CHM 103 **Name**_____

Sinex

Culminating Chemical Analysis Task
Analysis of Co^{+2} by Spectrophotometry

This is a completely individual task. No discussion with fellow students or your instructor is to occur. All work must be turned in before leaving the laboratory.

This task involves analyzing a Co^{+2} unknown solution by diluting a stock solution of $CoCl_2$ to make a series of working standard solutions. This analysis will be done by spectrophotometry. The 0.20 M stock solution will be your highest standard and it has been analyzed to give the following absorbances as a function of wavelength. All measurements are done in 1.2-cm cells. The only materials provided will be the stock solution, glassware, and the spectrophotometer. Everything else is your responsibility.

Wavelength	Absorbance
400 nm	0.028
420	0.132
440	0.235
460	0.416
480	0.674
500	0.845
520	0.920
540	0.706
560	0.376
580	0.174
600	0.106
620	0.080
640	0.055

You will need to plot an absorption spectrum and sketch a smooth curve through the data points. **Attach the graph.** Locate the wavelength value of maximum absorbance. Show on graph and record the value.

λ_{max} = _____ nm. (15)

From the absorption spectrum, calculate the value of the molar absorptivity at λ_{max}. (5)

From the 0.20M $CoCl_2$ stock solution, prepare a series of dilutions to produce a series of working standard solutions. The 0.20 M $CoCl_2$ stock solution will serve as your highest working standard solution. You will have 50 mL of stock solution to work with for diluting. You will need a total of at least five points including the blank to draw your calibration curve. All your working standards must have absorbances in the range of 0.1 to 1.0. Dilute your solution using a 25 mL graduated cylinder. **Attach a sheet of paper with all the dilution calculations for your series of working standards.** (20)

Now using the instructions provided in the laboratory or in SpectroPro, set up the Spectronic-20D to perform the analysis of the solutions at your λ_{max}. Record your concentrations and their measured absorbances in the table given below.

Solution Concentration	Absorbance
0 (blank)	

Using graph paper, draw (by hand) a calibration curve and fit a line to the data. **Attach the graph.** Analyze your unknown and determine its concentration. Show on graph and record. (15)

Unknown code: _____

A = _____ c = _____

When finished, all your working standard solutions are to be placed in the waste container.

Perform a linear regression using Excel or your TI-graphing calculator and report your regression equation in terms of the variables studied. Include the value of r^2. (10)

Equation	r^2

Using your regression equation, calculate the concentration of your unknown. Show your calculation. (5)

Calculate the value of the molar absorptivity from the regression results. Show your calculation. (5)

Once you have your calculated values of your unknown, bring them to your instructor. He will provide you with two more values of the unknown and the actual concentration.

Your value from graph (Value 1) _____

Your value from regression (Value 2) _____

Value 3 from instructor _____

Value 4 from instructor _____

Mean of 4 values above _____

Actual concentration _____

Calculate % error for the mean value and the % CV. Show all calculations below. (10)

% Error _____ % CV _____

How does your accuracy and precision compare to another student in the laboratory. Use data to support your comparison. (9)

List three possible sources of error for this experiment (not including student error). (6)

1. _____

2. _____

3. _____