Chem 2222. Quantitative Analysis
Problem Set 3, Summer 2008. Errors and Data Treatment.
Please complete the example problems and recommended exercises in Chapters 5-7 before attempting these problems.

1. The uncertainty (standard deviation) in a single buret reading for a 50-mL buret is about +/- 0.02 mL. Noting that two readings (initial volume and final volume) are required to deliver a specified volume of titrant, compute the uncertainty in the volume of titrant delivered, reported as both the standard deviation and the relative standard deviation
   a) for a delivery volume of 5.00 mL.
   b) for a delivery volume of 50.00 mL.

2. The following results were obtained for the determination of sulfur in a coal sample.
   %S: 1.36, 1.42, 1.28, 1.26
   a) Report the average, average deviation, standard deviation, and relative standard deviation for these data.
   b) Based on these data, report the average % sulfur with the 95% confidence limits.
   c) Again report the % sulfur in the sample with the 95% confidence limits, based on the knowledge from extensive experience that the standard deviation of the method is 0.04 %S.

3. Two samples of cow's milk yielded the following data for dioxin (2,3,7,8-TCDD).

Sample	dioxin, pg/g
A	54.2, 56.8
B	62.0, 60.3, 63.4

   a) Calculate the pooled standard deviation for these data.
   b) Report the results for sample A with the 90% confidence limits, based on the precision for all data obtained for both samples.

4. The following results were obtained for ascorbic acid in a vitamin C preparation.
   % ascorbic acid: 52.14, 52.26, 52.26, 52.56
   Apply the Q test to determine if the outlier should be retained at the 90% confidence level. Report the appropriate average based on your conclusion.

5. A new analytical method was applied to a standard sample known to contain 4.48% lindane.
   a) The new method yielded an average result of 4.60% lindane on the basis of six trials with a sample standard deviation of 0.12% lindane. Based on these data, is there a bias in the method at the 95% confidence level? Show clearly and completely the basis for your conclusion.
   b) The new method was applied to analysis of two separate batches of commercial pesticide preparations, yielding the following data as %lindane $\pm$ standard deviation.
      Sample A: 5.82 ± 0.12, 6 trials.
      Sample B: 5.68 ± 0.08, 8 trials.
      Based on data for these two samples, is their a significant difference in the lindane content (95% confidence level) between the two batches? Do not consider data from part a.

For the following question, summarize your results with any explanatory notes on a standard sheet of paper, and attach a printed copy of the spreadsheet.

6. Construct a spreadsheet to compute the pooled standard deviation for the following sets of data for the determination of total PCBs in fish tissue. Report the value of the pooled standard deviation.

Total PCBs, ppm		
Sample 1	Sample 2	Sample 3
9.2	10.1	8.6
9.8	10.6	8.2
8.9	9.9	8.4
	10.2	