1. Determine the smallest metric Schedule 40 steel pipe that will carry 4 L/min of the following fluids while maintaining laminar flow. Assume the fluids are at room temperature. Report your answer as a metric Nominal Pipe Size (DN).

   (a) water

   (b) hexane

   (c) propane

2. Acetone at 77°F is flowing in a 1 inch Schedule 80 steel pipe with a volume flow rate of 5.0 gpm. Compute the pressure difference between two points 300 feet apart if the pipe is horizontal.

3. Crude oil flows vertically downward through 60 m of DN 25 Schedule 80 steel pipe at a velocity of 0.64 m/s. The oil has a specific gravity of 0.86, is at a temperature of 0°C and has dynamic viscosity $\eta = 1.7 \times 10^{-2}$ Pa$\cdot s$. Compute the pressure difference between the top and bottom of the pipe. Report your result as $p_{\text{top}} - p_{\text{bottom}}$ in kPa.

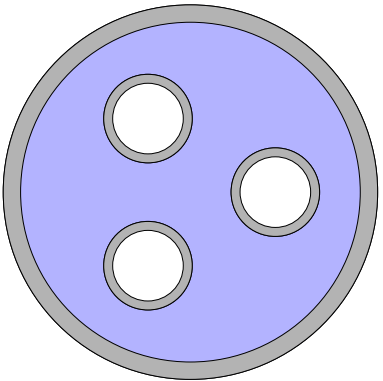
4. Estimate the pressure drop of propane at 77°F with a flow rate of 500 L/min in the following three scenarios. All pipes are Schedule 80 commercial grade steel.

   (a) A sudden contraction from a DN 125 pipe to a DN 50 pipe.

   (b) A sudden enlargement from a DN 50 pipe to a DN 125 pipe.

   (c) Flow through a fully open globe value placed in a DN 80 pipe.

5. Water at 15°C is flowing at a rate of 800 L/min through the shell constructed from an outer 5-in Schedule 40 steel pipe and three inner 1-in Schedule 40 steel pipes as shown below.



(a) What is the Reynolds number for the flow?

(b) What is the pressure drop across a length of 4 meters?

6. Compute the volume flow rate of water through the pipe system shown below. The piping is 4-in schedule 40 steel.

   Take into account the following losses: entrance loss from the tank, a fully open gate valve, two ninety degree standard elbows, 85 feet of straight pipe, and loss through the nozzle. Treat the nozzle as a sudden contraction from the 4-in pipe into a 2-in opening.

   As an approximation you may use the fully turbulent value of the friction factor for the loss in the 4-in pipe.

   Report your volume flow rate in ft^3/s.