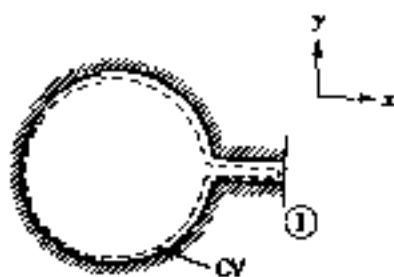


prob.1 >

15%

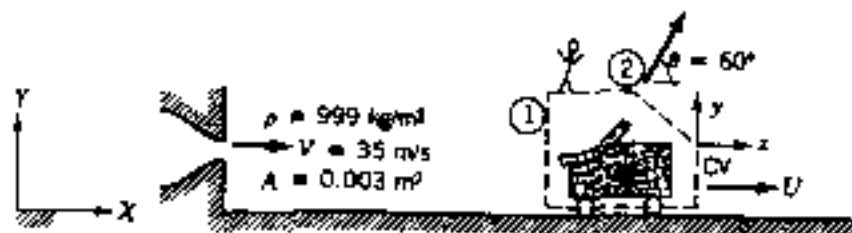
A tank of 0.05 m^3 volume contains air at 800 kPa (absolute) and 15°C . At $t = 0$, air escapes from the tank through a valve with a flow area of 65 mm^2 . The air passing through the valve has a speed of 311 m/s and a density of 6.13 kg/m^3 . Properties in the rest of the tank may be assumed uniform at each instant. Determine the instantaneous rate of change of density in the tank at $t = 0$.



prob.2 >

25%

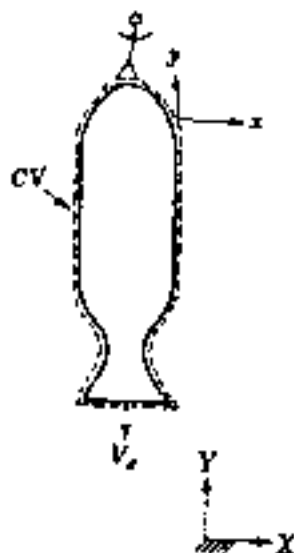
A vane, with turning angle $\theta = 60^\circ$, is attached to a cart. The cart and vane, of mass $M = 75 \text{ kg}$, roll on a level track. Friction and air resistance may be neglected. The vane receives a jet of water, which leaves a stationary nozzle horizontally at $V = 35 \text{ m/s}$. The nozzle exit area is $A = 0.003 \text{ m}^2$. Determine the velocity of the cart as a function of time and plot the results.



prob.3 >

30%

A small rocket, with an initial mass of 400 kg , is to be launched vertically. Upon ignition the rocket consumes fuel at the rate of 5 kg/s and ejects gas at atmospheric pressure with a speed of 3500 m/s relative to the rocket. Determine the initial acceleration of the rocket and the rocket speed after 10 s , if air resistance is neglected.

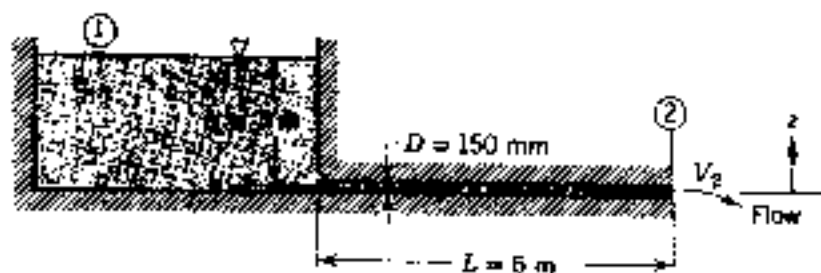


國 立 清 華 大 學 命 題 紙

八十七學年度 工程與系統科學 系 (所) _____ 組碩士班研究生入學考試

科目 流體力學 科號 4010 共 2 頁第 2 頁 *請在試卷【答案卷】內作答

- prob. 4) 30% A long pipe is connected to a large reservoir that initially is filled with water to a depth of 3 m. The pipe is 150 mm in diameter and 6 m long. As a first approximation, friction may be neglected. Determine the flow velocity leaving the pipe as a function of time after a cap is removed from its free end. The reservoir is large enough so that the change in its level may be neglected.



< hint: $\int \frac{dx}{a^2 - v^2} = \frac{1}{a} \tanh^{-1}\left(\frac{v}{a}\right) >$