm}$) at a rate of $Q = 45 \text{ L/min}$ and exits through a faucet of diameter 1.3 cm as shown below. Please determine the pressure at point (1) if all losses are included. The K_L values for the 90° elbow, globe valve and faucet are 1.5, 10 and 2, respectively. (20%) (Note that you may use the Moody chart shown in the next page)

