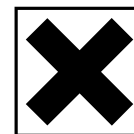
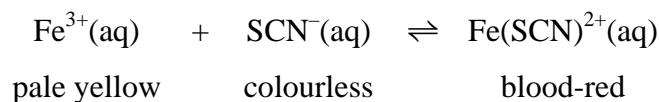


## The effect of concentration changes on equilibria

### Introduction

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



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

Ammonium chloride removes  $\text{Fe}^{3+}$  ions from the equilibrium by forming complex ions such as  $\text{FeCl}_4^{-}$ .

A possible reaction is:  $\text{Fe}^{3+}(\text{aq}) + 4\text{Cl}^{-}(\text{aq}) \rightarrow \text{FeCl}_4^{-}(\text{aq})$

### Apparatus

Goggles	de-ionised water	ammonium chloride, $\text{NH}_4\text{Cl}$
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

- Mix together one drop of 0.5M iron(III) chloride and one drop of 0.5M potassium thiocyanate in a test-tube. Add about  $5 \text{ cm}^3$  of water to form a pale orange-brown solution.
- Divide this solution into four equal parts in four test tubes.
- 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.
- Compare the colours of these solutions with the untouched samples. Record your observations.
- 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
$[\text{Fe}^{3+}]$ increased			
$[\text{KSCN}]$ increased			
$[\text{Fe}^{3+}]$ 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.