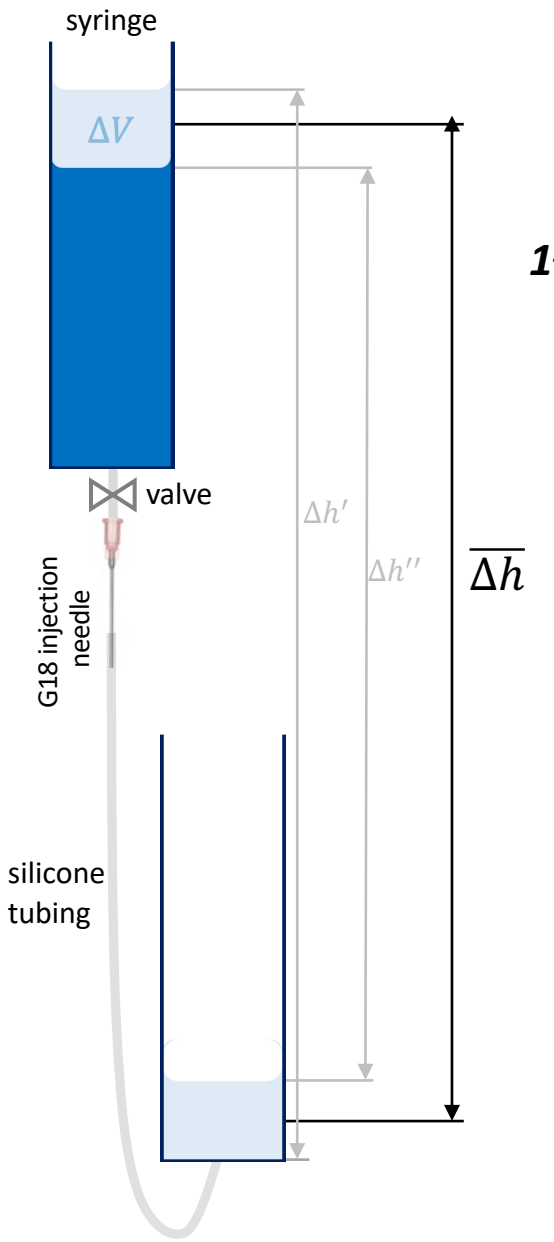
Medical biophysics II.

Flow lab

Department of Biophysics and Radiation Biology

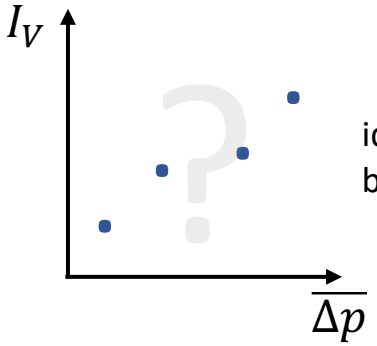


Pressure difference – volumetric flow rate relationship

1st task: To measure the flow time (Δt) of given fluid volume (ΔV) in cases of various average height differences ($\overline{\Delta h}$).

$$\overline{\Delta p} = \rho \cdot g \cdot \overline{\Delta h}$$

$$I_V = \frac{\Delta V}{\Delta t}$$



identify the function between I_V and $\overline{\Delta p}$

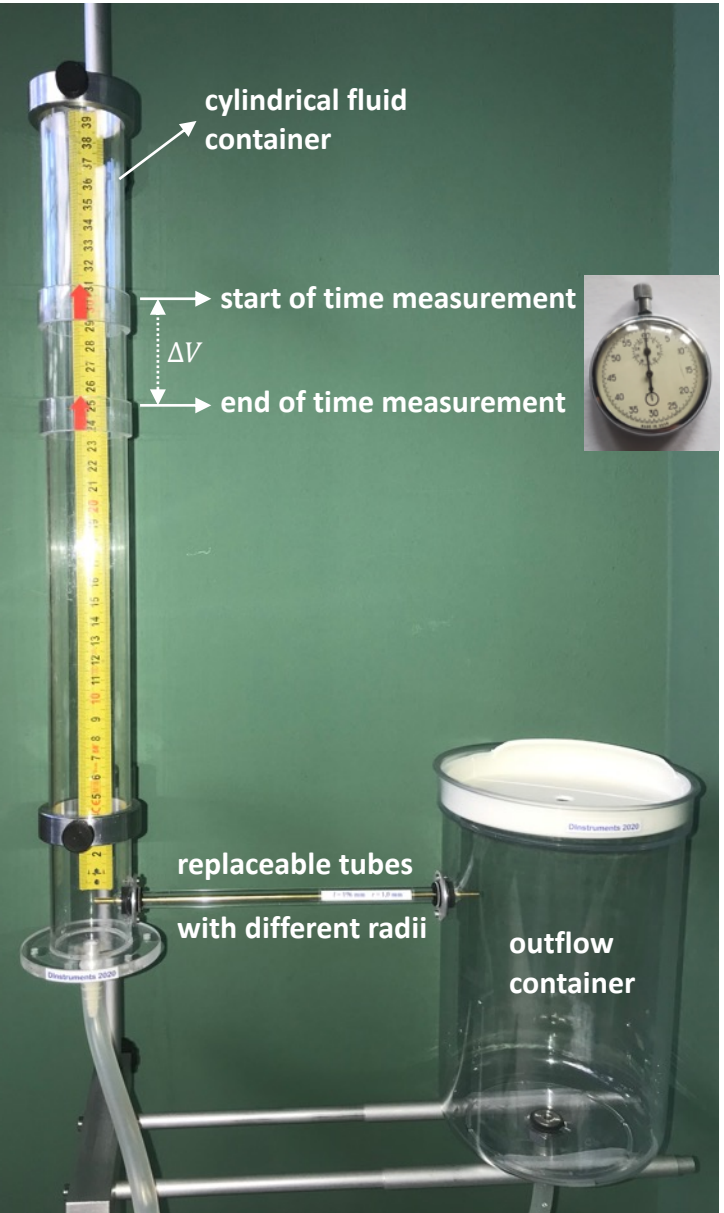
Pressure difference – volumetric flow rate relationship

$$\Delta V = 20\ ml$$

$\overline{\Delta h}$ (m)	Δt (s)
0,26	44
0,46	25
0,66	17
0,86	13

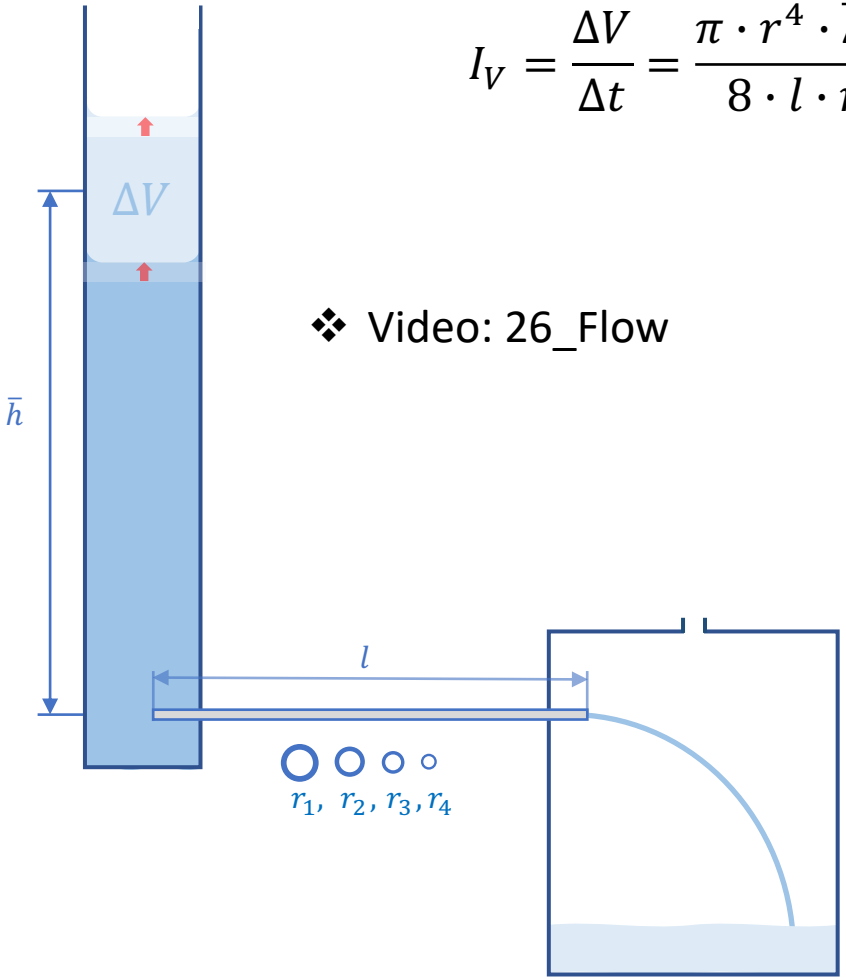
$$\overline{\Delta p} = \rho \cdot g \cdot \overline{\Delta h} \qquad I_V = \frac{\Delta V}{\Delta t}$$

Proving the Hagen – Poiseuille law



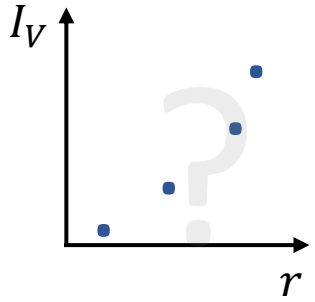
***2nd task*:** To measure the flow time (Δt) of given fluid volume (ΔV) in cases of various tube radii(r).

$$I_V = \frac{\Delta V}{\Delta t} = \frac{\pi \cdot r^4 \cdot \overline{\Delta p}}{8 \cdot l \cdot \eta}$$



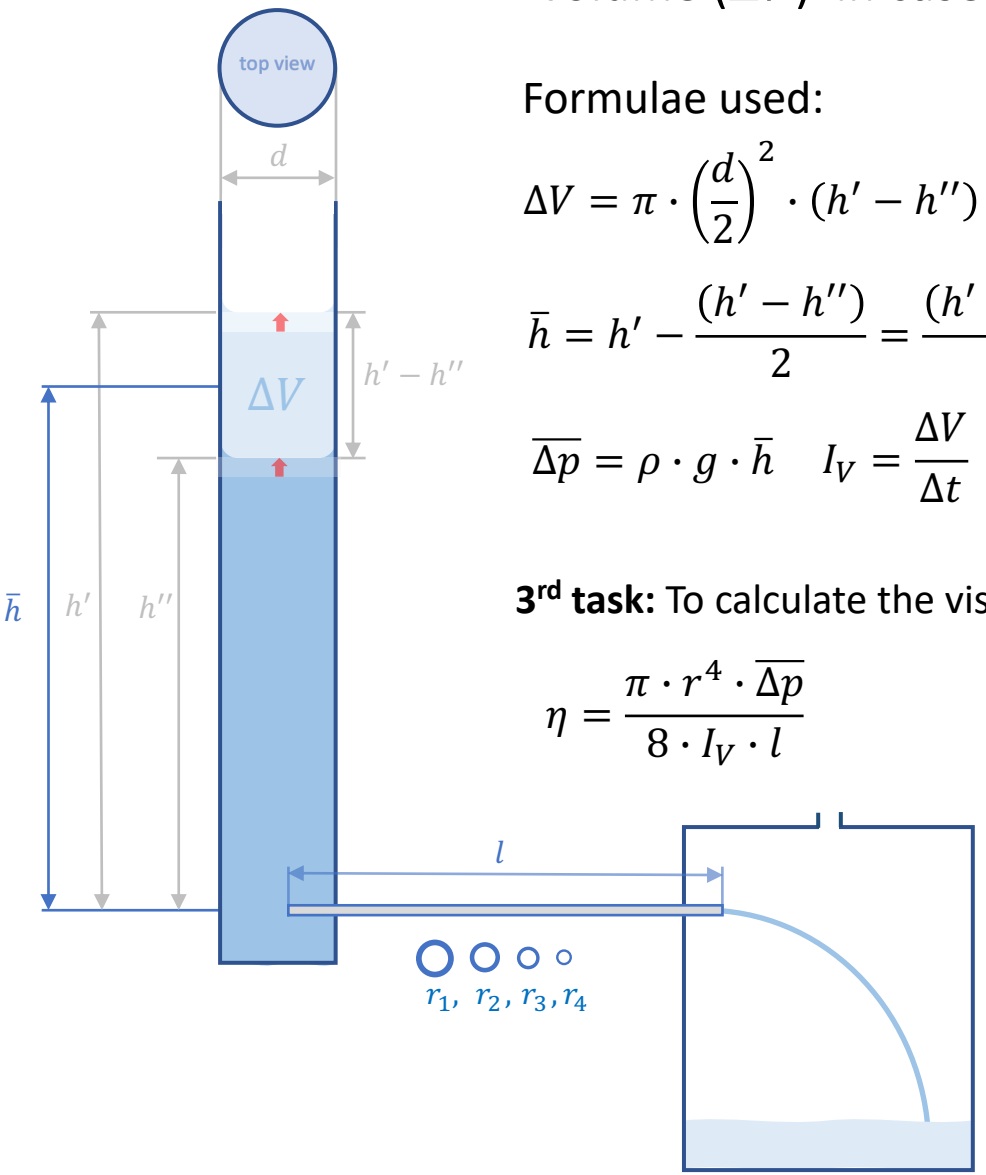
❖ Video: 26_Flow

identify the function between I_V and r



Proving the Hagen – Poiseuille law

***2nd task*:** To measure the flow time (Δt) of given fluid volume (ΔV) in cases of various tube radii (r).



Formulae used:

$$\Delta V = \pi \cdot \left(\frac{d}{2}\right)^2 \cdot (h' - h'')$$

$$\bar{h} = h' - \frac{(h' - h'')}{2} = \frac{(h' + h'')}{2}$$

$$\overline{\Delta p} = \rho \cdot g \cdot \bar{h} \quad I_V = \frac{\Delta V}{\Delta t}$$

3rd task: To calculate the viscosity of water

$$\eta = \frac{\pi \cdot r^4 \cdot \overline{\Delta p}}{8 \cdot I_V \cdot l}$$

Measurement results:

$$d = 4\ cm$$
$$l = 19{,}6\ cm$$
$$h' = 30\ cm$$
$$h'' = 25\ cm$$

Tube radius r (mm)	Flow time Δt (s)
1	12
0,8	26
0,6	85
0,415	378