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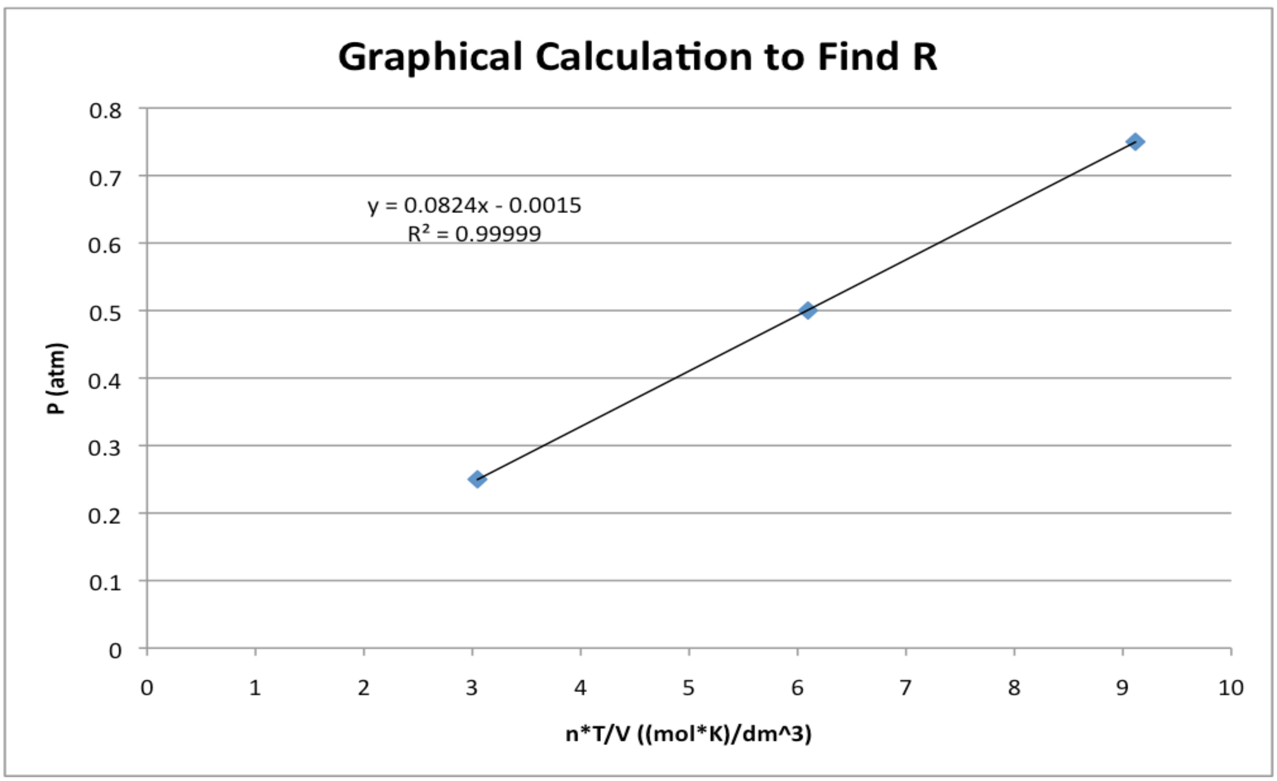
1/19/16
PChem II
HW1
Additional Problem 1

1.) The data listed below have been collected for oxygen gas at 273.15 K. Using these data, calculate the best values for the gas constant, R, and the molar mass of oxygen. (You'll need to make a graph).

P (atm)	V (molar vol, dm^3 / mol)	n/v	n/V * T	p (g/dm^3)	T (K)	PV/nT = R (atm * dm^3 / mol * K)
0.75	29.9649	0.033372379	9.115665328	1.07144	273.15	0.082275947
0.5	44.809	0.022316945	6.095873597	0.71411	273.15	0.082022698
0.25	89.6384	0.011155933	3.047243146	0.356975	273.15	0.082041369

	Value	Percent Error
Graphical R	8.2400E-02	4.1433E-03
Averaged Calc R	8.2113E-02	6.4999E-04
Correct R	8.2060E-02	0.00

The average of the calculated R values is actually more accurate than graphical best fit.



As for the molar mass of oxygen, the following calculations can be made, resulting in an accurate 32.03 prediction for the molar mass of O_2.

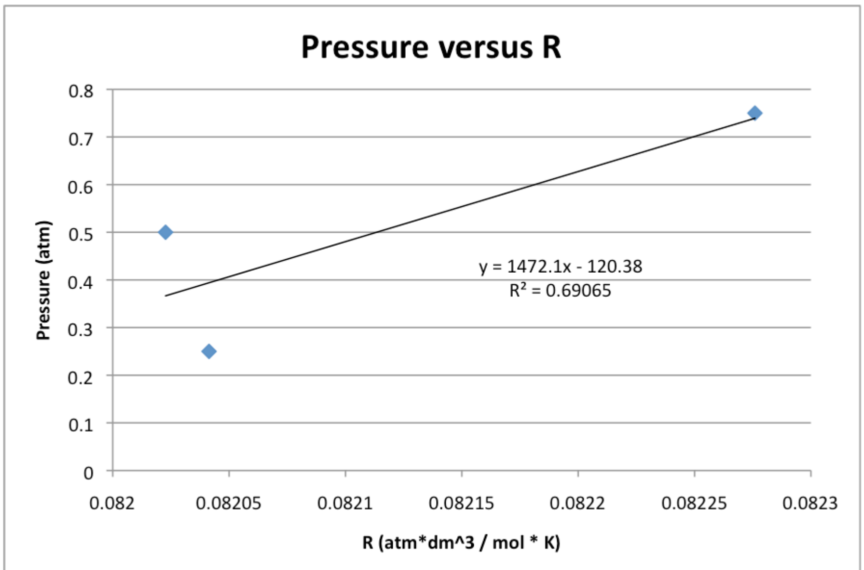
V (dm^3 / mol)	density (g/dm^3)	molecular mass of O2 (g/mol)
29.9649	1.07144	32.10559246
44.809	0.71411	31.99855499
89.6384	0.356975	31.99866784
average		32.03427176

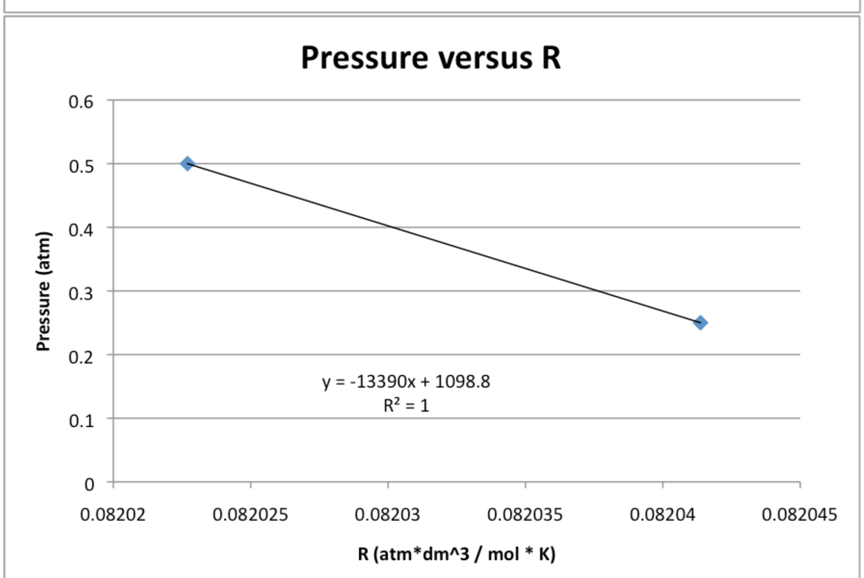
Continued.

You could also create a graphical representation. We are using the ideal gas law, which is only ideal at high temperature, and low pressure. If we create a graph and we look at when the pressure is zero, this would give a more realistic picture of the volume at ideal conditions. We could then use this find the molecular mass of O2.

Goal: want to estimate the molecular mass when the pressure of the substance is zero.

We could plot the value of R against the pressure and then solve for the value of R when the pressure is set to zero. However, if we perform this with the given chart above, we can see that there is a strong outlier. While a graphical fit was at first tried *with all three point, the fit was so poor that the outlier was excluded to adjust*.





Using the second graph, the value of R at zero pressure is calculated to be:

R_{best} = 0.08206124 (atm*dm^3 / mol * K)

Using this, we can extrapolate and use the density to find the ideal molecular mass. The ideal density at pressure 0 would be .0003/1.4289 = 0.000209952.

We can also fit the molecular mass calculated for the second two values and plot that against the pressure. Once again, if we observe P = 0, the molecular mass reported is 31.999 g / mol.