INDIAN INSTITUTE OF TECHNOLOGY, BOMBAY

COURSE	ROLL NO.	NAME	
CH1171	23B0912	Aditya Sanapala	
ASSIGNMENT NO.	DUE DATE	SUB. DATE	
5			

9.5

Experiment-5: Estimation of Iron

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. (eg: $KMnO_4$, $K_2Cr_2O_7$)

→ $KMnO_4 + Fe^{2+} + H_2SO_4 \longrightarrow Fe^{3+} + K_2SO_4 + MnSO_4 + H_2O$

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 $K_2Cr_2O_7$.

$$Zn + 2Fe^{3+} \longrightarrow Zn^{2+} + 2Fe^{2+}$$

→ The reduction of Fe^{3+} to Fe^{2+} can be brought upon by any of the following reagents: Powdered Zn, $SnCl_2$, H_2S, etc.

Observations: (Sample number = 26)

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

Attempt	Vol. of $KMnO_4$ used (mL)
Run 1	7.3 mL
Run 2	7.6 mL
Run 3	7.7 mL

Avg. amt. of $KMnO_4$ used (mL)

$= \frac{7.3 + 7.6 + 7.7}{3}$

$= 7.53$ mL

×0.5

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

Attempt	Vol. of $KMnO_4$ used (mL)
Run 1	11.8
Run 2	11.7
Run 3	11.6

Avg. amt. of $KMnO_4$ used (

$= \frac{11.8 + 11.7 + 11.6}{3}$

$= 11.7$ mL

×2

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Calculations:

$1000\ mL$ of $1N\ KMnO_4$ = $56\ g$ of Fe^{2+}

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

$V_{sol} = 10\ mL$, $N_{KMnO_4} = 0.1N$, $V_{KMnO_4} = V_{av.} = 7.53\ mL$

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

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

$$\Rightarrow \boxed{x = 0.4216\ g}$$

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

$V_{sol} = 10\ mL$, $N_{KMnO_4} = 0.1N$, $V_{KMnO_4} = V_{av} = 11.7\ mL$

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

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

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

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

$= 0.6552 - 0.4216$

$= \boxed{0.2336\ g}$

Result:

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

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

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

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