

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 $\text{Cr}_2\text{O}_7^{2-}$ 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. Calculate the % Mn and Cr in steel also taking into account the following information:

λ , nm	$\epsilon_{\text{MnO}_4^-}$	$\epsilon_{\text{Cr}_2\text{O}_7^{2-}}$
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?