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The relation between pressure and volume

Lab-report in Physics
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In this experiment we are to prove the relation $p_1v_1 = p_2v_2$. To prove this we use a piston and weights of different masses. The piston is then pulled down by the weights and we measure the distance (x). We then make a relation between the mass and the distance x. Here is the formula derived:

$$\Delta p = \frac{mg}{A}$$

$$p_1v_1 = p_2v_2$$

$$p_1v_1 = (p_1 - \Delta p)v_2$$

$$p_1Ad = (p_1 - \Delta p)A(d + x)$$

$$p_1d = (d + x)\left(p_1 - \frac{mg}{A}\right)$$

$$p_1d = (d + x)\left(\frac{p_1A - mg}{A}\right)$$

$$p_1dA = (d + x)(p_1A - mg)$$

$$d + x = \frac{p_1dA}{p_1A - mg}$$

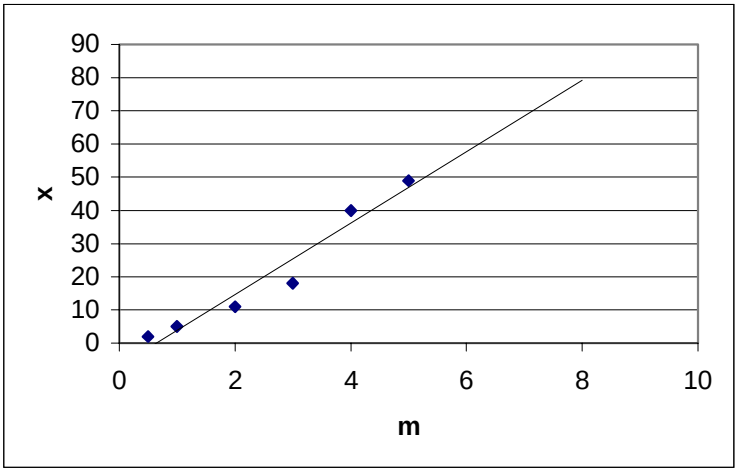
$$x = \frac{p_1dA}{p_1A - mg} - d$$

m is the mass of the weight
A is the area of the piston
d is the initial distance, where the piston was initially
x is the distance the piston has moved

So now it is just to collect data and look for a pattern and see if it match the formula. Here is the data:

Area = $7{,}94.10^{-4}$ m^2
p_1 = 101300 Pa
d = 0,03 m
g = 9,82 m/s^2

m (kg)	x (mm)
0,5	2
1	5
2	11
3	18
4	40
5	49



As you can see this curve is most likely to be linear, and so also according to the formula.