# Chemistry 236 -- Quiz 1

September 10, 2008 — Statistics and KaleidaGraph Basics

**Pledge and signature:**

**Note:** If you want your paper returned folded (*i.e.*, score concealed), please print your name on the back.

1. (2) Consider the number 2. If this represents a rounded experimental result, what are its absolute and percent uncertainties?

   0.5 & 25%

2. (3) A pressure is measured to be 654.15 Torr and is estimated to be uncertain by 0.85 %. Using the 10% rule, state this pressure and its uncertainty. 654(6) Torr

3. (5) Marge Inovera measures a quantity 32 times and obtains an average and a sum of squared residuals. If the latter is 489.155,

   a. Give Marge's estimated variance, standard deviation, and standard deviation in the mean. (Give precision commensurate with the provided information.)

   $s_y^2$ = 15.77919 $s_y$ = 3.97230 $s_y$-bar = 0.702211

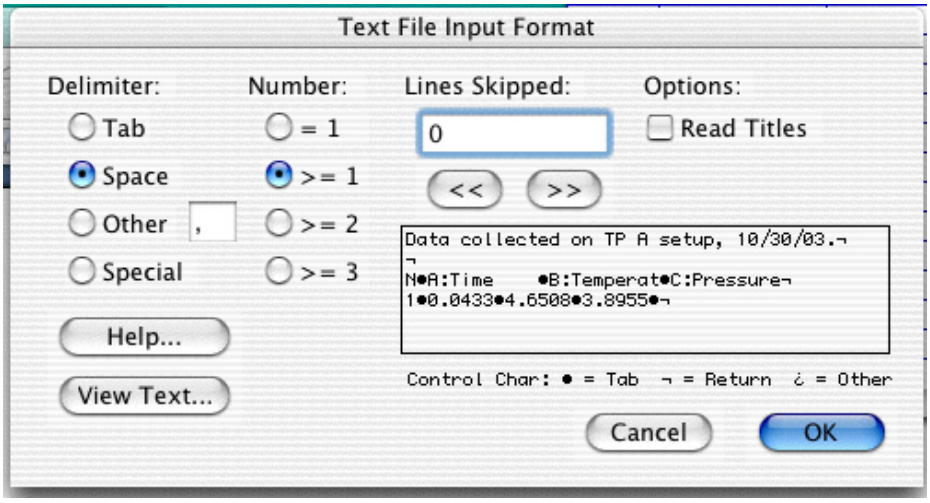
   b. Use the 10% rule to restate the latter two values.

   4.0 & 0.7

4. (2) State the following quantities unambiguously to 5 significant figures:

   a. 12000001 $1.2000 \times 10^7$ b. 66.123500 66.124

5. (4) You have recorded a boatload of data in the P Chem lab and now seek to plot and analyze them using KaleidaGraph. When you "Open" the file, you see:




   Precisely what do you select or enter in order to ensure that the resulting KG data sheet will contain all your data, in numerical format, with column headings?

   Delimiter: ____Tab____ Number: ___1 or >=1___ Lines Skipped: ____2_____

   Options: (Check or don't check?) Check

6. (5) Having Fits. You encountered your first truly nonlinear least-squares fitting problem in Problem Set 3, where you fitted first-order kinetics data to a delining exponential function of time plus a background. The resulting function contained three adjustable parameters.

   1. Write the fit relationship in mathematical form. Identify the independent and dependent variables and the adjustable parameters.

   $y = a\, e^{-bt} + c$ $t$ = ind.; $y$ = dep; $a,b,c$ = adjustable

   2. Suppose you carry out the fit by defining the fit relationship in the "Define Fit" box of the **General** fit routine. Write below EXACTLY what you must enter there, using a, b, and c as your adjustable parameters.

   a*exp(-b*x) + c; a= ... ; b = ... ; c = ... [reasonable initial estimates]

7. (3) Use error propagation to obtain expressions for $\sigma_z$ in terms of $\sigma_x$ and $\sigma_y$, in each of the following cases: (No other quantities are uncertain.)

   1. $z = \exp(ay)$ $\sigma_z = a\, z\, \sigma_y$

   2. $z = y/x$ $\sigma_z = z\,[(\sigma_x/x)^2 + (\sigma_y/y)^2]^{1/2}$

   3. $z = ax - by$ $\sigma_z = [a^2\sigma_x^2 + b^2\sigma_y^2]^{1/2}$

8. (2) Give two reasons why Excel cannot (easily) satisfy the data analysis requirements of this course while KaleidaGraph can.

   The main reasons: 1. Excel does not easily provide uncertainty estimates for adjustable parameters.
   2. Nonlinear LS is not easy to implement in Excel.

   I also gave some credit for answers commenting on the ease of preparing good-looking scientific graphs, and the difficulty of doing weighted LS fits in Excel.