

In-Class Quantitative Spectrophotometric Problems

1. One method for determining the concentration of Fe^{2+} is to react it with a solution of 1,10-phenanthroline to form a red-colored complex that absorbs at 510 nm. The following data were obtained for a series of standard solutions of Fe^{3+} . In each case a 25.00 mL portion of a standard was mixed with 5.00 mL of a 1,10-phenanthroline solution and diluted to 50.00 mL. The concentrations reported below are for the undiluted standards.

standard (ppm)	8.00	12.0	16.0	20.0	24.0	28.0
absorbance	0.315	0.473	0.631	0.789	0.947	1.105

What is the concentration of Fe^{2+} in a sample if a 25.00 mL portion of the sample is treated in the same manner, yielding an absorbance of 0.675?

2. UV/Vis spectrophotometry is used quite frequently for the quantitative analysis of biochemically important molecules, such as reduced nicotinamide-adenine dinucleotide (NADH) and cystidine monophosphate (CMP). A 56.0 mM solution of NADH has an absorbance of 0.285 at a wavelength of 340 nm and 0.683 at 260 nm, while an equimolar solution of CMP has an absorbance of 0.647 at 260 nm and an absorbance at 340 nm that is indistinguishable from the reagent blank. A sample that might contain NADH only, CMP only or a mixture of both NADH and CMP, gives an absorbance of 0.371 at 340 nm, and 1.50 at 260 nm. What species are present and at what concentrations?
3. An atomic absorption analysis for Pb^{2+} in an industrial plating bath was carried out by the method of standard additions. A 10.00 mL aliquot of the sample was placed into each of five separate 100-mL volumetric flasks. A portion of a 1000.0 ppb standard solution of Pb^{2+} was added to each flask before diluting to volume. The absorbance of each solution was then determined, with the results shown here:

standard added (mL)	0.00	1.00	2.00	3.00	4.00
absorbance	0.163	0.240	0.319	0.402	0.478

What is the concentration of Pb^{2+} in the original sample?