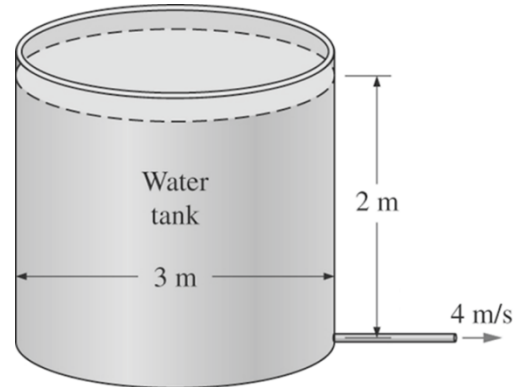

Fluid Mechanics - 2

A 3-m diameter tank filled with water drains to the atmosphere through a 10 cm diameter and 100 m long pipe. The tank water surface is open to the atmosphere and is initially filled 2 m above the center of the drain pipe. The friction factor of the pipe is 0.015, the kinetic energy coefficient factor for flow in the pipe is $\alpha=1$, and the loss coefficient at the entrance is $K_L=0.5$. Determine:

- (a) The initial discharge velocity from the tank (**25 points**).
- (b) The time required to lower the water level in the tank to 1 m (**30 points**).



- (c) In order to drain the tank faster, a pump is installed as shown in the figure. Determine the pump power needed to establish an average discharge velocity of 4 m/s at the initial instant when the tank is full (**30 points**).
- (d) Would the system work if the pump is installed near the exit? Justify your answer quantitatively. (**15 points**).

