

## EXPERIMENT 2 (ELECTRONS AND SOLUTION COLOR)

### Part 1 Preparation of Solutions

1. A. You prepare 100 mL of 0.10M manganese (II) sulfate for your study. How many grams of  $\text{Mn}(\text{SO}_4)$  (formula weight = 151) do you use?

$$151\text{g/mol} \times 0.10\text{mol/1000mL} \times 100\text{mL} = 1.51\text{g}$$

- B. Which one or more of the statements below are correct with regard to the above prepared solution (A)? Put a  $\checkmark$  in either the "Correct" or "Incorrect" column.

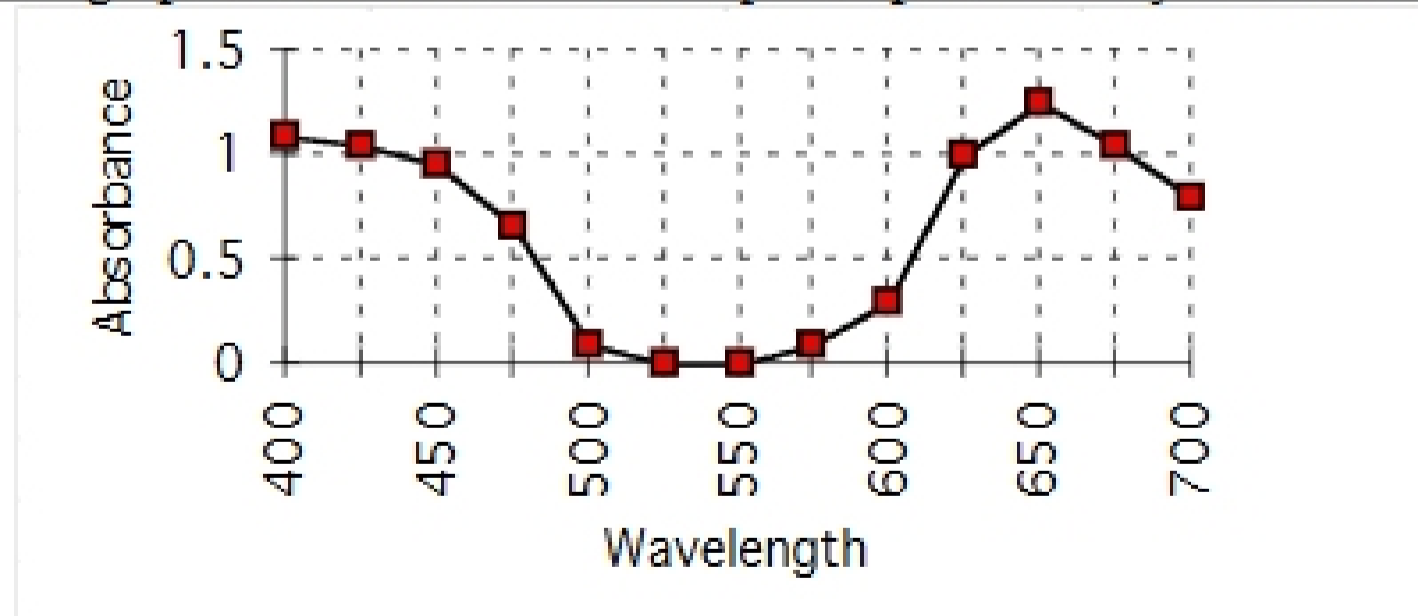
Statement	Correct	Incorrect
1. The prepared solution contains 10mmol of $\text{Mn}^{2+}$ ions.	$\checkmark$	
2. If you add 100mL water to your prepared solution, the resulting sample = 0.025M.		$\checkmark$
3. You remove 10mL from the prepared solution (A). This 10mL sample = 0.01M.		$\checkmark$

2. Below are the electron configurations for the ions  $\text{Mn}^{2+}$  and  $\text{Pb}^{2+}$  and their elements. Will solutions of  $\text{MnSO}_4$  and  $\text{PbBr}_2$  be colored or colorless? note: sulfate and bromide ions are colorless.

Element	Electron Configuration of element	Ion	Electron Configuration of Ion	Solution	Colored or colorless?
Mn	$[\text{Ar}] 4s^2 3d^5$	$\text{Mn}^{2+}$	$[\text{Ar}] 3d^5$	$\text{Mn}(\text{SO}_4)$	<i>Colored</i>
Pb	$[\text{Xe}] 6s^2 5d^{10} 6p^2$	$\text{Pb}^{2+}$	$[\text{Xe}] 6s^2 5d^{10}$	$\text{PbBr}_2$	<i>Colorless</i>

### Parts 2-3 Wavelength Color; Color and Light Absorption (Spectra)

3. The graph below shows the absorption spectrum of your unknown:



Information:  $\lambda$ 400-450 = violet; 450-500 = blue; 500-550 = green;  
 $\lambda$ 550-600 = yellow; 600-625 = orange, 625-700 = red

Based on the above spectrum, identify (circle) the complex ion:

Ion	Color of the Solution
[TiF <sub>6</sub> ] <sup>3-</sup>	violet-blue
[Cu(H <sub>2</sub> O) <sub>4</sub> ] <sup>2+</sup>	blue
<b>[FeCl<sub>4</sub>]<sup>-</sup></b>	<b>green-yellow</b>
[Ag(NH <sub>3</sub> ) <sub>2</sub> ] <sup>+</sup>	colorless
[Co(OH <sub>2</sub> ) <sub>6</sub> ] <sup>2+</sup>	red-violet

2) Is the following statement **correct** or incorrect?

The sample has an absorptivity factor (E) than is greater at  $\lambda$ 400 than at  $\lambda$ 500.

#### Parts 4-5 Concentration and Light Absorbance and What is the Sample Concentration?

4. A sample of unknown concentration is the same identity as that used to prepare the calibration graph shown below. The sample of unknown concentration has been diluted by placing 3.00mL in a 10.00mL volumetric flask and adding water to the calibration line of the flask. The absorbance of the diluted solution is 0.65 at the wavelength that was used for the calibration graph (below).

A) What is the molarity of the diluted sample?

$$\text{concentration} = \text{Abs}/E\ell = 0.65\text{Abs}/0.145\text{Abs}/\text{mm} = 4.48\text{mM} = 4.48 \times 10^{-3} \text{ M}$$

B) What is the original undiluted concentration of the sample?

$$M_i V_i = M_f V_f$$

$$M_i 3.00\text{mL} = 4.48 \times 10^{-3} \text{ M} \times 10.00\text{mL}$$

$$M_i = 1.49 \times 10^{-2} \text{ M}$$

