

CHEMISTRY 311 - ASSIGNMENT 2

Hand-in your answers in a **neat and organized format** to the appropriate number significant figures, showing chemical equations and calculations where appropriate.

Due date: Tuesday, Oct. 17th, 2017

1. Shown below are the results for the determination of acetaminophen (in mg) in ten separate tablets of Excedrin Extra Strength. Check for potential outliers and report the mean, standard deviation, coefficient of variation and the 95% confidence interval.

224.3 240.4 246.3 239.4 253.1 261.7 229.4 255.5 235.5 249.7

2. One of the methods used to evaluate procedures for digesting oysters and mussels prior to analyzing for the samples for cadmium involves measuring a spike recovery in which a known amount of cadmium is added to the tissue sample. The recovery is reported as the measured amount of cadmium relative to the amount added. Ideally, spike recoveries should fall within the range $100 \pm 15\%$. The results for one method are;

106% 108% 92% 99% 104% 101% 93% 93%

Assuming that the spike recoveries are normally distributed, what is the probability that any single spike recovery will be within the accepted range?

3. A 100.0 (± 0.1) mL water sample containing calcium and magnesium is volumetrically analyzed by titrating with $1.102 (\pm 0.003) \times 10^{-3}$ M EDTA. In the first titration the sum of calcium and magnesium concentrations is determined. A second titration is conducted after precipitating magnesium hydroxide at pH ~ 12 , such that the titration data yields only the calcium concentration. The concentration of magnesium is subsequently calculated by difference. If the uncertainty in each transferred titration volumes is ± 0.05 mL, calculate the molar concentration of both the calcium and magnesium and the relative uncertainty in each.

Titration 1: 48.16 mL (**Ca + Mg**)

Titration 2: 41.78 mL (**Ca**)

4. Six replicates for the determination of zinc in an individual's hair gave the following results (in ppm);

2.67 2.75 2.82 3.01 2.94 2.87

After six months of taking zinc supplements, the study was repeated. The mean value was 3.03 ± 0.22 ppm (value \pm s) for five replicate samples. Is the difference between the two sets of data significant at the 95% confidence level?

5. A 0.250 g sample of corn syrup was assayed for dextrose using a method that uses an enzyme assay. The sample was diluted in a volumetric flask to 100.0 mL. A 25 μL sample was analyzed and gave an absorbance of 0.736 at 490 nm. When the same volume of a 200. mg/L dextrose standard was analyzed by the same method it gave an absorbance of 0.886 at the same wavelength. What is the concentration of dextrose (%w/w) in the original corn syrup?

6. The following are relative peak areas for chromatograms of standard solutions of 2,3-butandione.

Conc (mM)	0.500	1.50	2.50	3.50	4.50	5.50
Peak Area	3.76	9.16	15.03	20.42	25.33	31.97

- Plot a calibration curve report the least squares linear expression.
- Calculate the concentration of 2,3-butandione in a sample that yielded a relative peak area of 16.30 (based on the mean of four replicate analysis) and use EQN 4-27 (textbook) to calculate the standard deviation in your answer.

7. A standard solution was prepared containing 10.0 ppm of caffeine and 15.0 ppm of an isotopically labeled internal standard. Analysis of the sample by gas chromatography-mass spectrometry gave signals for caffeine and the internal standard of 1.55×10^3 and 2.33×10^3 (arbitrary units), respectively. Sufficient internal standard was then added to a sample to bring it to a final concentration of 15.0 ppm in the internal standard. Analysis by the same method yielded signals for caffeine and the internal standard of 2.74×10^3 and 1.98×10^3 , respectively. Report the concentration of caffeine in the sample.

8. A urine sample is analyzed for copper by the method of standard additions as follows. Three 5.00 mL aliquots were taken from the same sample. Nothing is added to the first aliquot, 50. μL of a 100.0 mg/L Cu^{2+} standard was added to the second and 100. μL of the same standard was added to the third. The data is summarized below.

Sample	Volume of 100.0 ppm spike (μL)	Instrument Signal (a.u.)
1	0	0.205
2	50	0.320
3	100	0.426

- Ignoring the small volume change, calculate the conc of Cu^{2+} in the sample in mg/L.
- Determine the magnitude of the error introduced in part a) and indicate if this is a determinate or indeterminate error.