NEATH PORT TALBOT COLLEGE
COLEG CASTELL NEDD PORT TALBOT

School of Maths & Science
Science Practical

Standardisation of Potassium Manganate (VII) By Titration with Ammonium Iron (II) Sulfate

---

◆ **Aim**

To standardise a solution of potassium manganate (VII)

◆ **Introduction**

Potassium manganate (VII) is not suitable for a primary standard and therefore a solution of potassium manganate (VII) needs to be standardised before use.
A suitable primary standard is ammonium iron (II) sulfate. Most iron (II) salts are unstable, some of the iron (II) being oxidised to iron (III) by molecular oxygen. The oxidation reactions are faster in basic or neutral solutions. For this reason most iron (II) salts cannot be used as primary standards. This process is inhibited by the presence of acids. However ammonium iron (II) sulfate is reasonably stable to aerial oxidation and as a result may be used as a primary standard. Oxidation in solution is inhibited by the presence of acid and so sulfuric acid is added to the standard solution when making it up. In the titration the end point can be detected by watching for a permanent pink tinge. This occurs when MnO_4- is in slight excess (i.e. All the iron (II) has been converted to iron (III)). Potassium manganate (VII) acts as its own indicator.

◆ **Safety**

Control Measures
- The wearing of **safety glasses** and a **laboratory coat at all times** will be sufficient to take account of most hazards and significant risks.
- You are reminded of the need of good laboratory practice in order to maintain a safe working environment.

Hazards

Corrosive	Sulfuric acid
Harmful/ Irritant	Sulfuric acid Ammonium iron (II) Sulfate Potassium manganate (VII)
Oxidising	Potassium manganate (VII)

◆ **Procedure**

1. Weigh out *accurately* about 9.8 g of the provided iron (II) salt (iron (II) ammonium sulfate). Dissolve in about 30 cm^3 of dilute sulfuric acid (to prevent air oxidation of the Fe^{2+} to Fe^{3+}) and make up to 250 cm^3 of solution with distilled water in a volumetric flask.

2. Pipette 25.00 cm^3 aliquots of the iron (II) solution into a conical flask; add 25.00 cm^3 of 2 mol dm^{-3} sulfuric acid.

3. Titrate against the potassium manganate (VII) solution (approx. 0.02 mol dm^{-3}) until the first permanent pink colour is obtained.

4. Repeat the titration in the usual way

◆ **Questions**

1. Calculate the concentration of iron (II).

2. Write a half equation for the reduction of MnO_{4-}.

3. Write a half equation for the oxidation of Fe^{2+}.

4. Deduce the redox equation for the reaction of MnO_{4-} with Fe^{2+}.

5. Determine the concentration of potassium manganate (VII).

6. Why are most iron (II) salts unsuitable for use as primary standards? Why can we use ammonium iron (II) sulfate as a primary standard.

7. Explain why an indicator was not needed in this titration.

8. Suppose your titres in the experiment were 0.50 cm^3 too large. What error does this bring to the concentration of potassium manganate (VII)?

9. What are the cationic species present when the potassium manganate (VII) exactly neutralises the iron (II)?