Chemistry 236 -- Quiz 6

Lab Day ___

October 10, 2007 — Spectrophotometric Determination of *K*

Pledge and signature:

Note: If you want your paper returned folded (*i.e.*, score concealed), please print your name on the back.

1. (3) In a study of the I_2/mesitylene complexation reaction, May B. Knott prepares one sample by mixing 2.0 mL of 2.00-M mesitylene with 3.0 mL of 0.00055-M I_2, both solutions being in heptane as solvent. Assuming that volumes are additive, what is the concentration of mesitylene after the reaction mixture has come to equilibrium?

   a. 2.00 M b. 1.20 M c. 0.80 M
   d This cannot be determined without additional information. e. none of these

Questions 2-5 concern the equilibrium A + B ↔ C, which is studied spectrophotometrically at 550 nm, where only A absorbs light. A 1.000-cm path length cuvette is used. The stock solution of A at a concentration of 0.0227 M gives an absorbance of 1.229. 3.00 mL of this solution is mixed with 1.00 mL of 0.0319 M B, and this mixture gives an absorbance of 0.714 at 550 nm.

2. (3) Calculate (a) the <u>transmittance</u> associated with the first absorbance measurement, and (b) the <u>molar absorptivity</u> of A at 550 nm.

   (a) $10^{-A} = 0.0590$ (b) $\varepsilon = A/c\,\ell = 54.1$ L mol^{-1} cm^{-1}

3. (2) Calculate [A] in the equilibrium mixture.

   $c = A/\varepsilon\,\ell = 0.0132$ mol/L

4. (2) Calculate [B] in the equilibrium mixture.

   $[B]_0 - [B] = [A]_0 - [A]$ [B] = 0.0041_4 mol/L

5. (3) Calculate the equilibrium constant K_c for this system.

   $[C] = [A]_0 - [A] = 0.0038_4$ mol/L

   $K_c = [C]/([A]\,[B]) = 70._3$ L/mol

6. (3) For a particular reaction, $K = 8.6\times10^{19}$ at 25°C and $K = 1.09\times10^{15}$ at 125°C. If the first of these K values is uncertain by 3.5% and the second by 5.3%, what is the uncertainty in the natural logarithm of their ratio?

   If r = ratio, then its percent uncertainty is $(3.5^2 + 5.3^2)^{1/2}$ % = 6.35 %.

   If $z = \ln r$, then $s_z = s_r/r = 0.0635$ (0.06).