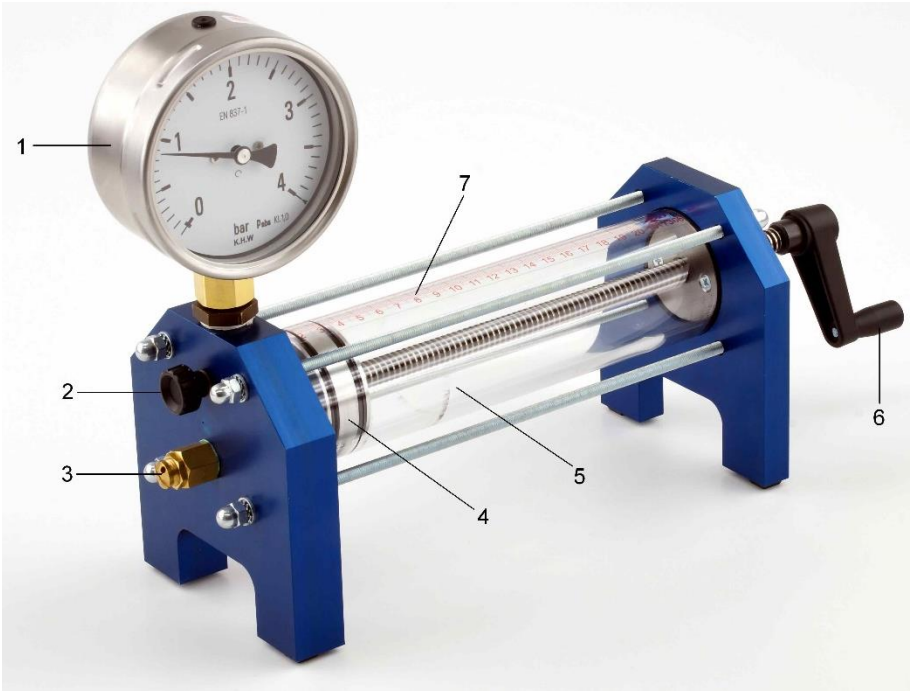
Boyle's Law Apparatus E 1017366

Instruction manual

12/13 SD/ALF



1	Manometer	4	Piston with ring-shaped gaskets	6	Crank with threaded shaft
2	Inlet and outlet valve	5	Main cylinder	7	Scale
3	Safety valve				

1. Description

Boyle's law apparatus E is for investigating the relationship between volume and pressure in a body of air inside an enclosed space at constant temperature. It also serves to confirm Boyle's law.

The apparatus consists of an enclosed perspex cylinder with a piston which can be moved in order to modify the volume enclosed. There is also a scale for determining the volume and a manometer to measure the pressure. The piston is moved by turning a threaded shaft with a crank handle. The force needed to achieve this is not very large since the ring gaskets on the piston are lubricated with a small amount of silicone oil.

An air inlet/outlet valve can equalise pressure with the surrounding atmosphere with the piston in any position. Any movement of the piston thereafter results in the pressure changing to above or below atmospheric pressure depending on the initial conditions.

A safety valve opens if the excess pressure should rise to more than 3.5 bars.

2. Technical data

Main cylinder:

Length:	230 mm
Internal diameter:	50 mm
Maximum pressure:	3.5 bars
Piston:	22 mm x 50 mm diam.
Volume:	410 cm³
Dead space volume V_0:	20 cm³ approx.

Scale:

Length:	200 mm
Divisions:	1 mm

Manometer:

Pressure range:	0 – 4 bars
Diameter:	100 mm
Tolerance class	1

3. Operation

- Turn the piston back and forth a little so that the gaskets come into contact with the silicone oil.
- Set the piston to the desired point, e.g. 20 cm and let air into the cylinder to equalise the air inside with the surrounding atmosphere (p = 1 bar).
- Close the air inlet/outlet valve.
- Move the piston to a new position by turning the threaded shaft.
- Read off the piston position s and the pressure p.
- Calculate the volume V using the following expression

$$V = s \cdot \pi \cdot \frac{d^2}{4} + V_0$$

where d = 50 mm, V_0 = 20 cm³

- Plot the measurements on a graph.

Note: the amount of air with which the Boyle's law apparatus is filled depends on the position of the piston when the pressure was equalised with the surrounding atmosphere. The maximum quantity of air inside is reached when the piston is at 20 cm.

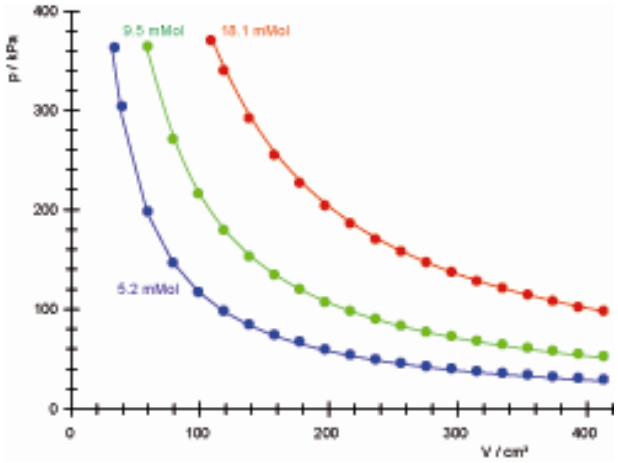


Fig. 1 Pressure-volume diagram for air at room temperature with three different amounts of substance