

1 Iron is an element that is essential in the human diet. Some people need to take iron supplement tablets to ensure an adequate intake of iron.

You will investigate the mass of iron in an iron supplement tablet by titrating a solution with potassium manganate(VII).



FB 1 is an aqueous solution of iron supplement tablets made by dissolving 14 tablets in 1.00 dm³ of solution. The iron in each tablet is iron(II) sulfate, FeSO₄•7H₂O.

FB 2 is 0.0100 mol dm⁻³ acidified aqueous potassium manganate(VII), KMnO₄.

FB 3 is dilute sulfuric acid, H₂SO₄.

(a) Method

- Fill a burette with **FB 2**.
- Pipette 25.0 cm³ of **FB 1** into a conical flask.
- Use the 25 cm³ measuring cylinder to add 10.0 cm³ of **FB 3** to the conical flask.
- Perform a rough titration and record your burette readings in the space below.

The rough titre is cm³.

- Carry out as many accurate titrations as you think necessary to obtain consistent results.
- Make sure any recorded results show the precision of your practical work.
- Record, in a suitable form in the space below, all your burette readings and the volume of **FB 2** added in each accurate titration.

Rinse the burette with distilled water and leave to drain while you continue Question 1.

Results

| | |
|-----|--|
| I | |
| II | |
| III | |
| IV | |
| V | |
| VI | |
| VII | |

[7] -

- (b)** From your accurate titration results, calculate a suitable mean value to use in your calculations. Show clearly how you obtain the mean value.

25.0 cm³ of **FB 1** required cm³ of **FB 2**. [1]

(c) Calculations

- (i)** Give your answers to **(c)(ii)**, **(c)(iii)** and **(c)(iv)** to an appropriate number of significant figures. [1]
- (ii)** Calculate the amount, in mol, of manganate(VII) ions in the volume of **FB 2** in **(b)**.

amount of MnO₄⁻ = mol [1]

- (iii)** Use your answer to **(c)(ii)** and the equations at the start of the question to calculate the concentration, in mol dm⁻³, of iron(II) ions in **FB 1**.

concentration of Fe²⁺ = mol dm⁻³ [1]

- (iv)** Use your answer to **(c)(iii)** to calculate the concentration, in g dm⁻³, of iron(II) ions in **FB 1**.

concentration of Fe²⁺ = g dm⁻³ [1]

- (v)** The manufacturer of the iron supplement tablets used to make **FB 1** claims that each tablet contains a minimum of 150 mg of Fe²⁺.

Use your answer to **(c)(iv)** and the information given about **FB 1** to determine whether this claim is correct. Show your working.

[1]

- (d)** A student used all the **FB 3** and suggests that dilute hydrochloric acid would be a suitable replacement. Suggest whether the student is correct or not. Explain your answer.

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 [1]

[Total:14]