Fluid Mechanics Homework #7

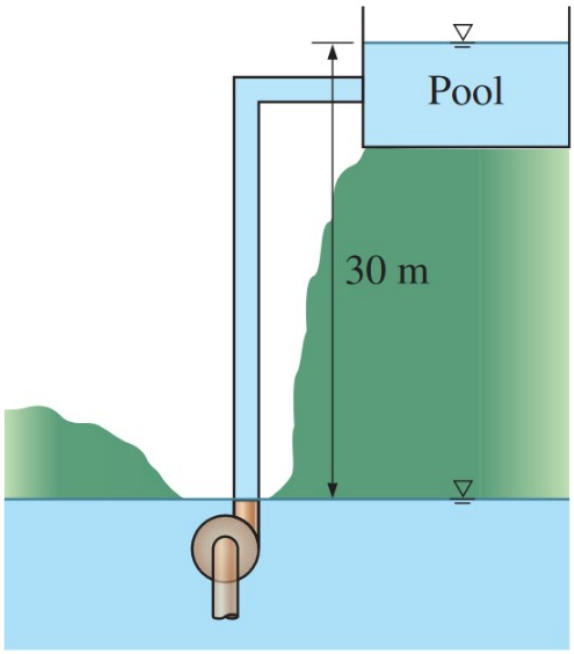
繳交期限：**2019/11/13(三) 09:10**

共五題，題號為：**5-88,93,111,6-85,94(a)**

題號的對照書本是 **Yunus A. Cengel and John M. Cimbala “Fluid Mechanics: Fundamentals and Applications 3/e (SI Units) ”**

5 – 88

Underground water is to be pumped by a 78 percent efficient 5-kW submerged pump to a pool whose free surface is 30 m above the underground water level. The diameter of the pipe is 7 cm on the intake side and 5 cm on the discharge side. Determine (*a*) the maximum flow rate of water and (*b*) the pressure difference across the pump. Assume the elevation difference between the pump inlet and the outlet and the effect of the kinetic energy correction factors to be negligible.

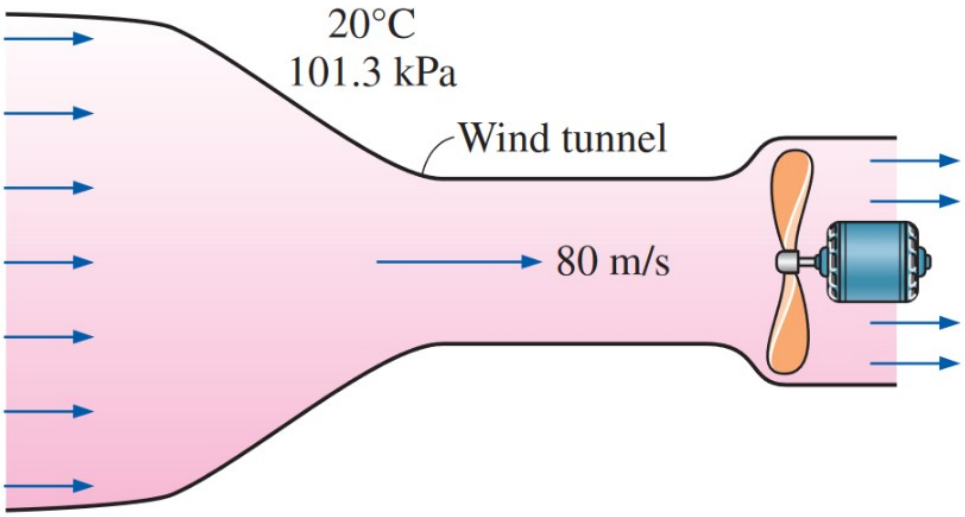


5 – 93

A fireboat is to fight fires at coastal areas by drawing seawater with a density of 1030 kg/m^3 through a 10-cm-diameter pipe at a rate of 0.04 m^3/s and discharging it through a hose nozzle with an exit diameter of 5 cm. The total irreversible head loss of the system is 3 m, and the position of the nozzle is 3 m above sea level. For a pump efficiency of 70 percent, determine the required shaft power input to the pump and the water discharge velocity.

5 – 111

A wind tunnel draws atmospheric air at 20°C and 101.3 kPa by a large fan located near the exit of the tunnel. If the air velocity in the tunnel is 80 m/s, determine the pressure in the tunnel.

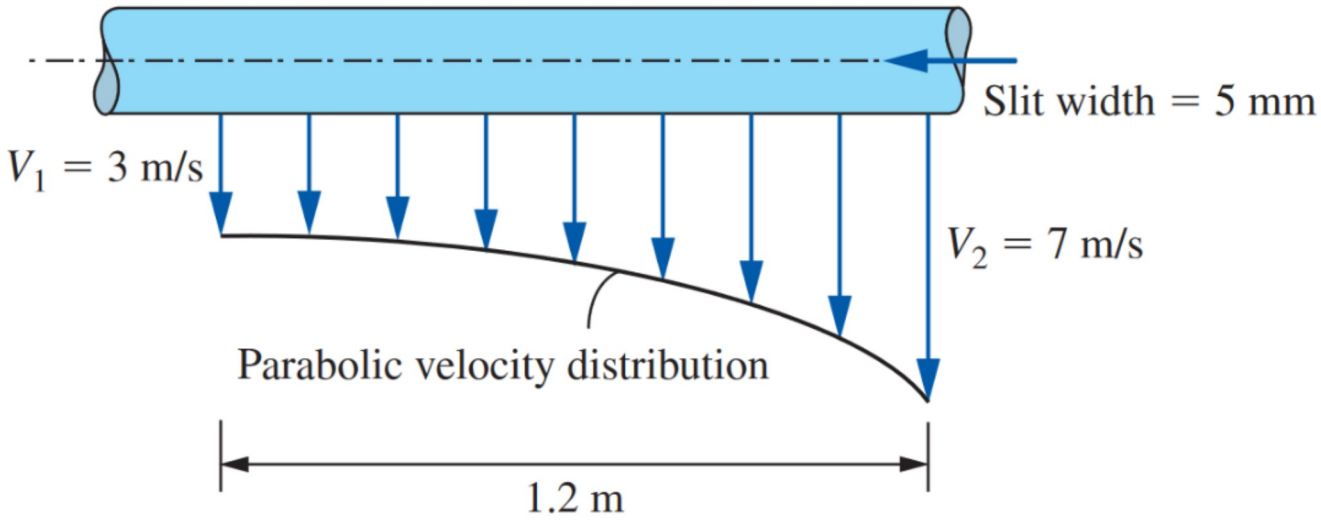


6 – 85

A soldier jumps from a plane and opens his parachute when his velocity reaches the terminal velocity V_T. The parachute slows him down to his landing velocity of V_F. After the parachute is deployed, the air resistance is proportional to the velocity squared (i.e., $F = kV^2$). The soldier, his parachute, and his gear have a total mass of m. Show that $k = mg/V_F^2$ and develop a relation for the soldier's velocity after he opens the parachute at time $t = 0$.

6 – 94(*a*)

Water is discharged from a pipe through a 1.2-m long 5-mm wide rectangular slit underneath of the pipe. Water discharge velocity profile is parabolic, varying from 3 m/s on one end of the slit to 7 m/s on the other, as shown in Fig. P6–94. Determine (*a*) the rate of discharge through the slit and (*b*) the vertical force acting on the pipe due to this discharge process.


Slit width = 5 mm
$V_1 = 3$ m/s
$V_2 = 7$ m/s
Parabolic velocity distribution
1.2 m