Solutions and Spectroscopy Worksheet

As you work through the steps in the lab procedures, record your experimental values and the results on this worksheet.

Part A: Determination of the Concentration of a Copper(II) Ion Solution

Complete the following table. (Enter concentrations to three significant figures.)

Data Table A: Calibration Curve of Cu^{2+} Solutions and Unknown

Stock Cu^{2+} solution concentration _____ M						
Solution #	Target Volume of Cu^{2+}, mL	Actual Volume of Cu^{2+}, mL	Target Volume of H_2O, mL	Actual Volume of H_2O, mL	$[Cu^{2+}]$, M (calculated)	Absorbance at ~620 nm (measured to 3 sf)
1	1.20		4.80			
2	2.40		3.60			
3	3.60		2.40			
4	4.80		1.20			
Equation of Trendline (to three significant figures): $y =$ _____ $x +$ _____				$R^2 =$ _____ (to three significant figures)		

Upload your graph as a file with a maximum size of 1 MB.

Would you predict the absorbance of Solution 2 to be greater or less than that of Solution 1?

Why?

What is the concentration of Cu^{2+} in your unknown solution? Record this concentration below. (*Hint:* Use the absorbance of the unknown and the trendline to solve for the Cu^{2+} concentration.)

Unknown #

Absorbance at 620 nm (measured)

$[Cu^{2+}]$ (calculated)

Part B: Preparation of a Copper(II) ion Solution from Solid $CuSO_4 \cdot 5\ H_2O$

You desire to make a copper(II) solution at the same concentration as the unknown you just determined in Part A. How many grams of $CuSO_4 \cdot 5\ H_2O$ are required to make 25.00 mL of this solution? Record the result as the target mass in Data Table B. (Enter concentrations to three significant figures.)

Data Table B: Preparation of a Cu^{2+} Solution from solid $CuSO_4 \cdot 5\ H_2O$

Target $[Cu^{2+}]$ from Part A, M	Target Mass $CuSO_4 \cdot 5\ H_2O$, g	Actual Mass $CuSO_4 \cdot 5\ H_2O$, g	Absorbance of Cu^{2+} solution at 620 nm	$[Cu^{2+}]$ calculated from absorbance, M

Would you predict the absorbance of your solution made from solid to be greater than or less than that of the unknown solution?

Why?

Part C: Preparation of a Copper(II) Ion Solution by Dilution of a Stock $CuSO_4$ Solution

You desire to make a copper(II) solution at the same concentration as the unknown you determined in Part A. How many mL of the copper(II) stock solution are required to make 25.00 mL of this solution? Record the result as the target volume in Data Table C. (Enter concentrations to three significant figures.)

Table C: Preparation of a Cu^{2+} Solution from stock Cu^{2+} solution

Stock Cu^{2+} solution concentration _____ M				
Target $[Cu^{2+}]$ from Part A, M	Target Volume Cu^{2+} solution, mL	Actual Volume Cu^{2+} solution, mL	Absorbance of Cu^{2+} solution at 620 nm	$[Cu^{2+}]$ calculated from absorbance, M

Would you predict the absorbance of your solution made from a dilution to be greater than or less than that of the unknown solution?

Why?