

Unit 1, Homework No. 1: Statistical Treatment of Data

Date issued: Monday, September 05, 2011. This homework is due on or before September 9, 5:00 pm. Late homework assignments will not be graded. Solutions will be available on the Monday after the due date.

1. Assuming that the ideal gas law holds, find the relative error in the number of moles, n , of nitrogen in a container if the pressure, $P = 0.855 \pm 0.003$ atm, the volume $V = 18.85 \pm 0.07$ liter, and the temperature $T = 297.3 \pm 0.07$ K. The ideal gas law tells us the $PV = nRT$.
2. Find the mean, \bar{x} , and the standard deviation, S , for the following set of numbers. Determine how many numbers lie below $\bar{x} - S$ and how many lie above $\bar{x} + S$. 32.41, 33.76, 32.91, 33.04, 32.75, 33.23.
3. Assume that the H-O-H bond angles in various crystalline hydrates have been measured to be 108° , 109° , 110° , 103° , 111° , and 107° . If these measurements all come from the same population, give your estimate of the population mean and its 95 % confidence interval.
4. Assume the melting point of NaCl has been measured 10 times, and that the results are 801.21, 801.01, 801.89, 801.55, 801.45, 801.52, 801.33, 801.28, 801.50, and 801.67 °C. Ignoring systematic errors, determine the 95 % confidence interval for the set of measurements.
5. Sally takes measurements 5 times and determines an average value of 15.71635% and a standard deviation of 0.02587%. Janet takes measurements 7 times with an average value of 15.68134% and a corresponding standard deviation of 0.03034% (different technique).
 - (a) Express the averages and standard deviations, and standard deviations of the mean to the correct number of significant figures.
 - (b) Using the proper statistical parameter, whose average value is more precise?
 - (c) Find the 95% confidence intervals of the mean, and the relative 95% confidence intervals of the mean.
 - (d) Are the two averages in agreement at this confidence level?
 - (e) If you owned a chemical company and had to choose between Sally's and Janet's technique, whose technique would you choose and why?