

Experiment No: 5

Observation Table

Table 1. Titration of hypo solution as given CuSO_4 solution

Indicator - Starch

Endpoint - Blue to Colourless

Table 1

S.No	Volume of CuSO_4 soln	Burette Readings		Volume of hypo soln (ml)
		Initial	Final	
1	10.0	0.0	9.0	9.0
2	10.0	9.0	18.0	9.0
3	10.0	18.0	27.0	9.0

Concordant Readings: 9.0 mL

Experiment No. 05

- 1) Aim: → To determine the strength of free chlorine in given water sample iodometrically. Given standard $N/40$ CuSO_4 solution to standardise $\text{Na}_2\text{S}_2\text{O}_3$
- 2) Apparatus Required: → Burette, Pipette, Measuring flask, Glass rod,
Chemicals used: → KI solution (10%), Hypo solution ($\text{Na}_2\text{S}_2\text{O}_3$), Starch solution (freshly prepared), $N/40$ CuSO_4 solution
- 3) Theory: → Chlorine is a powerful oxidising agent & is cheaply available. It is widely used for disinfection of potable & municipal water sample supplies to remove bacteria, fungus & other pathogenic micro-organisms & for deodorization. It is done with the help of bleaching powder or chlorine gas or chlorine dissolved in water in form of concentrated solutions or with chloramines

Chlorine gas hydrolyses in water almost completely to form hypochlorous acid (HOCl)

Table 2:-> Titration of hypo solution vs given water sample.

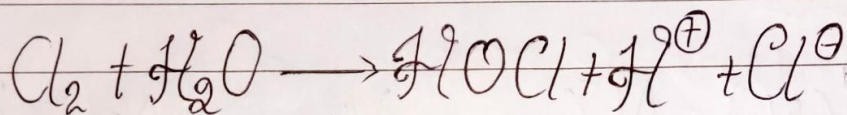
Indicator :-> Starch

Endpoint :-> Blue to Colourless

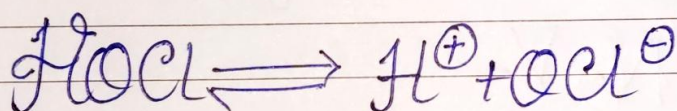
Table 2a

S.No	Volume of Water Sample Taken	Burette Readings		Volume of Hypo soln (in mL)
		Initial	Final	
1	10.0	0.0	3.5	3.5
2	10.0	3.5	7.0	3.5
3	10.0	7.0	10.5	3.5

Concordant Reading = 3.5 mL



HOCl dissociates into H^+ & OCl^- (hypochlorite ion) in the reversible reaction.



HOCl is a weak acid with $\text{pK}_a \approx 7.5$ at 25°C . HOCl, the prime disinfecting agent, is therefore dominant at $\text{pH} < 7.5$ & is a more effective disinfectant than OCl^- ion which dominates at $\text{pH} > 7.5$.

In dilute solutions & at $\text{pH} > 4$, very little molecular chlorine exists in soln.

The determination of available chlorine is done by treating the known volume of sample with an excess of a solution of K.I. The free chlorine present in water oxidises the corresponding amount of KI to I_2 . The liberated I_2 is estimated by titrating against standard hypo solution, using starch as indicator.

Calculations

$$\begin{aligned} \text{I.) } N_{\text{CuSO}_4} (N_1) &= N/40 & N_{\text{Hypo}} (N_2) &= ? \\ V_{\text{CuSO}_4} (V_1) &= 10 \text{ mL} & V_{\text{Hypo}} (V_2) &= 9 \text{ mL} \end{aligned}$$

$$N_1 V_1 = N_2 V_2$$

$$\frac{10}{40} = N_2 \times 9$$

$$N_2 = \frac{1 \cdot N}{36}$$

$$\text{II.) } N_{\text{water}} (N_3) = ? = \text{Equivalent to dissolved chlorine}$$

$$V_{\text{water}} (V_3) = 10 \text{ mL}$$

$$N_3 V_3 = N_4 V_4$$

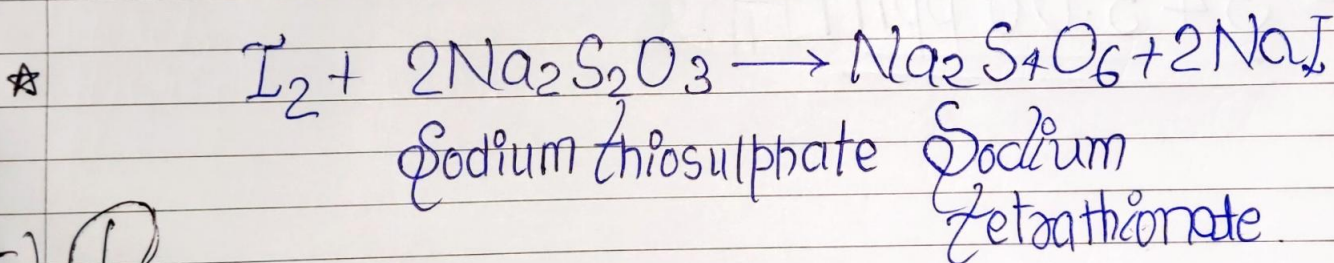
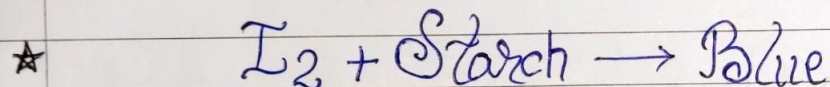
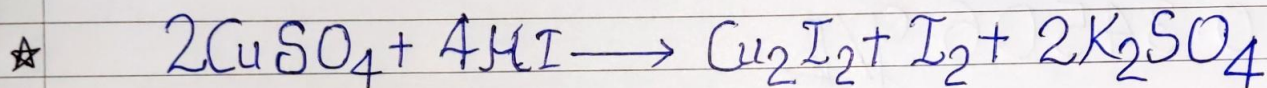
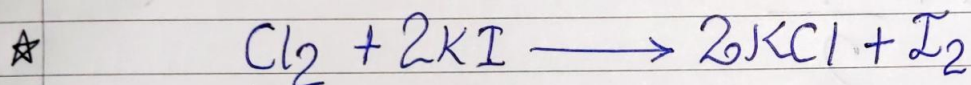
$$N_3 \times 10 = \frac{1}{36} \times 3.5$$

$$V_{\text{Hypo}} (V_4) = 3.5 \text{ mL}$$

$$[N_4 = N_2]$$

$$N_3 = 0.00972 \text{ N}$$

4). CHEMICAL REACTIONS.



5.) ★ Procedurze

Ex) Standardization of Hypo soln with given CuSO_4 solution

→ Take 10 mL of given CuSO_4 soln from pipette in conical flask. Add 1 mL of KI soln of titrate with hypo solution till faint yellow colour develops. At this point add 1-2 drops of starch as indicator. The solution will turn blue. Titrate further with hypo to colourless as end point. Note volume of hypo solution as V mL.

$$\text{Total Chlorine Residuals} = N_3 \times \frac{\text{Eq wt of } Cl_2}{2}$$

$$= 0.00972 \times \frac{71}{2}$$

$$= 0.34506 \text{ g/l}$$

$$= \underline{\underline{345.06 \text{ ppm Ans}}}$$

I) Titration of given water sample with hypo solution

Take 10 ml of given water sample from pipette in conical flask. Add 1 ml of KI soln & titrate with hypo solution till faint yellow colour develops. At this point, add 1-2 drops of starch as indicator. The soln turns blue. Add hypo till colourless as end point. Note volume of hypo used.

6) Result:

Amount of Residual chlorine in a given water sample = 345.66 ppm Ans

7) Precautions:

- (i) The soln being unstable should be treated immediately after preparation.
- (ii) The soln should be well shaken before each aliquot is withdrawn from titration.
- (iii) Chlorine vapours being harmful, the soln should

not be sucked into pipette with the mouth.

