

Chemistry 236 -- Quiz 1
January 28, 2014 — Statistics and KaleidaGraph Basics

1. (2) State the following two numbers *unambiguously* to 4 significant digits:
(a) 123456.789 1.235×10^5 (b) 0.000132 1.320×10^{-4}
2. (3) A pressure is measured to be 654.15 Torr and is estimated to be uncertain by 0.024 %. Using the 10% rule for uncertainties, state this pressure and its uncertainty. $654.15(16)$ Torr
3. (2) A quantity x is uncertain by 2.0% and y is uncertain by 3.0%. Give the % uncertainties for z in each of the following cases:
(a) $z = 3.14159/x^2$ 4.0% (b) $z = 8x^2/y^2$ $(52)^{1/2}\%$
4. (2) A quantity x is uncertain by 2 and y is uncertain by 3. Give the uncertainties for z in each of the following cases:
(a) $z = 9x$ 18 (b) $z = 111 + 2x \pm 3y$ $(97)^{1/2}$
5. (6) Many important processes follow a mathematical relationship of form $y = \frac{ax}{1+bx}$; examples are Michaelis-Menten kinetics and the Langmuir adsorption isotherm. To facilitate analysis, such data have traditionally been linearized by inverting both sides of the equation, so that y is transformed to $Y = 1/y$.
(a) Writing the transformed relation as $Y = A + BX$, obtain expressions for X in terms of x and for A and B in terms of a and b .
$$X = 1/x \quad A = b/a \quad B = 1/a$$

(b) If the original y data have constant uncertainty Δy , what is the uncertainty ΔY in Y ? $\Delta Y = \Delta y/y^2$
(c) Hence, how should the Y_i values be weighted in the transformed straight-line fit?
$$w_i = 1/\Delta Y^2 = y_i^4/\Delta y^2$$
6. (4) Give (a) the expression for the mean of n measurements, and (b) the error propagation expression for n independent variates (use summation notation). (c) Taking every individual variate x_i to have standard deviation Δ , derive the expression for the standard deviation in the mean.

[This is the exercise on p. 23 of the ClassPak, assigned as Stats Prob. 15.]

7. (1) Using Formula Entry in KaleidaGraph, you enter $3/2*5 + 1.0/3^2 - 4/2^{-3}$ and press Run. What result do you get? 24.3889
8. (2) In a KG data sheet, you have three columns ($c0 \pm c2 = A \pm C$) containing 100 numbers each. You wish to compute the corresponding 100 values of $A/C^2 + 3B^3$ and put them in the 4th column (D). Write *exactly* what you must enter in the Formula Entry window to carry out this operation.

$$c3 = c0/c2^2 + 3*c1^3$$

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 your data, in numerical format, with column headings?

Delimiter: space **Number:** ≥ 1 **Lines Skipped:** 2

Options: (Check or don't check?)

10. (1) Under the Curve Fit menu in KaleidaGraph, there are many specific choices, including Linear. Yet, even if your lab data are to be fitted to a straight line, you must still almost always use the General routine. Why? The General routine is our only way to get parameter uncertainties, which are almost always an important outcome of our analyses and need to be reported.