Homework #1 Key

8. Ranges are: major (>1%), minor (0.01-1%), trace ($10^{-2} - 10^{-6}$%), or ultra-trace (10^{-6}- 10^{-9}%)

9. The ideal way to measure accuracy is to compare measured results to the "true" value, if known. This can be done using standards such as standard reference materials. The confidence limit is often used as a statistical means to predict accuracy, absent any systematic errors.

10. Typically we use the method standard deviation (or variance), s_{method}. This contains contributions from the sampling and technique standard deviations.

12. The confidence limit is calculated using the standard deviation and the number of observations. Therefore, if you can decrease the standard deviation of a method, you will decrease the confidence limit (this can be very hard to accomplish). If you increase the number of measurements, the magnitude of the confidence limit decreases for two reasons, one because n is in the denominator of the CI calculation, and a second because Student's t depends on the number of degrees of freedom, by decreasing as the number of degrees of freedom (which is based on the number of observations) increases.

13. Increasing the number of measurements comes with an proportional increase in cost and time (which also costs money in the real world).

17. Blanks allow the assessment of contamination and/or some matrix interferences.

18. Both can help identify the presence of systematic errors in a method.

19. The working curve (or calibration curve) describes the dependence of the analytical signal on the concentration of analyte in the measured sample. Often a mathematical relationship between signal and concentration can be defined (typically using regression analysis) to allow quantitative evaluation of the concentration of an unknown based on its analytical signal.

20. FOM are quantitative description of the performance of an analytical method and are typically used to validate or verify that the method is meeting desired performance characteristics. FOM include accuracy, precision, LDR, LOD, sensitivity and selectivity.

21. Generally the non-electrical domain refers to chemical or physical characteristics of an analyte, while the electrical domain refers to an electrical quantity such as current or potential that can be used to encode a non-electrical domain signal by means of a transducer.