CHEM 322 **Name**_____
Spring 2013 **Due In Class Friday, May 3**

Complete the following on separate paper. Show your work and **clearly identify your answers**.

1. Calculate the frequency in hertz, the wavelength, the energy in joules and the energy in kJ/mol associated with the 1685 cm^{-1} C=O vibrational absorption band of an amide.

2. A compound has a molar absorptivity of 1.24×10^4 L $cm^{-1}mol^{-1}$. What concentration of the compound would be required to produce a solution that has a transmittance of 10.2% in a 2.50 cm cell? What absorbance does this correspond to?

3. A monochromator with a focal length of 0.58 m was equipped with an echellette grating of 2500 blazes per millimeter. (a) Calculate the reciprocal linear dispersion of the instrument for first order spectra. (b) If 2.0 cm of the grating were illuminated, what is the first order resolving power of the monochromator? (c) At approximately 430 nm, what minimum wavelength difference could in theory be completely resolved by the instrument?

4. Why to quantitative and qualitative analyses often require different monochromator slit widths?

5. For Na^0 and Mg^+ compare the ratios of the number of ions in the 3p excited state to the number in the ground state in (a) a natural gas-air flame (1800 K), (b) a hydrogen-oxygen flame (2950 K), (c) an inductively coupled plasma source (7250 K).

6. In the concentration range of 500 to 2000 ppm of U, there is a linear relationship between absorbance at 351.5 nm and concentration. At lower concentrations the relationship is nonlinear unless about 2000 ppm of an alkali metal salt is introduced to the sample. Explain.

7. Why is an electrothermal atomizer more sensitive than a flame atomizer?

8. Use equation 7-13 in your text for the resolving power of a grating monochromator to estimate the theoretical minimum size of a diffraction grating that would provide a profile of an atomic absorption line at 589.0 nm having a line width of 0.002 nm. Assume that the grating is to be used in the first order and that it has been ruled at 2400 grooves/mm.

9. A portable photometer with a linear response to radiation registered 63.8 μA with the solvent blank in the light path. The photometer was set to zero with no light striking the detector. Replacement of the solvent with an absorbing solution yielded a response of 41.6 μA. Calculate: (a) the percent transmittance of the sample solution, (b) the absorbance of the sample solution, (c) the transmittance expected for a solution in which the concentration of the absorber is one half that of the original solution, (d) the transmittance to be expected for a solution that has twice the concentration of the sample solution.

10. Why are atomic emission methods with an ICP source better suited for multi-element analysis than flame atomic absorption methods?

11. Why does a deuterium lamp produce a continuum rather than a line spectrum in the ultraviolet?

12. Explain the difference between a fluorescence emission spectrum and a fluorescence excitation spectrum. Which more closely resembles an absorption spectrum?

13. What are the advantages of an FTIR spectrometer compared to a dispersive instrument?

14. What length of mirror drive in a spectrometer with a Michelson interferometer would be required to provide a resolution of (a) 0.050 cm^{-1} (b) 0.40 cm^{-1} (c) 4.0 cm^{-1} (d) 1 nm