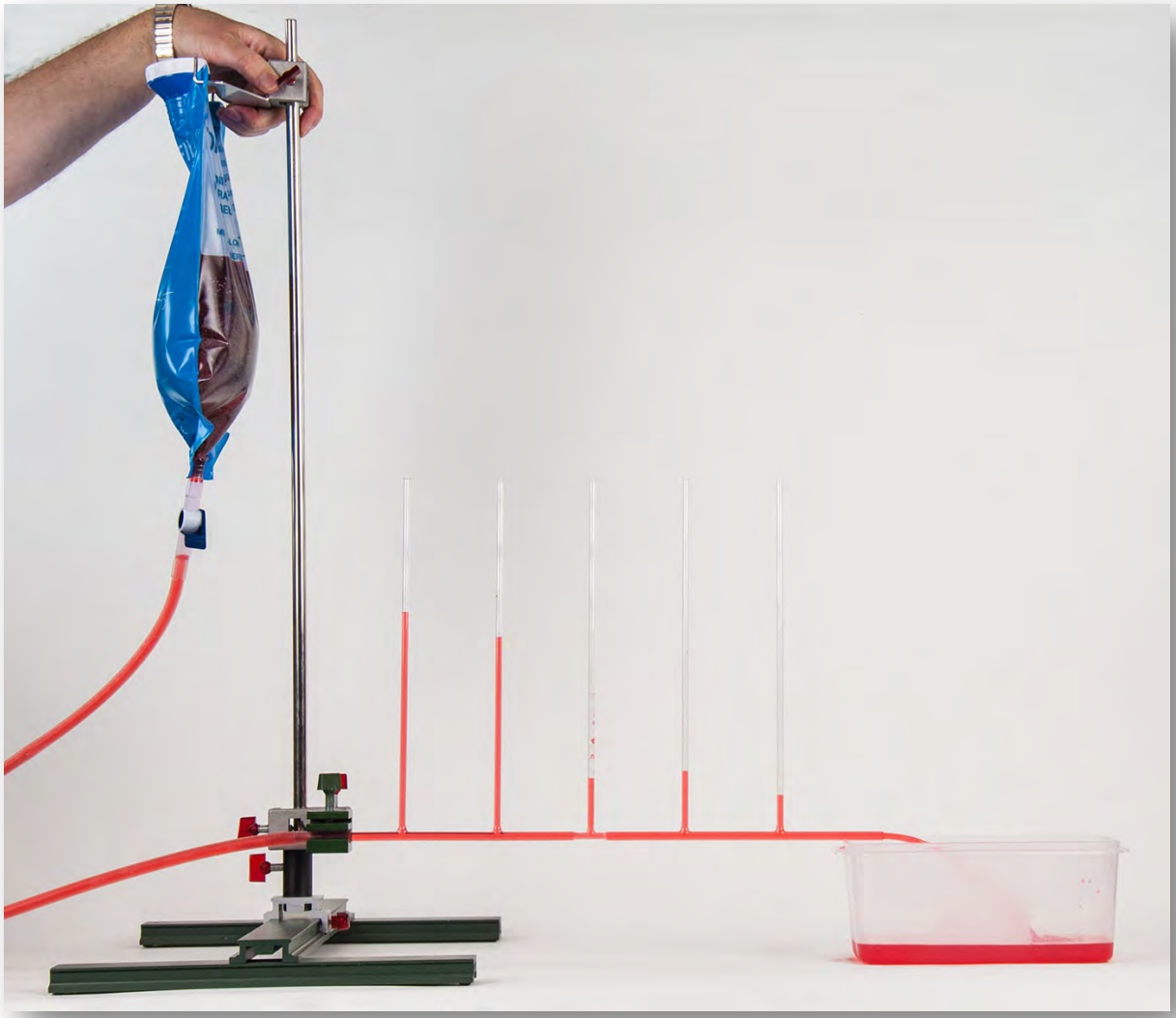
FLOW TUBE OF VARYING DIAMETER

MED 19.04



Material:

Item Code	Qty	Description
DS101-1G	1	Support base, large, L=500 mm
DS093-04	1	Sliding saddle "Sepp", H=40 mm
DS095-3K	1	Bosshead cross-pattern, demo 03
DS404-1G	1	Plate clamp on support
DS201-00	1	Support rod, round, L=1000 mm, D=12 mm
DM462-2D	1	Flow tube of varying diameter
DM461-1B	1	Discharge bag 3000 ml, with stopcock and holder
C7447-1G	1	Water Tank, 230x150x105 mm, plastics
P7050-1A	1	Powder dye, red

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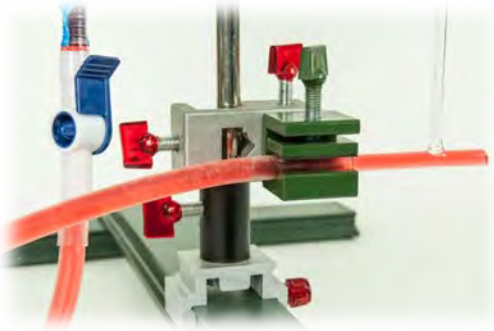
Purpose
To investigate the relation of pressures in stationary flows of tubes with varying diameter

Preparation
Place the sliding saddle in the centre of the support base; afterwards insert the support rod into this sliding saddle.



Mount the bosshead right above the sliding saddle and fix the plate clamp on support at this bosshead.

Fix the suspension of the discharge bag in the centre of the support rod and hang the discharge bag on the suspension; make sure that the stopcock of the discharge bag is closed.

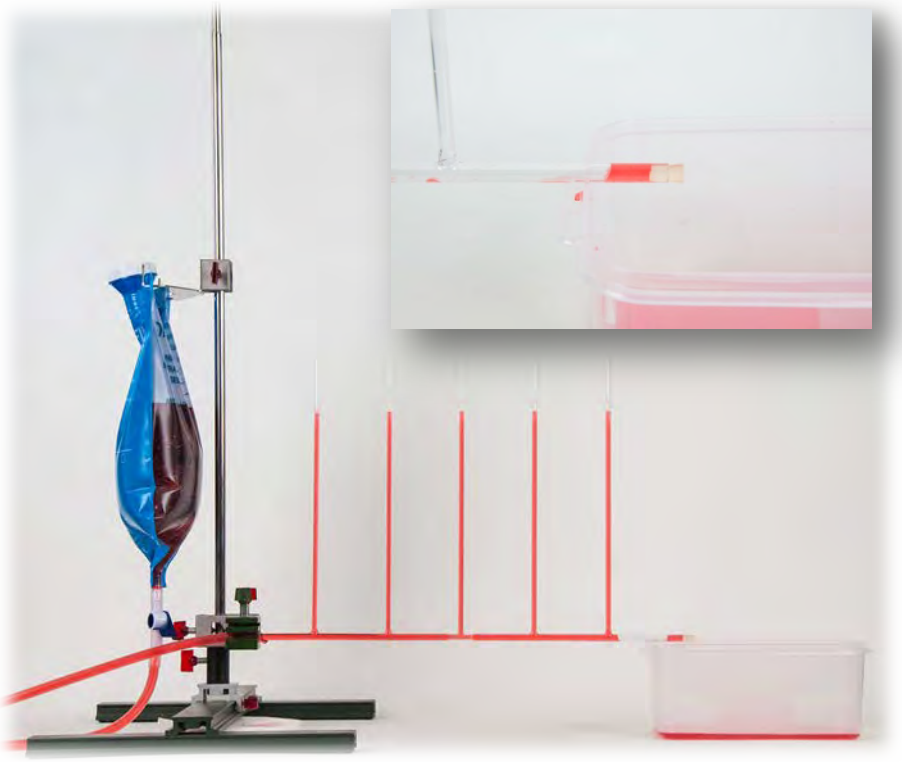
Moisten one end of the flow tube and insert the tube carefully for around 3 cm into the hose of the discharge bag.

The flow tube is fixed at the plate clamp on support with this covered end.

Place the free end of the flow tube on the edge of the water tank, thus the flow tube should be in horizontal position. If required this can be adjusted by changing the height of the bosshead; afterwards pour 2000 ml coloured water into the discharge bag.

Lower the discharge bag until the water level is a few centimetres below the upper end of the manometer tubes (standing tubes).

Close the free end of the flow tube with the small silicone stopper



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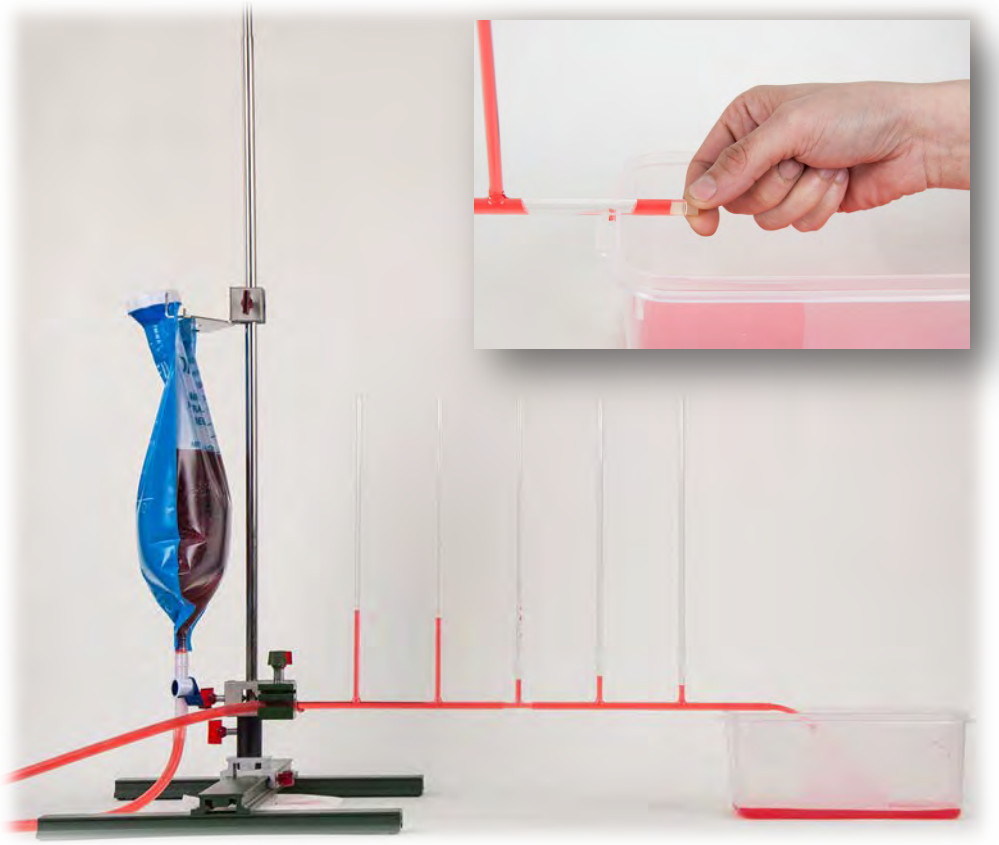
Experiment 1
Open the stopcock of the discharge bag slowly and observe the filling of the manometer tubes. Now remove the small silicone stopper.



The water flows through the horizontal flow pipe, observe the height of the liquid pillars in the manometer tubes. This height shows the static pressure at these points.

Result
A linear pressure drop can be observed at the manometer tubes, however it is not linear.

At the choke point (the centre of the horizontal tube) the pressure (water pillar) is lower.
The reason for this is the higher flow speed.

Stop the flow by closing the end with the silicone stopper again.

Now you can clearly see that the liquid pillars (pressures) on all pipes are of the same height when the liquid in the horizontal pipe is at rest.
The liquid level in the tubes is also the same as in the discharge bag; we find the principle of "communicating vessels" here.

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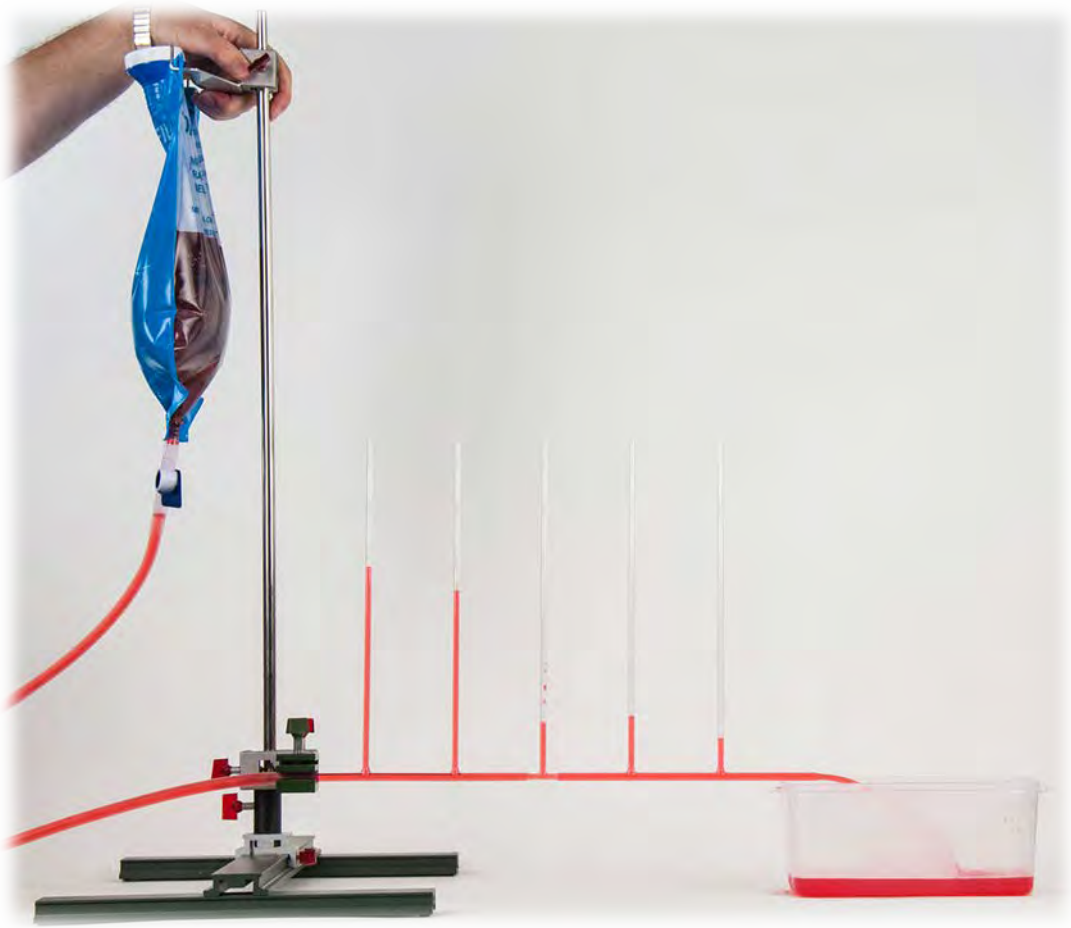
Experiment 2
Remove the silicone stopper again from the end of the flow tube.
Move the discharge beaker slowly to the upper end of the support rod and later on put it back to its original position.

Again observe the height of the water pillars in the manometer tubes.



Result
The higher the discharge bag is raised the higher is also the pressure in the flow tube; the height of the liquid pillars changes proportionally.

Note
The flow through tubes is described by Bernoulli's equitation

$$\rho.v^2/2 + \rho.g.h + p = \text{const.}$$

from which the reduction in pressure p results with increased flow velocity v.