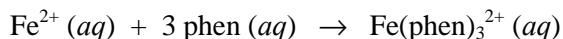


**Part 2. Standard Iron Solution Calculations****Dilution calculations:**  $V_1M_1 = V_2M_2$ ,*where  $M_1$  and  $M_2$  are the molarities of the original concentrated and the final dilute solutions and  $V_1$  and  $V_2$  are the volumes of the original concentrated and the final dilute solutions*

- Calculations:**
1. Convert g/L into a mole/L concentration for the standard  $\text{Fe}^{2+}$  solution
  2. Calculate the molarity of the stock  $\text{Fe}(\text{phen})_3^{2+}$  solution prepared from the standard  $\text{Fe}^{2+}$  solution using the stoichiometry of the following equation:



3. Calculate the molarities of the five standard  $\text{Fe}(\text{phen})_3^{2+}$  solutions prepared from the stock  $\text{Fe}(\text{phen})_3^{2+}$  solution

**Part 4. Iron Content Determination by Visible Spectrophotometry****Beer's law:**  $A = \epsilon l c$ 

**Known:** Absorbance of the  $\text{Fe}(\text{phen})_3^{2+}$  sample,  $A$   
 Molar absorptivity for  $\text{Fe}(\text{phen})_3^{2+}$  at 510 nm,  $\epsilon (\text{M}^{-1}\text{cm}^{-1})$   
 Dilution factors  
 Pathlength,  $l = 1 \text{ cm}$   
 Mass of the complex iron sample (g)  
 Moles of  $\text{Fe}^{3+}$  per gram of sample (mole/g) – ?

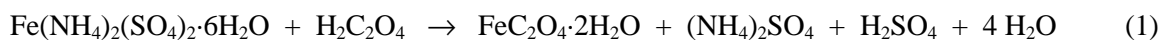
- Calculations:**
1.  $M(\text{Fe}(\text{phen})_3^{2+}) = \frac{A}{\epsilon l}$  (mole/L)
  2. Total dilution factor =  $5 \times 5 \times X$ , where  $X$  is your final dilution
  3.  $M_{\text{original}}(\text{Fe}^{3+}) = M(\text{Fe}(\text{phen})_3^{2+}) \times \text{Total dilution factor}$
  4. In 25 ml of solution:  $\text{moles Fe}^{3+} = M_{\text{original}}(\text{Fe}^{3+}) \times 0.025 \text{ L}$
  5.  $\text{Moles Fe}^{3+}/\text{g sample} = \frac{\text{moles Fe}^{3+}}{\text{mass of sample (g)}}$

**$K_xFe_y(C_2O_4)_x \cdot zH_2O$  Molecular Formula Determination**

**Known:** Moles of  $C_2O_4^{2-}$  per gram of sample (mole/g sample)  
 Moles of  $K^+$  per gram of sample (mole/g sample)  
 Moles of  $Fe^{3+}$  per gram of sample (mole/g sample)  
 $y = 1$   
 $x = ?$  and  $z = ?$

**Calculations:**

- $C_2O_4^{2-} : Fe^{3+} = \frac{\text{moles of } C_2O_4^{2-} / \text{g sample}}{\text{moles of } Fe^{3+} / \text{g sample}} \Rightarrow x = ?$
- $g Fe^{3+} / \text{g sample} = \text{moles } Fe^{3+} / \text{g sample} \times MW (Fe)$
- $g C_2O_4^{2-} / \text{g sample} = \text{moles } C_2O_4^{2-} / \text{g sample} \times MW (C_2O_4^{2-})$
- $g K^+ / \text{g sample} = \text{moles } K^+ / \text{g sample} \times MW (K)$
- $g H_2O / \text{g sample} = 1.000 \text{ g} - g Fe^{3+} / \text{g sample} - g C_2O_4^{2-} / \text{g sample} - g K^+ / \text{g sample}$
- $\text{mole } H_2O / \text{g sample} = \frac{g H_2O / \text{g sample}}{MW (H_2O)}$
- $H_2O : Fe^{3+} = \frac{\text{moles of } H_2O / \text{g sample}}{\text{moles of } Fe^{3+} / \text{g sample}} \Rightarrow z = ?$

**Determination of the Theoretical Yield and Percent Yield of  $K_xFe_y(C_2O_4)_x \cdot zH_2O$** **Chemistry involved:**

**Note:** Equation (2) has to be balanced before you start working on these calculations.

**Known:** Actual yield of the product (g)  
 Moles of  $FeC_2O_4 \cdot 2H_2O$ , produced in reaction (1) and used as a starting material in reaction (2). See Post-lab 5, question 5 for reference.  
 theoretical yield (g) – ? and percent yield (%) – ?

**Calculations:**

- Determine moles of  $K_x[Fe_y(C_2O_4)_x] \cdot zH_2O$  from moles of  $FeC_2O_4 \cdot 2H_2O$  using stoichiometry of equation (2)\*. Assume that  $FeC_2O_4 \cdot 2H_2O$  is the limiting reactant.
- Theoretical yield (g) = Moles  $K_x[Fe_y(C_2O_4)_x] \cdot zH_2O \times MW (K_x[Fe_y(C_2O_4)_x] \cdot zH_2O)$
- Percent yield =  $\frac{\text{actual yield (g)}}{\text{theoretical yield (g)}} \times 100\%$

\* If you were unable to balance equation (2) due to the erroneous molecular formula determination, leave equation (2) unbalanced and use a 1-to-1 molar ratio of  $FeC_2O_4 \cdot 2H_2O$  to  $K_x[Fe_y(C_2O_4)_x] \cdot zH_2O$  to complete the theoretical yield calculation.