

**Analytical Chemistry**  
**Problem Set 4**  
**Due Friday, February 27, 2009 (at 4 p.m.)**  
Total Number of Points = 40

1. (5 points) You are determining nickel concentrations using ion chromatography. A dilute sample known to contain  $\text{Ni}^{2+}$  gives the following measurements (in microamperes or  $\mu\text{A}$ ): 175, 104, 164, 193, 131, 189, 155, 133, 151, 176. Eight measurements on a blank give a mean signal of  $45 \mu\text{A}$ . A sample known to contain  $1.00 \mu\text{M Ni}^{2+}$  gives an average uncorrected signal of  $1797 \mu\text{A}$ . Determine (to one significant figure) the signal and concentration detection limits for your experiment.
2. (4 points) Harris 18-3
3. (5 points) Harris 18-12
4. (12 points) Harris 18-13. Hints: (i) Since  $n$  has units of molecule  $\text{cm}^{-3}$ , the absorption cross section ( $\sigma$ ) should have units of  $\text{cm}^2 \text{ molecule}^{-1}$ . (I differ from Harris on this point.) (ii) For part (a), I will tell you that  $\sigma$  at 300 nm is  $3.2 \times 10^{-19} \text{ cm}^2 \text{ molecule}^{-1}$ . You should be able to determine  $\sigma$  at 325 nm from the spectrum on p. 378 with little difficulty. (iii) While in this problem transmittance is defined using base  $e$ , it is still the case that absorbance is defined to be  $A \equiv -\log(T)$ . (iv) In part (b), you should carry at least two extra figures until the very end of the calculation. Else, you will predict no increase in transmittance.
5. (4 points) Harris 18-18
6. (10 points) Harris 18-19. Note that you should assume that the concentrations of unknown nitrite are the same in solutions B and C. Also, the answer to part (b) in the back of the book should have units of  $\mu\text{g}$ .