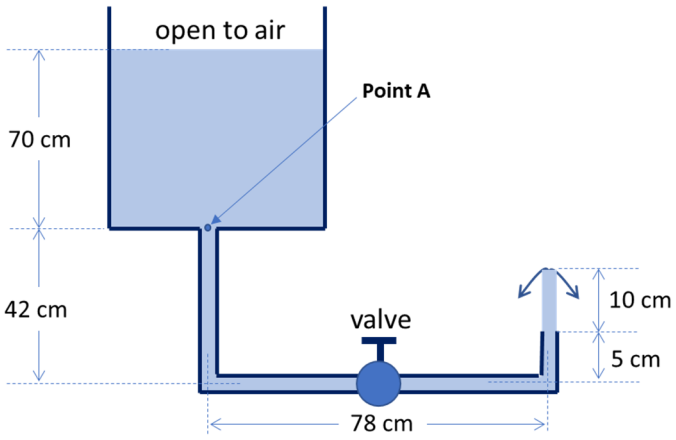
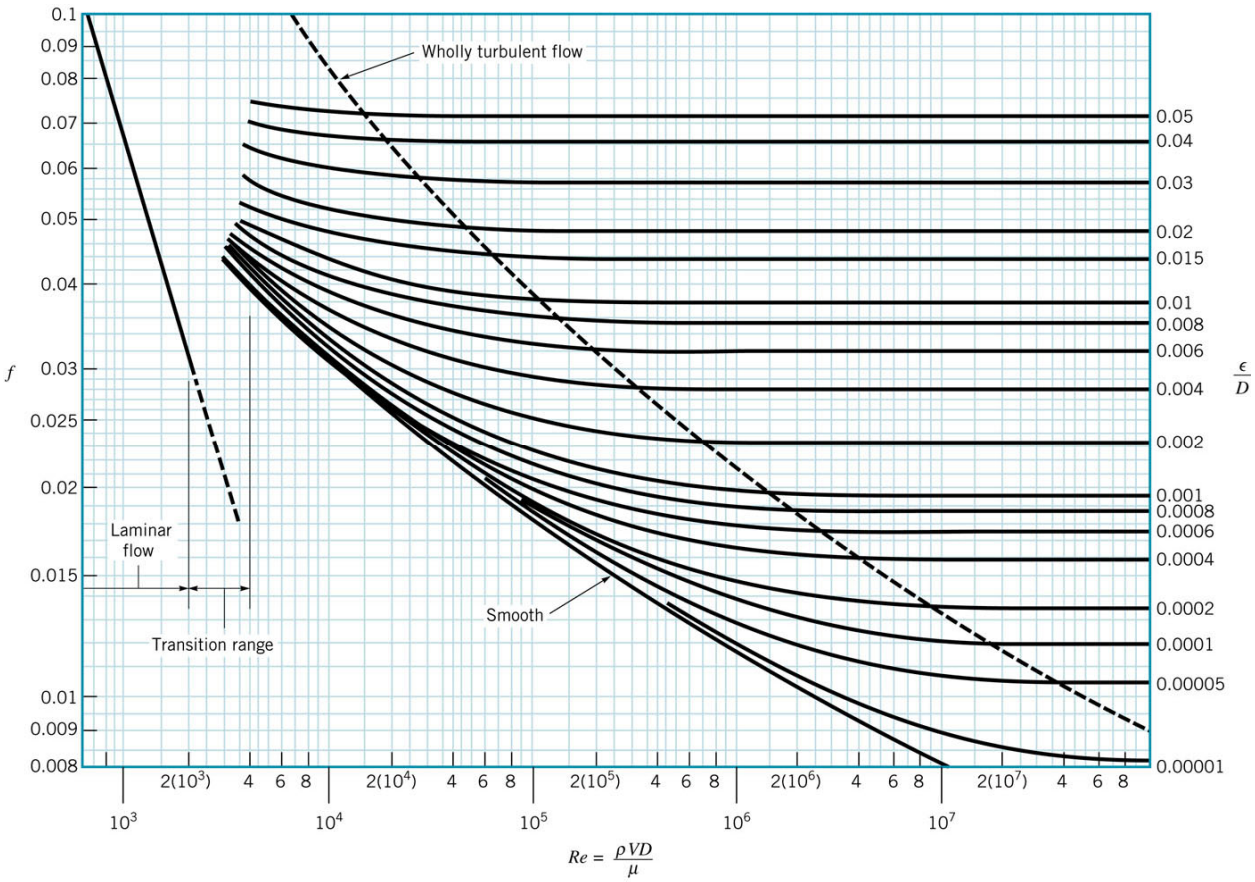
## Fluids - 2

Water is drained steadily from a large tank through a valve (see figure below). The pipe is 1.25 cm in diameter and its surface roughness is 0.05mm. The two 90° regular elbows are threaded. The loss associated with flow from the tank into the pipe is negligible. When the valve is full open, the water is discharged into the air and reaches a height of 10 cm as shown below.

1. Determine the speed of water at pipe's exit; (**20 pts**)
2. Determine the pressure at point A in the figure; (**15 pts**)
3. Determine the loss coefficient $K_L$ of the fully opened valve
   - Set up the necessary equations for solving this problem (**50 pts**);
   - Obtain the numerical value of $K_L$ (**15 pts**). Partial credit will be given for your work.

Loss coefficient table and Moody chart are available on the next page. Properties of water: density – 1000 kg/m3; viscosity – 0.001 Pa·s. g=9.81 m/s$^2$.






**Loss Coefficients for Pipe Components** $\left(h_L = K_L \frac{V^2}{2g}\right)$ **(Data from Refs. 5, 10, 27)**

| Component | $K_L$ |
|---|---|
| **a. Elbows** | |
| Regular 90°, flanged | 0.3 |
| Regular 90°, threaded | 1.5 |
| Long radius 90°, flanged | 0.2 |
| Long radius 90°, threaded | 0.7 |
| Long radius 45°, flanged | 0.2 |
| Regular 45°, threaded | 0.4 |
| **b. 180° return bends** | |
| 180° return bend, flanged | 0.2 |
| 180° return bend, threaded | 1.5 |
| **c. Tees** | |
| Line flow, flanged | 0.2 |
| Line flow, threaded | 0.9 |
| Branch flow, flanged | 1.0 |
| Branch flow, threaded | 2.0 |