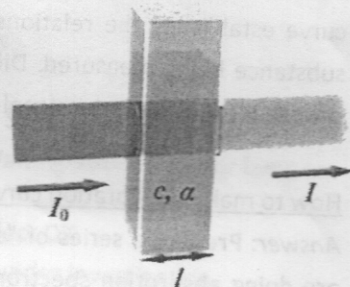


INV 20: How much cobalt is in the soil? – One-day lab

Student handout

1. Goal:

- Prepare a standard curve of absorbance versus known cobalt (II) nitrate concentrations.
- Determine the concentration of cobalt (II) ion obtained from a soil sample.
- Determine if cobalt (II) nitrate should be added to the soil. If so, you will determine the required amount in order to meet the necessary nutritional needs of the animals. See lab manual for details.



2. Theory:

- In spectroscopy, the absorbance A is defined as:

$$A = \log_{10} \left(\frac{I_0}{I} \right) = -\log T$$

Where I is the intensity of the light at a specified wavelength λ that has passed through a sample (transmitted light intensity) and I_0 is the intensity of the light before it enters the sample.

- Beer-Lambert Law: $A = \epsilon b c$

A : absorbance (no unit) ϵ : molar absorptivity [L/mol-cm] c : concentration [mol/L]

b : thickness of the solution in the light path (usually constant when using the same cuvette)

3. Procedure:

- Before experiment: show proposal and one sample calculation (How to make a 0.05 M solution with $V_{\text{final}} = 10 \text{ mL}$ from 0.1 M stock solution? $C_{\text{initial}} V_{\text{initial}} = C_{\text{final}} V_{\text{final}}$).
- Wear goggles.
- Make 6~8 diluted solutions of different concentrations. For each solution, $V_{\text{final}} = 10 \text{ mL}$.
 - Suitable dilution range: 0.01 M – 0.09 M
 - Refer to SpectroVis Instructions for the measurements

4. After experiment:

- Solutions should go into the liquid waste bottle.
- Remove cuvette from the spectrometer.
- Empty and clean the cuvette.
- Turn in the copies of notes.
- Report is due in one week.

5. FAQs about standard (calibration) curve:

- What is a standard (calibration) curve?

Answer: For this lab, a standard curve is an experimentally measured relationship between concentration and signal (e.g. absorbance). You don't ever really know the true standard curve; you can only estimate it at a few points by measuring the absorbance of a series of standard solutions. Then draw a line or a smooth curve that goes as much as possible through the points, with some points being a little higher than the line and some points a little lower than the line. That's what we mean by that is a "best fit" to the data points.