



ECHE 225: Fall 2024

Homework #8: Energy form of the Bernoulli Eqn, Internal flow

Due: October 31

1. [Chapter 12] 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 8 cm on the intake side and 6 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 outlet and the effect of the kinetic energy correction factors to be negligible.

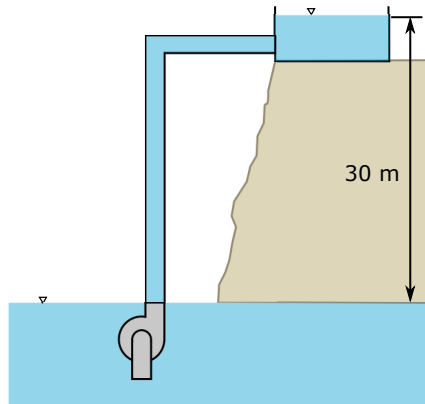


Figure 1: Schematic for Problem 5

2. [Chapter 12] A fireboat is to fight fires at coastal areas by drawing seawater with density 1030 kg/m^3 through a 15-cm-diameter pipe at a rate of $0.06 \text{ m}^3/\text{s}$ and discharging it through a nozzle with an exit diameter of 3 cm. The total irreversible head loss of the system is 4 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.
3. [Chapter 14] In fully developed laminar flow in a circular pipe the velocity at $R/2$ (midway between the wall surface and the centerline) is measured to be 13 m/s . Determine the velocity at the center of the pipe.

Answers

1. (a) 13.3 kg/s , (b) 287 kPa
2. 324 kW , 84.9 m/s
3. 17.33 m/s