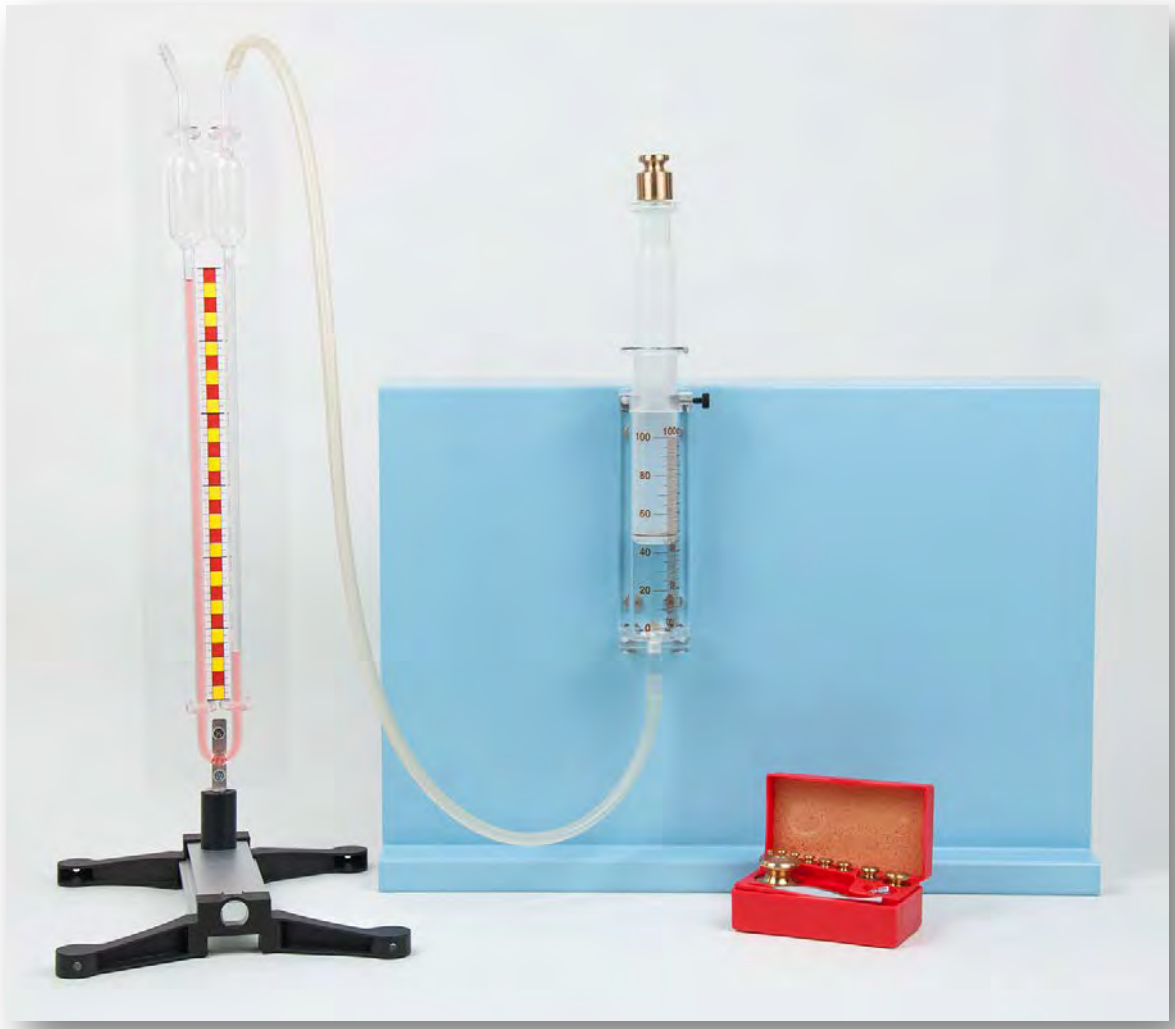
LIQUID (U-TUBE) MANOMETER MED 16.07



Material:

Item-no.	Qty.	Description
DS615-1P	1	Metal plate for MBC system, 50 x 35 cm
C6100-1B	1	Syringe, 100 ml, glass
C6100-5H	1	Holder for syringe 100ml, "inno"
C7445-6S	1	Hose, silicone, D=6/9 mm, L=100 cm
DM120-1D	1	Balance weights, set, 10mg - 200g
C6100-2A	1	Syringe, 120ml, plastics
DS090-3K	1	Claw base "Sepp", 260 x 220 mm
DM450-1M	1	U-tube manometer

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Purpose
Demonstrating overpressure and underpressure with a liquid manometer.

Preparation
- place the magnetic holder for the 100 ml syringe as show on the image

- pull the piston out of the syringe and remove the plastic balls from the inside, afterwards insert the piston again

- fix the U-tube manometer to the saddle claw base

- fill the Manometer with water, around 50 ml of coloured water are required

- connect a short piece of silicone hose to one of the connector of the Manometer

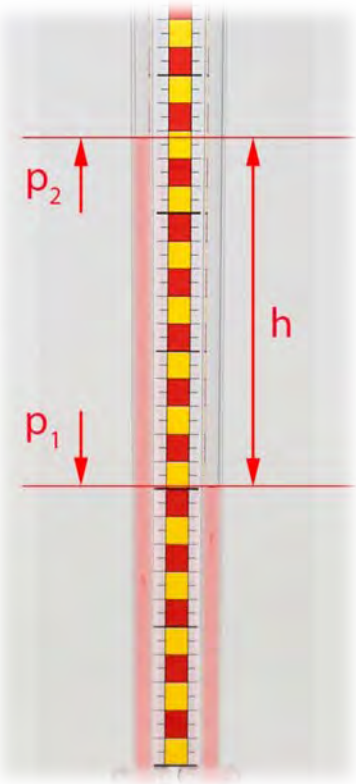
- soak up the coloured water with the plastics syringe and connect this syringe to the short piece of silicone hose

- now carefully pour so much water into the U-tube that the water level reaches approximately to the middle of the scale (as shown on the left image)

- draw the syringe up to 50 ml and connect it to the Manometer with a long piece of the silicone hose

- the mass of syringe alone exerts already a pressure force which is displayed on the Manometer tubes (as shown on the right image)

- since we cannot tare the U-tube manometer (liquid manometer), we note the height difference "h" - this is our "initial pressure":



The height difference of the water pillars is ……. cm.

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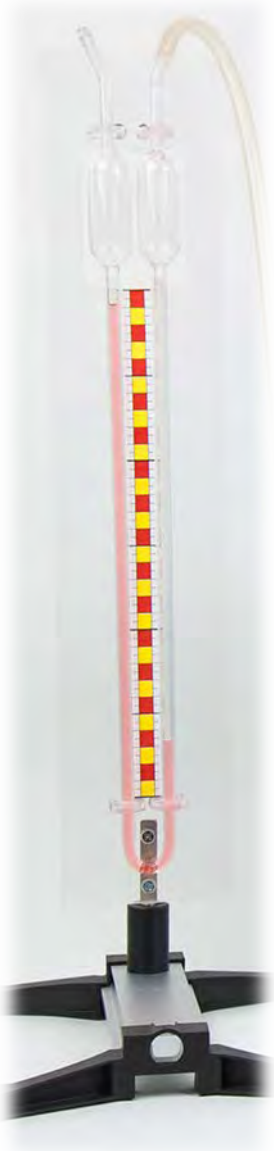
Experiment 1
Place a 100 g weight on the piston plate of the syringe.



The height difference of the water pillars is now ……. cm.

The difference to the experiment setup without weight is……. cm.

This corresponds to a pressure of……. hPa.

How can the height difference be converted into pressure?

The pressure difference of both ends of the U-tube Manometer is ***Δp = ρ · g · h***
with the height difference h of the two water pillars.

$$\Delta p = p_2 - p_1 = 1\ g/cm^3 \cdot 9{,}81\ m/s^2 \cdot \ldots\ mm = \ldots\ Pa$$

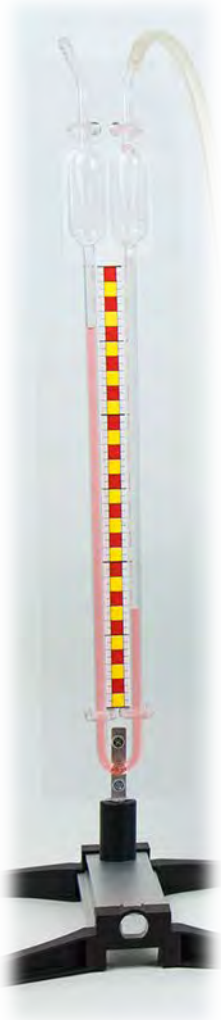
(1 cm water pillar = 1 hPa)

Compare
The diameter of the piston is 31 mm which results in an area of 7.54 cm².

The 100 g weight exerts a pressure force of 0.981 N.

$$Pressure = \frac{Force}{Area} \qquad p = \frac{F}{A} \qquad 1P = \frac{\mathrm{N}}{\mathrm{m}^2} \qquad 100\ hPa = \frac{\mathrm{N}}{\mathrm{cm}^2}$$

Experiment 2
Place a 50 g weight on the piston plate of the syringe.
Afterwards repeat the steps from the 1st experiment.

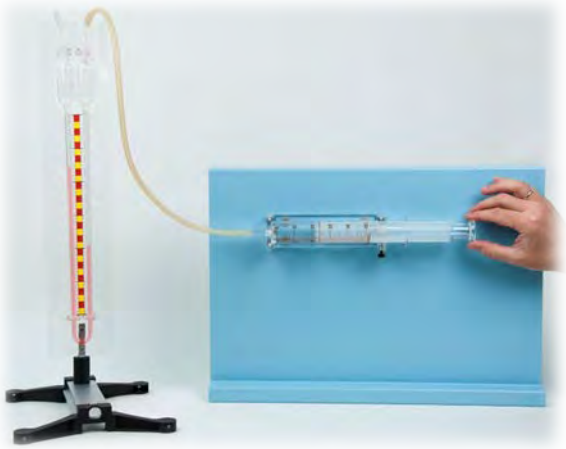


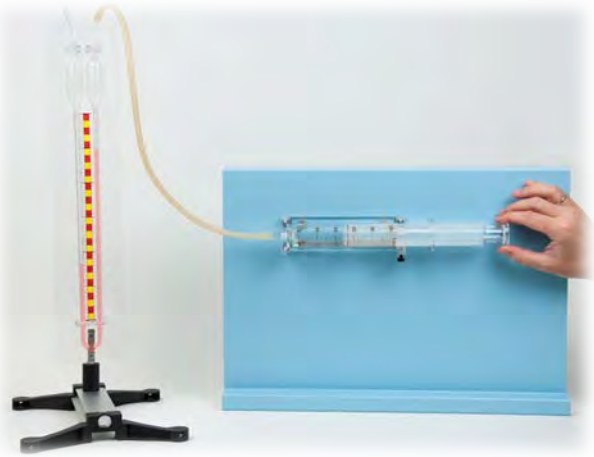
The height difference of the water pillars is now ……. cm.

The difference to the experiment setup without weight is……. cm.

This corresponds to a pressure of……. hPa.

We can also display both overpressure and underpressure with the U-tube manometer.





Note
If the syringe is mounted horizontally, the weight of the piston is irrelevant.