

Name: _____

Chem 2113

Test 4

Summer 2000

Questions are worth 25 points each. OMIT ONE QUESTION by clearly writing OMIT in the space provided for your work. If you fail to mark OMIT on a question I will omit the last question of the test. Show your work and circle your answers for full credit.

1. Sketch a block diagram for an instrument that is to be used for molecular absorbance measurements. Assuming the device is to be use in both the ultraviolet and visible regions, and at multiple wavelengths, show an appropriate specific component (or components) that could be used to accomplish this.

Explain what changes would have to be made (and why they would be made) for an instrument for atomic absorbance measurements.

2. Perform the following conversions:

a) A frequency of 119.07 MHz to wavelength.

b) The energy of a photon with a wavelength of 254 nm.

c) 33.3%T to A

d) An *einstein* of light is equivalent to 1 mol of photons for a specified wavelength of light. Calculate the energy in kJ for an einstein of light of 755 nm.
(1 mol = 6.022×10^{23})

3. A sample of copper is to be determined using atomic absorption analysis. A 0.0586 g sample of a copper ore is crushed, and the resultant ore flour is digested in 3M HNO₃. The stock solution is then prepared by dilution of the filtrate to 500.0 mL in a volumetric flask. The analysis then proceeds as follows:

mL Stock	mL 10.0 ppm Cu std.	Final volume	A
10.0	0.00	100.0	0.214
10.0	5.00	100.0	0.521

Calculate the percent copper in the ore sample.

4. Consider the simultaneous determination of two components. Species C absorbs strongly ($\epsilon = 7550$) at 512 nm and exhibits no absorbance at 690 nm. Species P absorbs strongly ($\epsilon = 9850$) at 690 nm and absorbs weakly ($\epsilon = 1000$) at 512 nm. When using a 1.00 cm cell, a mixture of C and P was determined to have an absorbance of 0.890 at 512 nm, and an absorbance of 0.736 at 690 nm. What is the concentration of species C and P in this mixture.

5. Consider the spectrophotometric determination of iron(II) using the 1,10 phenanthroline complex. Standards were prepared from a stock solution of iron(II). All measurements were made in a 1.00 cm cell.

Fe(II)	Transmittance
0.00	1.000
2.00	0.896
5.00	0.759
7.50	0.664
15.00	0.439

Calculate the slope, the y-intercept, and the correlation coefficient for the linearly related data. Determine the molar absorptivity for the iron(II)-1,10 phenanthroline chelate (Stoichiometry of this chelate is 1:1).

The unknown was prepared by dissolving a 0.0598g sample containing iron(II) and diluting this sample to 500.0 mL. A 10.00 mL aliquot of this solution was treated like the standards and diluted to 50.00 mL. This solution had a transmittance of 0.125. Calculate the percent iron in the unknown.