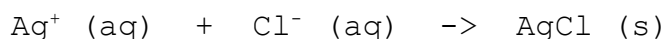


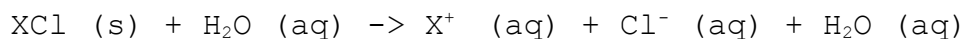
## Volumetric Analysis of Chloride Introduction

Volumetric analysis is a method for determining the composition of a substance by precisely measuring the volume of a reacting substance. The amount of a substance present can be determined by finding the volume of a chemical required to react with it. The reactions end-point is usually signified by an indicator.

In this experiment we will determine the composition of an unknown chloride salt (XCl) by reacting chloride and silver ions to produce a silver chloride precipitate.



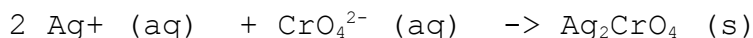
We will begin our experiment by first adding our unknown XCl sample to water. The XCl will disassociate in the water into  $\text{Cl}^-$  and  $\text{X}^+$  ions:



We then add a solution of Potassium Chromate ( $\text{K}_2\text{CrO}_4$ ) to serve as an indicator. The potassium chromate will change our unknown solution to a yellow color.

A 1M solution of  $\text{AgNO}_3$  is added to serve as the source for our  $\text{Ag}^+$  ions. As  $\text{AgNO}_3$  is added  $\text{AgCl}$  will precipitate out of the solution. The initial quantity of  $\text{Cl}^-$  ions present serves as the limiting agent to our reaction.

The  $\text{CrO}_4^{2-}$  ion will react with excess  $\text{Ag}^+$  ions once all the  $\text{Cl}^-$  ion, which has a greater affinity to react with  $\text{Ag}^+$  ions, is completely consumed. This will trigger a color change in our solution from yellow to reddish-brown as the reddish  $\text{Ag}_2\text{CrO}_4$  precipitates out.



The Volume of  $\text{AgNO}_3$  added is used to determine the moles of  $\text{AgCl}$  created.

Moles of  $\text{AgCl}$  = Moles of  $\text{AgNO}_3$  added = (Volume of  $\text{AgNO}_3$  added) X (Molarity of  $\text{AgNO}_3$ )

We can determine the % of  $\text{Cl}^-$  present in are unknown:

Moles of  $\text{Cl}^-$  = moles of  $\text{AgCl}$

Weight of  $\text{Cl}^-$  in XCl sample = (moles of  $\text{Cl}^-$ )x(atomic weight of  $\text{Cl}^-$  = 35.4527)

%  $\text{Cl}^-$  in sample = (weight of  $\text{Cl}^-$  in XCl sample / weight of XCl sample) x 100 %