# The effect of concentration changes on equilibria

## Introduction

Iron(III) ions and thiocyanate ions react in solution to produce the complex ion thiocyanotoiron(III) according to the equation shown below:

$Fe^{3+}(aq) + SCN^{-}(aq) \rightleftharpoons Fe(SCN)^{2+}(aq)$

pale yellow colourless blood-red

The colour produced by the complex ion can indicate the position of the equilibrium.

Ammonium chloride removes $Fe^{3+}$ ions from the equilibrium by forming complex ions such as $FeCl_4^-$.

A possible reaction is: $Fe^{3+}(aq) + 4Cl^-(aq) \rightarrow FeCl_4^-(aq)$

## Apparatus

| | | |
|---|---|---|
| Goggles | de-ionised water | ammonium chloride, $NH_4Cl$ |
| Bench mat | spatula | 0.5M KSCN |
| 4 test-tubes and test-tube rack | glass stirring rod | 0.5M iron(III) chloride |
| 2 teat pipettes | potassium thiocyanate | |

## Method

1. Mix together one drop of 0.5M iron(III) chloride and one drop of 0.5M potassium thiocyanate in a test-tube. Add about 5 $cm^3$ of water to form a pale orange-brown solution.
2. Divide this solution into four equal parts in four test tubes.
3. Add one drop of 0.5M iron(III) chloride to one test tube.
   Add one drop of 0.5M potassium thiocyanate to a second test tube.
4. Compare the colours of these solutions with the untouched samples. Record your observations.
5. Add a spatula-full of solid ammonium chloride to a third test-tube and shake well.
   Compare the colour of this solution with the remaining tube and note your observation.

## Suggested results table

| Change | Observation | Cause | Inference |
|---|---|---|---|
| $[Fe^{3+}]$ increased | | | |
| [KSCN] increased | | | |
| $[Fe^{3+}]$ decreased | | | |

## Analysis

Suggest a cause for each colour change observed, and then suggest what can be inferred about a shift in the position of equilibrium.



 