Spectroscopy – Sample Problems

1. A solution has a %T of 60%. What is the absorbance?

2. What are the units on the molar extinction coefficient in $A = \varepsilon l C$? $E^{1\%}$?

3. Copper sulfate has a molar extinction coefficient of 20 L mol^{-1} cm^{-1} at 600nm. What is the concentration of a solution of copper sulfate that gives an absorbance of 1.00 for a 1.0 cm pathlength?

4. β-carotene has a molar extinction coefficient of 100,000 L mol^{-1} cm^{-1}. What is the concentration of a solution of β-carotene that gives an absorbance of 1.00 for a 1.0 cm pathlength?

5. One mg of a protein is dissolved in 1.0 mL of buffer and its A_{280} is read as 0.90 (assume 1.0 cm pathlength).
   a) What is the $E^{1\%}$ for this protein?

   b) What is the molar extinction coefficient for this protein if its MW = 40,000?

6. A protein solution gives an A_{280} of 0.60 when one part of concentrated protein solution is added to 20 parts buffer (assume 1.0 cm pathlength). If the protein has an $E^{1\%} = 9.5$, what is the concentration of the **original protein solution** in mg/mL?

7. Consider an enzyme of 1000 amino acid residues (MW ~ 110,000) containing the listed average composition of 1.4% (14) Trp, 3.2% (32) Tyr, and 3.9% (39) Phe.
   a) Given the molar extinction coefficients, ε (280 nm), for Trp (5.6×10^3). Tyr (1.4×10^3) and Phe (0.2×10^3), **estimate** the theoretical molar extinction coefficient for this enzyme.

   b) **Estimate** the $E^{1\%}$ value and absorbance for a 1 mg/mL solution and a 1.0 cm path?