

# Chemical Reactions and Qualitative Analysis

## An Inquiry Activity

### Introduction

To protect human health and safeguard the environment, the EPA regulates the amounts of many cations, including barium, copper, iron, lead, silver and zinc, in drinking water. Precise quantitative analysis of these cations is achieved using special instruments. Sometimes, however, all one really wants to know is if these cations are present in water. This question can usually be answered by qualitative analysis, in which the possible impurities in water are separated from one another and then identified using a series of characteristic chemical reactions.

### Concepts

- Chemical reactions
- Qualitative analysis
- Precipitation reactions
- Complex ion reactions

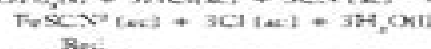
### Background

Inorganic qualitative analysis of water involves carrying out a series of chemical reactions to test for the presence or absence of specific ions. In this experiment, you will design a qualitative analysis scheme for the separation and identification of three metal cations—iron(III) ( $\text{Fe}^{3+}$ ), silver ( $\text{Ag}^{+}$ ) and zinc ( $\text{Zn}^{2+}$ ) ions. The cations can be separated from the mixture using precipitation reactions to selectively precipitate one cation. After the cations have been separated, they can be positively identified using characteristic complex ion reactions or additional precipitation reactions. Consider the following relevant chemical reactions of iron(III), silver and zinc ions.

#### Precipitation Reactions



#### Complex Ion Reactions



### Experiment Overview

The purpose of this experiment is to design and carry out a sequence of chemical reactions for the separation and identification of iron(III) ( $\text{Fe}^{3+}$ ), silver ( $\text{Ag}^{+}$ ) and zinc ( $\text{Zn}^{2+}$ ) ions in water. Two parallel series of tests will be carried out, one with a known sample containing all three metal cations, the other with an unknown sample containing only one or two metals.

# Flinn Scientific Qualitative Analysis

**Rachel S Tattersall**



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