Questions: Text book assignment #5

13-1 Express the following absorbances in terms of percent transmittance: (a) 0.0510 (b) 0.918 (c) 0.379

13-2 Convert the accompanying transmittance data to absorbances: (d) 3.58% (e) 0.085 (f) 53.8%

13-5 A solution containing 4.48 ppm KMnO₄ has a transmittance of 0.309 in a 1.00 cm cell at 520 nm. Calculate the molar absorptivity of KMnO₄ at this wavelength.

13-7 A solution containing the complex formed between Bi(III) and thiourea has a molar absorptivity of 9.32 x 10³ L mol⁻¹ cm⁻¹ at 470 nm.
(a) What is the absorbance of a 6.24 x 10⁻⁵ M solution of the complex at 470 nm in a 1.00 cm cell?
(b) What is the percent transmittance of the solution described in (a)?
(c) What is the molar concentration of the complex in a solution that has the absorbance described in (a) when measured at 470 nm in a 5.00 cm cell?

13-11 The equilibrium constant of the conjugate acid/base pair

\[ \text{HIn} + \text{H}_2\text{O} \rightleftharpoons \text{H}_3\text{O}^+ + \text{In}^- \]

is 8.00 x 10⁻⁵. From the additional information

<table>
<thead>
<tr>
<th>Species</th>
<th>Absorption Maximum, nm</th>
<th>430 nm</th>
<th>600 nm</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIn</td>
<td>430</td>
<td>8.04 x 10³</td>
<td>1.23 x 10³</td>
</tr>
<tr>
<td>In⁻</td>
<td>600</td>
<td>0.775 x 10³</td>
<td>6.96 x 10³</td>
</tr>
</tbody>
</table>

(a) calculate the absorbance at 430 nm and 600 nm for the following indicator concentrations: 3.00 x 10⁻⁴ M, 2.00 x 10⁻⁴ M, 1.00 x 10⁻⁴ M, 0.500 x 10⁻⁴ M, 0.250 x 10⁻⁴ M.
(b) plot absorbance as a function of indicator concentration.

13-14 A portable photometer with a linear response to radiation registered 73.6 µA with a blank solution in the light path. replacement of the blank with an absorbing solution yielded a response of 24.9 µA. Calculate
(a) the percent transmittance of the sample solution.
(b) the absorbance of the sample solution.
(c) the transmittance to be expected for a solution in which the concentration of the absorber is one third that of the original sample solution.
(d) the transmittance to be expected for a solution that has twice the concentration of the sample solution.

13-30 Why do quantitative and qualitative analyses often require different monochromator slit widths?