Self Quiz – Spectrophotometry

1. The Transmittance of solutions B and D of substance X is 15.85% and 50.12%, respectively. At what volume ratio should solutions B and D be mixed so that the transmittance of the resulting solution would be 21.13%?
Assume all measurements are made in the same cell and the same wavelength.

2. Theory: What happens when a molecule absorbs light? Hint: Be as detailed as you like…you will likely see a problem in this general area on the exam.

3. A 0.9934 g sample of steel is dissolved in acid and the solution diluted to 250.0 mL (Solution A). A 50.00 mL aliquot of solution A is treated with potassium persulfate in the presence of $Ag+$ ions acting as catalysts and potassium periodate, whereupon Mn and Cr are oxidized to MnO_4^- and $Cr2O_7^{2-}$ and diluted to 100.0 mL (solution B). The absorbance of solution B at 440 nm and 545 nm was 0.204 and 0.170, respectively in a 1.00 cm cell. <u>Calculate the % Mn and Cr in steel</u> also taking into account the following information:

λ, nm	ε_{MnO4-}	$\varepsilon_{Cr2O72-}$
440	95	369
545	2350	11.0

4. An optical filter permits the passage of only a red spectrum line of wavelength 6600 Angstrom.
Calculate a) the wavelength in nm and μm, b) the frequency, and c) the wavenumber.

5. Explain the differences between absorbance, transmittance and molar absorptivity.

6. If the stray radiation P_s is equal to 1.0% of the radiant power P_0 that passes through the cuvette, and the real transmittance of samples A1 and A2 (in the absence of stray radiation) is 0.040 and 0.400, respectively, calculate the % error in the measured concentration of each sample that is caused by stray radiation.

7. What are the differences between a single beam and double beam spectrometer? What are filters and diffraction gratings used for?