Name Answer Key

Quiz 2 (10 pts)
CEM 434
Fall 2016

1 (2 pts). What types of noise are frequency dependent? Independent?.

flicker & environmental (freq. dependent)

thermal & shot (freq. independent)

2 (2 pts). The following data were obtained with repetitive weighings of a 1.004 g standard: 1.003, 1.004, 1.001, 1.000, 1.006 and 1.007. Assuming the variation is random, calculate the signal-to-noise ratio. How many measurements would have to be averaged to obtain a S/N= 500. $\left(\frac{S}{N}\right)_n = \sqrt{n}\left(\frac{S}{N}\right)_i$

Mean = 1.003_5 g

SD = 2.74×10^{-3} = 0.0027

$\left(\frac{S}{N}\right)_n = \left(\frac{S}{N}\right)_i \sqrt{n}$

$\frac{S}{N} = \frac{\text{mean}}{\text{std. dev}} = \frac{1.003}{0.0027} = 366 = 3.7 \times 10^2$

$3.7 \times 10^2 = \left(\frac{S}{N}\right)_i \sqrt{6}$

$\sqrt{n} = 3.3$

$\left(\frac{S}{N}\right)_i = 1.5 \times 10^2$

$500 = (1.5 \times 10^2)\sqrt{n}$ → n = 11 measurements

3 (4 pts). Explain the basic principles of SPME and SPE. What steps are involved and what are the advantages of each?

SPME = headspace or liquid extraction. Preconcentration possible. Removal of matrix possible.
Can use in small or large volumes
rapid - fewer steps.
Extraction conditions must be very precisely controlled.
More limited chemistries of solid phase - but this is changing

SPE = liquid extraction method. Preconcentration possible. Removal of matrix possible.
need mL's of sample volume at minimum
need organic solvent to extract from stat phase.
More steps than SPME.
Greater variety of stationary phase chemistries available

4 (2 pts). Assume a SPME experiment was performed in solution using 0.01 L of 0.0045 M analyte. The percent recovery of the analyte was found to be 75%. If the adsorbed analyte was desorbed into a 10 x 10-6 L injector volume, what is the preconcentration factor, if any?

$(0.01\,L)(0.0045\ mol/L) = (4.5\times10^{-5}\ moles)\left(6.02\times10^{23}\ \frac{molecules}{mol}\right) = 2.71\times10^{19}\ molecules$

75% recovery $\Rightarrow (2.71\times10^{19}\ molecules)(0.75) = 2.03\times10^{19}\ molecules$

$(2.03\times10^{19}\ molecules)\left(\frac{1\ mole}{6.02\times10^{23}\ molecules}\right) = 3.38\times10^{-5}\ moles$

$\text{New conc} = \frac{3.38\times10^{-5}\ moles}{10\times10^{-6}\ L} = 3.38\ M$

$\text{Preconcentration} \Rightarrow \frac{3.38}{0.0045} \approx \underline{750\times}$