5. Isothermal process

1 Introduction

The aim of the experiment is verification of the Boyle– Mariotte law, expressed with the equation:

$$pV = idem$$

2 The experiment station description

The experiment station is composed of an elastic U-tube manometer, partially filled with a manometric liquid (fig. 1). The rigid left arm of U-tube manometers is ended with a valve (*Z)* opened and closed manually. Closing the valve causes the occurrence of a reservoir of the gas. The reservoir has constant cross-section and adjustable, (by the position of a manometric liquid), height *(L_i).* The change of meniscus position is obtained by moving the right arm of the U - tube.

3 Experiment description

During the experiment, the volume of the gas reservoir above the manometric liquid in the left arm of the U-tube manometer shall be increased by lowering the right arm of the manometer. The volume of the gas is proportional to the height of the reservoir *(L_i).*

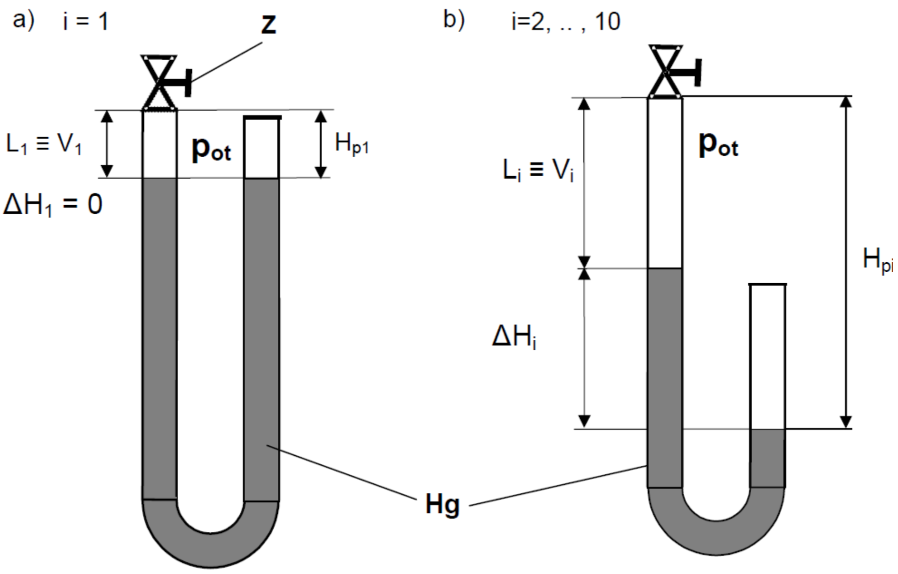

Fig. 1. The test station

The tested gas (air) is in the left arm of the U-tube (fig. 1a). The initial pressure (i=1) is equal to the ambient pressure $p_1=p_0$ (valve opened). The volume change is performed after closing the valve *(Z),* before lowering the right arm of the U-tube (fig. 1b). The height of the liquid meniscus *(H_{pi})* shall be determined for a few corresponding, arbitrary values of *(L_i)*. The value of pressure(p_i) of the gas in the reservoir in the left arm of the U–tube is the algebraic sum of the ambient pressure p_0 and pressure which represents the height of liquid column (ΔH_i) in the U-tube (fig. 1b: the density of the manometric liquid is $\rho = 0{,}87\, {}^{g}/_{cm^3}$, gravitational acceleration is $g = 9{,}81\, {}^{m}/_{s^2}$)

4 Elaboration of results

Based on obtained results calculate the pressures (p_i) of the tested gas

1. Present the results as dependence Y=f(X) on a coordinate system, where:

$$X = \frac{L_1}{L_i}$$

$$Y = \frac{p_i}{p_1}$$

2. Establish the trend line as a representation of first-degree polynomials as well as R^2.

If the law of Boyle– Mariotte is fulfilled, the points on the coordinate system should be gathered around a straight line which starts at the beginning of the system (*intersect with point 0,0 in the chart)*

Date: .... **p_{ot}=** .... **t_o=** .... **T_o=** ....

i	1	2	3	4	5	6	7	8	9	10
L_i mm										
H_{pi} mm										
ΔH_{pi} mm										
P_i MPa										
X										
Y										