

BOYLE-MARIOTTE'S Law

Equipment:

cylinder and piston made of acrylic glass
(e.g. diameter of 26 mm)
three flat weights
(e.g. 1.8 kg, 3.6 kg and 10.8 kg)

Chemicals:

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Safety:

The usual precautionary measures should be taken into account when handling heavy objects, which can easily lead to crushing or even breaking of fingers and toes if they fall down.

Procedure:

Preparation: The inner wall of the cylinder is lightly greased.

Procedure: The different weights are successively placed one on top of the other on the piston of the air-filled cylinder, starting with the lowest weight. It is advisable to lift the weights slightly by hand and then press them down to overcome the static friction. This procedure allows to feel the equilibrium position quite well. Light tapping with a wooden handle (or shaking with a vibrator) may also be helpful.

Observation and Explanantion:

If the cross section of the piston equals 5.3 cm^2 , the pressure due to the weights increases to around 133 kPa, 200 kPa and finally 400 kPa, whereas the volume of the air trapped in the cylinder decreases to $\frac{3}{4}$, $\frac{1}{2}$, $\frac{1}{4}$ of the initial value. As expected according to BOYLE-MARIOTTE'S law, the volume of the gas (at constant temperature, here room temperature) is inversely proportional to the pressure.

Disposal:

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Supplement:

An interesting alternative is the "Gas Law Apparatus." By turning the hand crank, individual gas volumes can be preset; the pressure gauge immediately shows how the pressure increases as the volume decreases. In this way, it is easy to demonstrate the inverse proportionality of gas volume and pressure. The digital thermometer can be used to verify that the temperature remains (more or less) constant.

