

COURSE CH 117 L	ROLL NO. 23B0912	NAME Aditya Sanapala	
ASSIGNMENT NO. 5		DUE DATE	SUB. DATE

Experiment -5: Estimation of Iron

9.5

Aim: To estimate the amount of ferrous and ferric ions in a solution containing both.

Principle:

- The quantitative estimation of Fe^{2+} can be carried out by volumetric titration involving an oxidizing agent. (e.g: KMnO_4 , $\text{K}_2\text{Cr}_2\text{O}_7$)
- $\text{KMnO}_4 + \text{Fe}^{2+} + \text{H}_2\text{SO}_4 \rightarrow \text{Fe}^{3+} + \text{K}_2\text{SO}_4 + \text{MnSO}_4 + \text{H}_2\text{O}$
- By calculating the amount of KMnO_4 consumed, we can find the amount of Fe^{2+} .
- The quantitative estimation of Fe^{3+} generally involves the quantitative reduction of Fe^{3+} to Fe^{2+} and subsequent estimation of the Fe^{2+} by titration with KMnO_4 or $\text{K}_2\text{Cr}_2\text{O}_7$.



- The reduction of Fe^{3+} to Fe^{2+} can be brought upon by any of the following reagents: powdered tin, SnCl_2 , H_2S , etc.

Observations: (Sample number = 26)

Experiment-1: estimation of Fe^{2+}

Attempt	Vol. of KMnO_4 used (mL)	Avg. amt. of KMnO_4 used (mL)
Run 1	7.3 mL	$= \frac{7.3 + 7.6 + 7.7}{3}$
Run 2	7.6 mL	$= 7.53 \text{ mL}$
Run 3	7.7 mL	$\times 0.5$

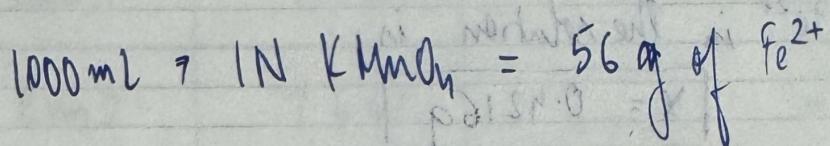
Experiment-2: estimation of Fe^{3+}

Attempt	Vol. of KMnO_4 used (mL)	Avg. amt. of KMnO_4 used (mL)
Run 1	11.8	$= \frac{11.8 + 11.7 + 11.6}{3}$
Run 2	11.7	$= 11.7 \text{ mL}$
Run 3	11.6	$\times 2$

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Calculations:



(a) Experiment-1: Estimation of Fe^{2+}

$$V_{\text{Sol}} = 10 \text{ mL}, \quad N_{\text{KMnO}_4} = 0.1 \text{ N}, \quad V_{\text{KMnO}_4} = V_{\text{av}} = 7.53 \text{ mL}$$

$$\text{amt. of } \text{Fe}^{2+} \text{ in the given solution} = \frac{10 \times N \times V_{\text{av}} \times 56}{1000}$$

$$X = \frac{10 \times 0.1 \times 7.53 \times 56}{1000} = 0.4216$$

$$\Rightarrow X = 0.4216 \text{ g}$$

(b) Experiment-2: Estimation of Fe^{3+}

$$V_{\text{Sol}} = 10 \text{ mL}, \quad N_{\text{KMnO}_4} = 0.1 \text{ N}, \quad V_{\text{KMnO}_4} = V_{\text{av}} = 11.7 \text{ mL}$$

$$\text{Total amt. of } \text{Fe}^{2+} \text{ in the solution} = \frac{10 \times N \times V_{\text{av}} \times 56}{1000}$$

$$Y = \frac{10 \times 0.1 \times 11.7 \times 56}{1000} = 0.6552$$

$$Y = 0.6552 \text{ g}$$

Now, amt. of Fe^{3+} ion = $Y - X$

$$= 0.6552 - 0.4216$$

$$= \underline{\underline{0.2336 \text{ g}}}$$

Result:

→ The amount of Fe^{2+} in the solution is

$$\boxed{X = 0.4216 \text{ g}}$$

→ The amount of Fe^{3+} in the solution is

$$\boxed{Y - X = 0.2336 \text{ g}}$$