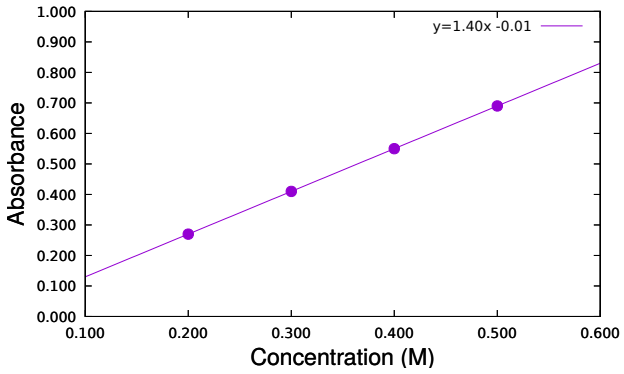
Worksheet 4: Spectroscopy III

1. Using the calibration curve below, determine the concentration of an unknown that has an absorbance of 0.372.



2. Assuming the width of the cuvet used to generate the calibration curve above was 1 cm, what is the molar absorptivity of this chemical?

3. If the unknown from Problem 1 was diluted to 250 mL from an original 10 mL sample, what was the concentration of the original sample?

4. If the absorbance of an unknown sample were 0.800, how could you determine its concentration?

5. A 0.122 M solution of analyte X has a transmittance of 35% at a wavelength of 735 nm. What will the percent transmittance of a 0.234 M solution of the same analyte be?

6. Cu^+ reacts with neocuproine to form the colored complex $(neocuproine)_2Cu^+$, with an absorption maximum at 454 nm. Neocuproine reacts with few other metals. The copper complex is soluble in isoamyl alcohol, an organic solvent that does not dissolve appreciably in water. Suppose that the following procedure is carried out:

   - A rock containing copper is pulverized and all metals are extracted from it with a strong acid. The acidic solution is neutralized with base and made up to 250.0 mL in flask A.
   - Next, 10.0 mL of the solution are transferred to flask B and treated with 10.00 mL of reducing agent to convert Cu^{2+} to Cu^+. Then, 10.00 mL of buffer are added so that the pH is suitable for complex formation with neocuproine.
   - 15.00 mL of this solution are withdrawn and placed in flask C. To the flask are added 10.00 mL of an aqueous solution containing neocuproine and 20.00 mL of isoamyl alcohol. After the mixture has been shaken well and the phases allowed to separate, all of the copper complex is in the organic phase.
   - A few milliliters of the upper layer are withdrawn and the absorbance at 454 nm is measured in a 1.00-cm cell. A blank carried through the same procedure gives an absorbance of 0.056.

   (a) Suppose that the rock contained 1.00 mg of Cu. What will be the concentration of Cu in the isoamyl alcohol phase?

   (b) If the molar absorptivity of the neocuproine-Cu complex is 7.90×10^3 M^{-1} cm^{-1} what will be the observed absorbance?

   (c) A rock is analyzed and found to give a final absorbance of 0.874 (uncorrected for the blank). How many milligrams of Cu are in the rock?