

Laboratory Exercise: Common Anions

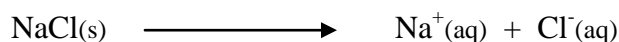
In this exercise we will examine the particular reactions of several common anions and will use these results to identify the anions present in an unknown solution.

Salt derives from the Latin *sal* for ordinary Table Salt. Currently it is a generic term for substances formed by reaction of an Acid and a Base that are composed of a cation and an anion. (Strictly speaking Oxides and Hydroxides, ionic compounds composed of the O^{2-} or OH^- ions are not considered salts.) So the salt Sodium Chloride (NaCl) is generated by the reaction of the acid Hydrochloric Acid (HCl) and the base Sodium Hydroxide (NaOH):

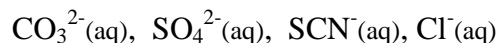


and it contains the cation Na^+ and the Cl^- .

Many salts are soluble in Water such that the anion and cation dissociate and form an aqueous solution we denote as (aq). Sodium Chloride will dissolve in Water to produce:



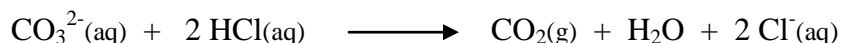
We intend to examine aqueous solutions of salts of the following anions:



Each has a distinct chemistry that can be used to identify its presence.

Carbonate (CO_3^{2-})

Will react with an acid such as Hydrochloric Acid (HCl) to produce Carbon Dioxide (CO_2) gas that will appear as a bubbling.



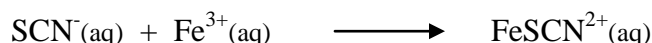
Sulfate (SO_4^{2-})

Will react with Barium Ion (Ba^{2+}) to form a white solid.



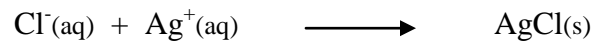
Thiocyanate (SCN^-)

Will react with Ferric Ion (Fe^{3+}) to produce a dark orange solution.



Chloride (Cl⁻)

Will react with the Silver Ion (Ag⁺) to form a white solid.



We will begin by examining the behavior of solutions of salts of each of these anions to confirm the above chemical reactions. Then we will test a solution that contains an unknown mixture of these anions to determine which ions are present. This method of testing solutions for the presence of anions assumes the test for one anion will not give a positive result for another anion.

Procedure

All your measurements must be made to the correct number of significant figures and must have the unit of measurement indicated.

1. Obtain four medium test tubes and label each for one of the four cations.
2. Obtain a 1 mL sample of each of the aqueous salts for each anion.
3. To the sample of the Carbonate salt, add 1 mL of HCl. Observe what happens.
4. To the sample of the Sulfate salt, add 1 mL of HCl and a few drops of Barium Chloride. Observe what happens.
5. To the sample of the Thiocyanate salt, add 1 mL of Acetic Acid and a drop or two of Ferric Nitrate. Observe what happens.
6. To the sample of the Chloride salt, add 1 mL of HNO_3 and a few drops of Silver Nitrate. Observe what happens.
7. Dispose of each solution by washing it down the drain with plenty of Water. Rinse your test tubes with Deionized Water.
8. Obtain a 4 mL sample of the Unknown anion solution. Split this into four 1 mL samples in each of four test tubes.
9. Individually perform each of the above tests (3-6) on the unknown sample. Observe your results and identify the anions present.