

NEATH PORT TALBOT COLLEGE COLEG CASTELL NEDD PORT TALBOT

School of Maths & Science Science Practical

Determination of the Molar Mass of an Ethanedioate Salt

◆ Aim

To find the molar mass of an ethanedioate salt via titration with a standardised solution of potassium manganate (VII)

◆ Introduction

The purpose of this experiment is to determine the relative molecular mass of an ethanedioate salt.

◆ Safety



Control Measures

- The wearing of safety glasses, gloves and a laboratory coat at all times will be sufficient to take account of most hazards and significant risks.
- Keep stoppers on bottles as much as is possible.
- All waste is to be placed in the labelled container immediately after use.
- You are reminded of the need of good laboratory practice in order to maintain a safe working environment.

Hazards



Harmful/ Irritant

Dilute sulfuric acid / potassium manganate (VII)



Toxic

Ethanedioate compounds

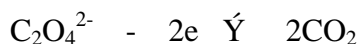


Oxidising

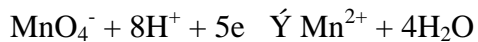
Potassium manganate (VII)

◆ Theory

Ethanedioate ion reacts according to:



combination with



gives



or more simply, **two moles of MnO_4^-** react with **five moles of $\text{C}_2\text{O}_4^{2-}$**



Thus if a sample of W g of the ethanedioate requires a volume V (cm^3) of MnO_4^- solution of concentration m (mol dm^{-3}) then

$$\text{Moles of } \text{MnO}_4^- = mV/1000$$

$$\text{Thus} \quad \text{moles of } \text{C}_2\text{O}_4^{2-} = \frac{5mV}{2 \times 1000} = \frac{5mV}{2000} \quad (1)$$

$$\text{Now} \quad \text{moles} = \frac{\text{mass}}{\text{molar} \cdot \text{mass}} = \frac{W}{Mr} \quad (2)$$

$$\text{Therefore} \quad \text{moles of } \text{C}_2\text{O}_4^{2-} = \frac{W}{Mr} = \frac{5mV}{2000}$$

$$\text{Therefore} \quad Mr = \frac{2000W}{5mV}$$

◆ Procedure

1. Weigh out accurately 0.3g of the provided ethanedioate salt into a 600 cm³ beaker.
Add 240 cm³ of recently prepared deionised water, and 250 cm³ of 1 mol dm⁻³ sulfuric acid. Cool to 25-30 °C and stir until all the ethanedioate is dissolved. Add about 15 cm³ of the manganate (VII) solution over a period of 60-90 secs. while stirring slowly. Now heat the solution to 55- 60 °C and complete the titration until a faint pink colour persists for 30 sec.
2. Repeat to obtain three consistent mass/titre values.

◆ Results

	Sample 1	Sample 2	Sample 3
Mass of compound and container /g			
Mass of container less some compound /g			
Mass of compound used /g			
Final burette reading / cm ³			
Initial burette reading / cm ³			
Volume of KMnO ₄ solution used / cm ³			

◆ Calculation

	Sample 1	Sample 2	Sample 3
Ratio Mass/Titre g cm ⁻³			

Calculate the relative molecular mass, Mr, of the compound.

◆ Questions

1. Explain why you do not need to add an indicator in a manganate (VII) titration.

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2. Explain why mass/titre values cannot be averaged unlike the titres obtained using a standard solution.

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3. Give the full displayed structural formula of the ethanedioate ion.

4. What can you deduce about the consistency, or otherwise, of the three mass/titre ratios.

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5. Assume that one of your titres in part 2 was 0.25 cm^3 too large and estimate the effect this would have on the Mr.

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