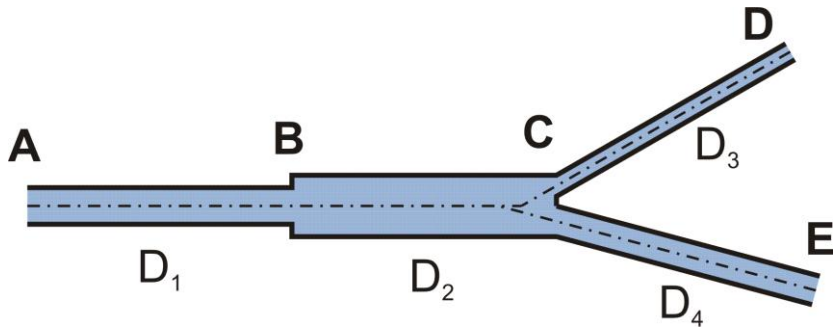
4th exercise

Hydraulics of pipelines: Continuity equation, Bernoulli equation, friction losses and local losses

4.1.

A pipeline system consists of reach **AB** – diameter $\mathbf{D_1 = 0.05\ m}$, reach **BC** – diameter $\mathbf{D_2 = 0.075\ m}$, reach **CE** – diameter $\mathbf{D_4 = 0.03\ m}$, and from reach **CD**, the diameter of which is still unknown. However, mean velocity in reach **BC** $\mathbf{v_2 = 2\ ms^{-1}}$, mean velocity in reach **CD** $\mathbf{v_3 = 4.5\ ms^{-1}}$**.** There is a request that discharge in the last reach should be one third of the total discharge ($\mathbf{Q_4 = Q_1/3}$). Determine a discharge in every pipe and calculate other characteristics – or mean velocity **v**, or diameter **D**.



*(**Result**: Q_1= 8,84 l.s^{-1}; Q_2= 8,84 l.s^{-1}; Q_3= 2,94 l.s^{-1}; Q_4= 5,9 l.s^{-1}; D_3= 4,08 cm)*

4.2

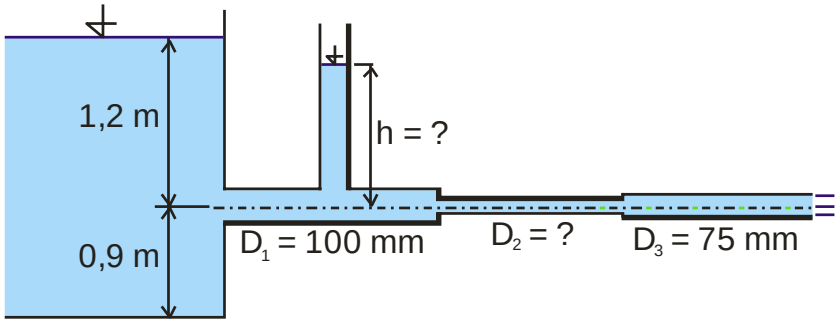
Liquid outflows from the large reservoir through the pipeline with diameter D_1. After a certain distance this diameter will be changed to diameter D_2 and then into D_3. At the end of the pipeline the liquid outflows to the open space.

a) Calculate the discharge outflowing from the reservoir

b) Determine to what height the level rises in the open tube connected to the first pipe section (h =?)

c) Determine at which internal diameter D_2 an underpressure of 80 kPa would be generated on this pipe section.

Solve for a hypothetical case of ideal liquid with a density of 1000 kg.m^{-3}.



*(**Result**: Q = 21,1 l.s^{-1}, h = 0,82 m, D_2 = 45 mm)*