

Problem Set #6  
Due 4/19/11

1. A solution containing 7.42 mg/275 mL of an environmental water pollutant with a molecular weight of 374 has a transmittance of 37.4% in a 1.25 cm cell at 254 nm.
  - a. Calculate the molar absorptivity of the species.
  - b. Calculate the concentration of another solution of the pollutant that is analyzed with the same cell and the same wavelength and gives a transmittance of 82.4%
2. You discover four bottles of ferrocene on a back shelf. They are labeled as having different concentrations. To check to see if the labels are correct you measure the absorbance of each bottle at 254 nm using a 1.25 cm cuvet. Based on the following data, are the bottles labeled correctly? If so, explain why. If not, what should the label(s) read?

Absorbance	Concentration (M)
0.057	7.24E-06
0.143	1.82E-05
0.272	3.81E-05
0.417	5.31E-05

3. A 450 mL solution of  $6.15 \times 10^{-6}$  M TNT is measured to have an absorbance of 0.234 at 254 nm using a 1.00 cm cuvet. A second, 250 mL solution of TNT is determined to have an absorbance of 0.401 under the same conditions. If these two solutions are mixed together, what will the absorbance of the resulting solution be?

4. You are given the job of analyzing a 7.24 L mixture of two compounds A (molecular weight 819.2) and B (molecular weight 375.3) and determining the concentration of each. The molar absorptivity data at two wavelengths for each compound is shown below. Using a 1.00 cm cuvet, the mixture had an absorbance of 0.692 at 254 nm and 0.417 at 528 nm. Based on previous data, you know the following information:

Wavelength	Molar Absorptivity ( $M^{-1} \text{ cm}^{-1}$ )	Molar Absorptivity ( $M^{-1} \text{ cm}^{-1}$ )
	A	B
254 nm	2,763	12,692
528 nm	9,842	3,734

5. Your boss next gives you a mixture of two different compounds (C and D) and asks you to determine the concentration of each drug in the mixture. This time your boss also provides you with standard samples of each drug. You obtain the following spectroscopic data:

Wavelength (nm)	Absorbance for pure compound C ( $4.28 \times 10^{-3} \text{ M}$ )	Absorbance for pure compound D ( $1.12 \times 10^{-2} \text{ M}$ )	Absorbance for mixture
214	0.965	0.194	0.511
254	0.265	0.290	0.340
290	0.545	0.274	0.425
328	0.111	0.175	0.182
450	0.627	0.877	0.973
528	0.793	0.555	0.751
554	0.316	0.601	0.615

6. Harris Chapter 5, Problem 24

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Suggested/Review Problems:

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|----------------------------------|----------------------------------|
| 1. Harris Chapter 5, Problem 28  | 4. Harris Chapter 18, Problem 10 |
| 2. Harris Chapter 17, Problem 19 | 5. Harris Chapter 19, Problem 1  |
| 3. Harris Chapter 18, Problem 8  | 6. Harris Chapter 19, Problem 3  |