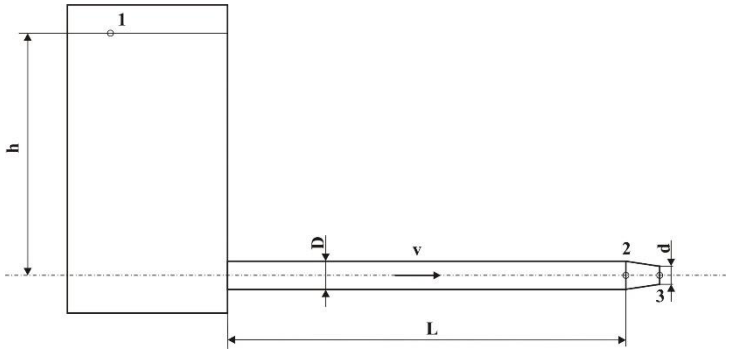
IME 5th Problem solving seminar – 2019

<u>Problem 1</u>: Outflow of a water pipe

There is a large-diameter tank filled with water, whose top is open to the air. At the side of this tank, there is an outlet water pipe connected with length 15 m and diameter 20 cm below 6 m from the water surface. The water flows out of the pipe (to the air??)

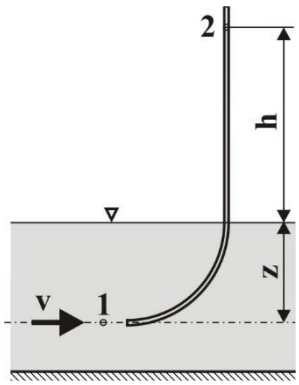
a) **Find the velocity of the water at the outlet, if the friction loss is neglected!**
b) **Find the velocity of the water at the outlet, if the pipe friction factor/coefficient is 0.03!**
c) **The area of the outlet cross section is halved by adding a confuser to the end of the pipe. Calculate the outlet water velocity!**
d) **What is the water velocity in the pipe after adding the confuser?**



<u>Problem 2</u>: Pitot tube/pitot probe

A curved tube is immersed into horizontally flowing water with velocity of *v*=5 m/s.

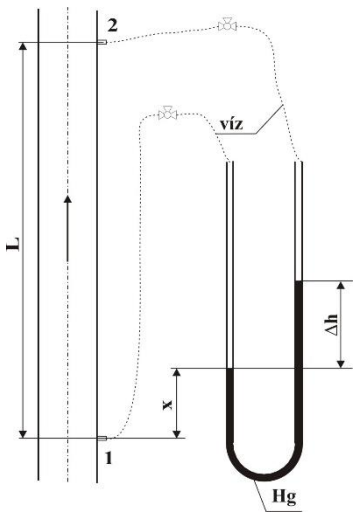
a) **Determine the difference between the level in the tube and the surface of the water!**
b) **Calculate the gauge pressure at the level of the leg of the tube and at the stagnation point if z=0.5 m!**



<u>Problem 3</u>: Vertical pipe

A U-tube manometer is connected to a vertical pipe as shown in the figure. The length between the connection points is *L*=1.5 m. The water flows upwards with a volume flow rate of *Q*=4 dm^3/s. The inner diameter of the pipe is 54.2 mm and the pipe friction factor is 0.019.

a) **Find the pressure difference between the connection points (1) and (2).**
b) **Calculate the difference between the levels of the mercury in the manometer!**



<u>Problem 5</u>: Vertical expanding pipe (diffuser)

The pressure difference between two points of a vertical expanding pipe (diffuser) is measured by mercury U-tube manometer. Find the volume flow rate, if Δ*h*=120 mm, *d*=100 mm, *D*=150 mm. Water flows in the pipe, and the pressure transmitting fluid is also water.