Chemistry 236 -- Quiz 1

January 29, 2013 — 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 1.17. If this represents a rounded experimental result, what are its <u>absolute</u> and <u>percent</u> uncertainties?   ±0.005, 0.43%

2. (3) A pressure is measured to be 654.15 Torr and is estimated to be uncertain by 0.14 %. Using the 10% rule for uncertainties, state this pressure and its uncertainty.   654.2(9) Torr

3. (4)   Marge Inovera measures 25 values of a quantity y for a range of x values from 0 to 11. When she uses KaleidaGraph to carry out an unweighted fit of these data to a 4th-order polynomial (5 adjustable parameters), she obtains Chisq = 0.0015799. She then repeats the fit using weights and obtains Chisq = 1334.45.

   a.   Calculate Marge's estimated variance and standard deviation in y for the unweighted fit. (Give precision commensurate with the provided information.) $s_y{}^2 = 7.8995\times10^{-5}$, $s_y = 0.0088879$

   b.   In Marge's weighted fit, the s_y values she enters in the column used for weighting are known in only a relative sense. If the fit yields for the error in a, $s_a = 0.00075518$, what is the appropriately adjusted value of this error estimate? $s_a \times (\mathsf{Chisq}/\ )^{1/2} = 0.0061686$

4. (5)   a.   If y has uncertainty 0.012, what is the percent uncertainty in $z = e^{3y}$? 3.6%

   b.   In thermodynamics, the standard Gibbs free energy change for a reaction is related to the equilibrium constant K° by $G^\circ = -RT \ln K^\circ$. If K° is uncertain by 4.0% at $T = 308.15$ K, what is the uncertainty in G° ? [$R = 8.3145$ J mol^{-1} K^{-1}] $RT\, s_K/K = 102.5$ J/mol

5. (2)   A quantity x is uncertain by 1.0% and y is uncertain by 3.0%. Give the % uncertainties for z in each of the following cases:

   a. $z = \sqrt{5}\ y$ 1.5%   b. $z = 5\, x^3/y$ $\sqrt{18}$ %

6. (2)   A quantity x is uncertain by 1 and y is uncertain by 2. Give the uncertainties for z in each of the following cases:

   a. $z = -3y$ 6   b. $z = 11 + 9x - 4y$ $(145)^{1/2}$

7. (1) Using Formula Entry in KaleidaGraph, you enter `3*2 + 1.0/2*3^2 - 7/2^3` and press `Run`. What result do you get?   9.625

8. (2) You want to fit your data to the function $y = ax + b/x^3$. Using a, b, and x to represent the appropriate quantities, write <u>exactly</u> what you must enter in the Define box of the $\mathsf{General}$ routine.

   a*x + b/x^3; a = ... ; b = ...

9. (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

   Delimiter: _Tab_   **Number:** 1 or >=1   **Lines Skipped:** _2_   **Options:** Check

10. (2) Give two reasons why Excel cannot (easily) satisfy the data analysis requirements of this course while KaleidaGraph can. (Hint: What are the chief virtues of the $\mathsf{General}$ routine?)

   In Excel, it is not easy to (1) do nonlinear LS, (2) do wtd fits, and (3) get parameter errors.