Introduction

The process of determining the composition of a sample of matter by conducting chemical tests is called qualitative analysis. In this experiment, you will learn how to conduct qualitative tests to determine if certain anions or cations are present in solution. You will then use these tests to determine the ionic composition of an unknown solution.

No two ions give the same set of chemical reactions. Each ion is unique and reacts in its own, characteristic way. Qualitative analysis is made possible by this fact. Solutions of unknown ions can be subjected to chemical tests and the results can be compared to the results given by known ions, in the same tests. By conducting the appropriate tests and applying rules of logic, the identities of the ions present in an unknown solution can be determined.

In this experiment, you will observe several types of chemical reactions that are commonly used as tests in qualitative analysis. These reactions include a color change, the evolution of a gas, and the formation of a precipitate. In precipitation reactions, two ionic solutions are combined and, upon mixing, a solid product—the precipitate—is formed. This solid is a compound formed from ions from each solution and it precipitates, or "falls out of solution", because it is insoluble in water.

A precipitate generally forms very quickly, and in very fine particles. This gives the solution the appearance of cloudy water or thick paint, depending upon the nature and amount of the precipitate formed. The precipitate will slowly settle out of the solution. Testing for precipitate formation is done often to determine the ionic composition of solutions.

Objectives

1. To identify common anions and cations in solution using simple chemical tests.
2. To use these tests to identify ions in an unknown solution.

Equipment

- 2 safety goggles
- 9 small test tubes
- 1 test tube rack
- 1 25-mL graduated cylinder
- 1 250-mL beaker
- 1 gas burner
- 1 medicine dropper
- 1 nichrome wire (10-cm length)
- 1 cobalt-blue glass
- 1 test tube holder
- 1 ring stand
- 1 ring support
- 1 wire gauze
- 1 crucible tongs
- 1 plastic wash bottle