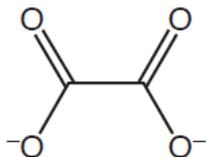


A Level Chemistry A
H432/03 Unified chemistry

Question Set 8

1 This question is about ethanedioic acid, (COOH)₂, and ethanedioate ions, (COO⁻)₂.

(a) The ethanedioate ion, shown below, can act as a bidentate ligand.



Fe³⁺ forms a complex ion with three ethanedioate ions.
The complex ion has two optical isomers.

Draw the 3D shapes of the optical isomers.

In your diagrams, show the structure of the ethanedioate ligands and any overall charge.

[3]

(b) Ethanedioic acid, (COOH)₂, is present in rhubarb leaves.

A student carries out a redox titration using aqueous cerium(IV) sulfate, Ce(SO₄)₂(aq), to determine the percentage, by mass, of ethanedioic acid in rhubarb leaves.

In the titration, Ce⁴⁺(aq) ions oxidise ethanedioic acid in hot acid conditions:



Ce⁴⁺(aq) ions have a yellow colour. Ce³⁺(aq) ions are colourless.

The student weighs 82.68g of rhubarb leaves and extracts ethanedioic acid from the leaves.

The ethanedioic acid is added to dilute sulfuric acid to form a colourless solution which is made up to 250.0 cm³ with distilled water.

The student heats 25.00 cm³ of this solution to 70 °C and titrates this volume with 0.0500 mol dm⁻³ Ce(SO₄)₂ from the burette.

The student repeats the titration to obtain concordant (consistent) titres.

Titration results

The trial titre has been omitted.

| | 1 | 2 | 3 |
|---------------------------------|-------|-------|-------|
| Final reading/cm ³ | 24.30 | 47.80 | 23.65 |
| Initial reading/cm ³ | 1.05 | 24.30 | 0.50 |

(i) This titration is self-indicating and the student does not need to add an indicator.

What colour change would the student observe at the end point?

[1]

(ii) Calculate the percentage, by mass, of ethanedioic acid in the rhubarb leaves.

Give your answer to an **appropriate** number of significant figures.

[6]

Total Marks for Question Set 8: 10

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