Chemistry 236 -- Quiz 2

Lab Day ____

February 14, 2012 — Least Squares, Probability, and KaleidaGraph

Pledge and signature:

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

1. (7) Consider the probability distribution, $P(x) = c\,x^2$, defined over the range $-1 \le x \le 2$. For this distribution, calculate: (a) the normalization constant, (b) the mean, (c) the variance, and (d) the standard deviation.

2. (6) (a) If you generate 10^5 random numbers having this distribution, how many are expected to fall within the x range 1.40–1.50? And what is the standard deviation of this value?

(b) If you now generate 10^6 such random numbers, what do you get in place of your results in 2a?

(c) Compare the *per cent* standard deviations in a and b.

3. (5) A quantity x is uncertain by 3.0% and y is uncertain by 4.0%. Give the % uncertainties for z in each of the following cases:

a. $z = 9/y$

b. $z = 3\,x^4$

c. $z = 1/\sqrt{8x}$

d. $z = 5\,x/y^2$

e. $z = 23\,y^2/x$

4. (9) **Least Squares and KaleidaGraph.**

(a) The declining exponential function with a background is a very commonly occurring functional form in the analysis of kinetics data. Write **exactly** what you should enter in the KG Define Fit box to fit your kinetics data to this relation

(b) Why are bad initial values likely to give you more problems here than in, say, fitting calibration data to a quadratic polynomial?

(c) In one of your KG exercises, you generated 10^4 sums of 12 random numbers. Describe the shape of the resulting histogram, and give the expected mean and standard deviation.

(d) Suppose instead you generated 10^4 sums of 16 random numbers. How would the results change? (Be quantitative.)