PHYS102 Lab-Final Fall 2016-17

Name	Student Number	Group	Signature

Duration of this exam is 30 minutes. You may use a calculator. Write your answer short and below each question.

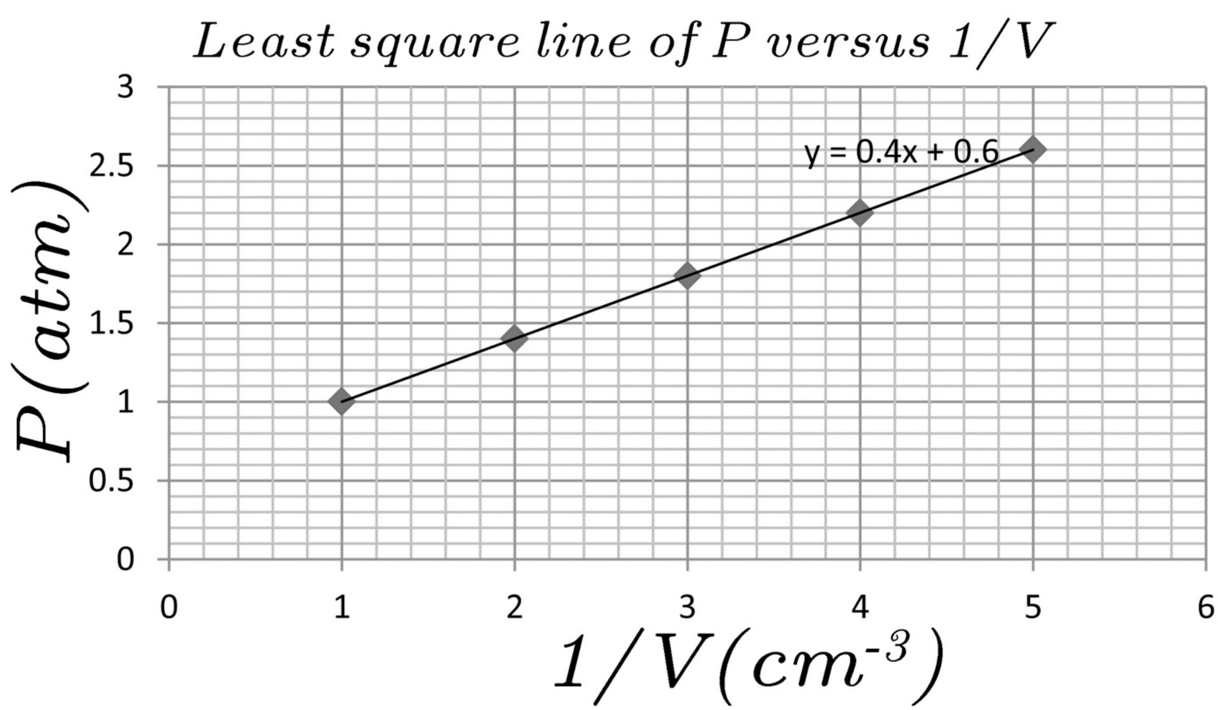
$$1cm^3 = 10^{-6}m^3,\ 1atm = 1.01 \times 10^5 pas.,\ R = 8.314\frac{J}{mol.K}$$

In Experiment 2 you measured the volume of the gas in terms of its pressure at constant room temperature $T = 300K$. The following table was recorded during the experiment:

$P\ (atm)$	$V\ (cm^3)$
1.0	45
1.4	40
1.8	37
2.2	32
2.6	28

The ideal gas law which must be satisfied by an ideal gas is given by $PV = nRT$.

In the following graph we plot the least square line of P versus $\frac{1}{V}$:



If the equation of this least square line is given by $y = 0.4x + 0.6$, answer the following questions:

Question 1) In accordance with the above graph, what quantity is represented by y and what is its unit? (*2 points*)

Your answer: The physical quantity is preassure, measured in atm.

Question 2) What quantity is represented by x and what is its unit? (*2 points*)

Your answer: The physical quantity is 1 over volume, measured in cm^{-3}.

Question 3) Choose two points on the line in the graph and find the slope of the line with its unit. (*2 points*)

Your answer: $m = \frac{\Delta y}{\Delta x} = \frac{2.6atm - 1atm}{5cm^{-3} - 1\ cm^{-3}} = 0.4\ atm\ cm^3 = 0.4\ 1.013\ \times 10^5\ Pa\ (10^{-2}m)^3 = 0.04\ J$

Question 4) What physical quantity is represented by the slope of the line P versus $\frac{1}{V}$? (*2 points*)

Your answer: Energy

Question 5) Use the ideal gas law, the temperature of the gas given above and the slope of the least square line to find the number of the mole of the gas i.e., n. (*2 points*)

Your answer: $nRT = P\ V = 0.04\ J \Rightarrow n = \frac{0.04J}{RT} = \frac{0.04J}{8.314\frac{J}{mol\ K}300\ K} = 1.6\ \times 10^{-5}mol$

Question 6) In Experiment 1 the value of the specific heat of the brass is found to be 360 $\frac{J}{kg.K}$. If the theoretical value of the specific heat of the brass is known to be 380 $\frac{J}{kg.K}$ what is your percentage error. (*2 points*)

Your answer:

$$\%error = \left|1 - \frac{c_{experimental}}{c_{theoretical}}\right| = 1 - \frac{360}{380} = 0.052 = 5.2\%$$