



## **Volumetric Analysis: Oxidation - Reduction**

**Chemistry – Leaving Cert**

**Quick Notes**

## Volumetric Analysis: Oxidation - Reduction

Potassium Permanganate ( $\text{KMnO}_4$ ) is a very powerful oxidising agent which gains five electrons when it is fully reduced. It is not available in a pure state and its solubility is low, therefore it is not a primary standard.  $\text{KMnO}_4$  solution is standardised by titrating it against a solution of ammonium iron sulphate, which is a reducing agent and primary standard. The solution is acidified to prevent hydrolysis and also to prevent the  $\text{Fe}^{2+}$  being oxidised to  $\text{Fe}^{3+}$  by atmospheric oxygen or by oxygen in the water. To standardise a solution of  $\text{KMnO}_4$  by titration, potassium permanganate solution is put into the burette (read from top of meniscus) and ammonium iron sulphate solution as well as dilute sulphuric acid is placed in the conical flask. In the absence of sufficient acid, a brown precipitate of  $\text{MnO}_2$  develops. The colour change throughout the experiment is purple to colourless to a faint permanent pale pink colour. To determine the amount of iron in an iron tablet, a titration is carried out with potassium permanganate in the burette and the iron tablet solution with dilute  $\text{H}_2\text{SO}_4$  in the conical flask. A faint permanent pink colour indicates the end-point. Sodium thiosulfate ( $\text{Na}_2\text{S}_2\text{O}_3$ ) is a reducing agent that is not a primary standard because it is not available in a pure state. To standardize a solution of sodium thiosulfate, the solution of sodium thiosulfate of unknown concentration is placed in the burette, standardised  $\text{KMnO}_4$  solution is put in the conical flask along with excess potassium iodide and excess dilute  $\text{H}_2\text{SO}_4$ . The colour changes observed throughout the titration is red to pale yellow to blue/black to colourless. To determine the percentage of hypochlorite in bleach, standardised thiosulfate solution is put into the burette, an iodine solution is put into the conical flask (which is a diluted bleach solution and excess KI and dilute  $\text{H}_2\text{SO}_4$ ). The indicator is starch which is added when the solution turns pale yellow and the colour change at the end of the titration is blue/black to colourless.