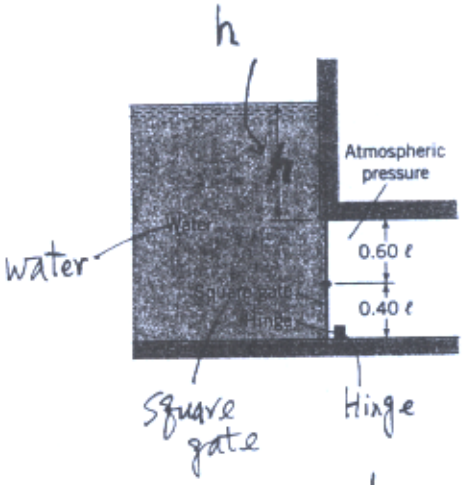
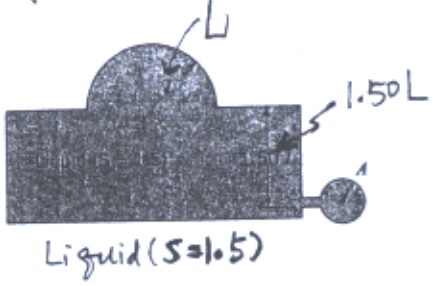
1) For a given hypothetical flow, the velocity from time t = 0 to t = 5 s was $u$ = 2 m/s , v = 0. Then, from time $t$ = 5 s to $t$ = 10 s, the velocity was $u$ = +3 m/s v= - 4m/s. A dye streak was started at a point in the flow field at time $t$ = 0, and the path of a particle in the fluid was also traced from that same point starting at the same time. Draw to scale the streakline, pathline of the particle, and streamlines at time t = 10 s. (12%)

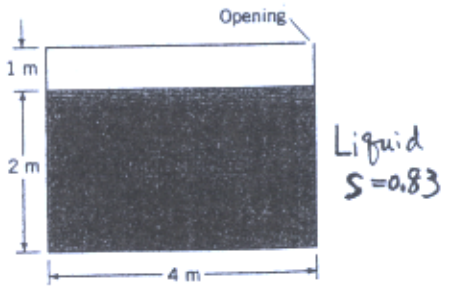
2 ) The square gate shown is eccentrically pivoted so that it automatically opens at a certain value of $h$. What is that value in terms of $\ell$ . (12%)




3) Find the vertical component of force in the metal at the base of the spherical dome shown when gage A reads 8 psig. Indicate whether the metal is in compression or tension. The specific gravity of the enclosed fluid is 1.5. The dimension $L$ is 3 ft. Assume the dome weighs1000 lbf . $\gamma_{water}$ = 62.4 lbf / ft$^3$ . (12%)

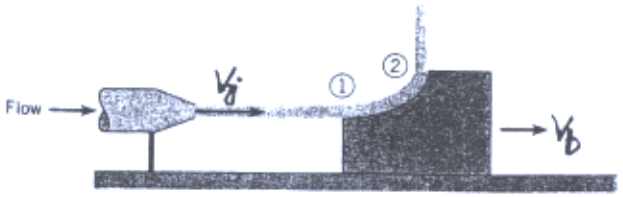



4) The tank shown is 4 m long, 3 m high, and 3 m wide, and it is closed except for a small opening at the right end. It contains oil (S = 0.83) to a depth of 2 m in a static situation. If the tank is uniformly accelerated to the right at a rate of 19.62 m/s$^2$, what will be the maximum pressure intensity in the tank during acceleration? and what will be the total fluid force acting on the ceiling of the container ? (16%)

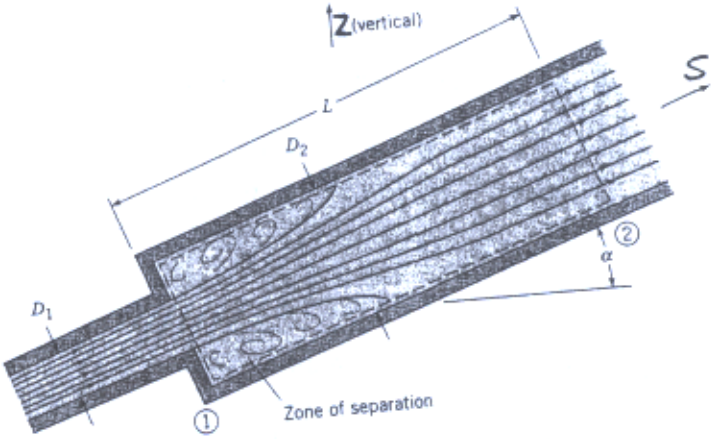



(背面仍有題目,請繼續作答)

5) *A* stationary nozzle produces a jet with a speed Vj and an area Aj. The jet strikes a moving block and is deflected 90° relative to the block. The block is sliding with a constant speed $v_b$ on a rough surface. Find the frictional force F acting on the block. (16%)




6) Consider the fluid flow from a small pipe into a larger pipe as shown in the figure. Assuming the turbulent flow conditions here, $V_1$ is the velocity in the small pipe and $V_2$ is the velocity in the larger pipe ,find the head loss due to the expansion as a function of the flow velocities in the two pipes. (16%)




7) A pump draws water from a reservoir, where the water-surface elevation is 520ft, and forces the water through a pipe 5000 ft long and 1 ft in diameter. This pipe then discharges the water into a reservoir with water-surface elevation of 620 ft. The flow rate is 7.85 cfs, and the head loss in the pipe is given by $0.01(L/D)(V^2/2g)$. Determine the head supplied by the pump, $h_p$, and the power supplied to the flow, and draw the hydraulic grade line and energy grade line for the system. Assume that the pipe is horizontal and is 510 ft in elevation. (16%)