

1 FB 1 is an aqueous solution containing 100.00 g dm^{-3} of sodium thiosulphate, $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$.

FB 2 is an aqueous solution containing $0.023 \text{ mol dm}^{-3}$ of the chromate ion, CrO_4^{2-} .

Chromate ions, CrO_4^{2-} , oxidise iodide ions, I^- , in the presence of acid, H^+ , and produce aqueous iodine, I_2 which can be titrated with sodium thiosulphate. You are to use this reaction to show that the CrO_4^{2-} ion is reduced to Cr^{3+} during this reaction.

(a) Use a burette to measure between 45.0 cm^3 and 45.5 cm^3 of **FB 1** into the 250 cm^3 volumetric (graduated) flask labelled **FB 3**. Record your burette readings in Table 1.1.

Table 1.1 Dilution of FB 1

Final burette reading	/ cm^3	
Initial burette reading	/ cm^3	
Volume of FB 1	/ cm^3	

[2]

Fill the flask to the mark with distilled or deionised water and mix the contents thoroughly by shaking. This solution is **FB 3**. **Fill the second burette with the solution FB 3 you have prepared.**

(b) Pipette 25.0 cm^3 of **FB 2** into a conical flask and add, from a measuring cylinder, 10 cm^3 of dilute sulphuric acid and 10 cm^3 of 5% aqueous potassium iodide, KI. Titrate the contents of the conical flask with **FB 3** until the colour of the iodine solution has faded to a light orange/yellow colour. Add 1 cm^3 of starch indicator and continue the titration until the blue-black colour of the starch-iodine complex disappears leaving the transparent pale blue colour of Cr^{3+} . Record your burette readings in Table 1.2. **Repeat the titration as many times as you think necessary to obtain accurate results. Make certain that the recorded results show the precision of your practical work.** **Table 1.2 Titration of FB 2 with FB 3**

Final burette reading / cm^3				
Initial burette reading / cm^3				
Volume of FB 3 used / cm^3				

[10]

Summary

25.0 cm^3 of **FB 2** reacted with cm^3 of **FB 3**.

Show which results you used to obtain this volume of **FB 3** by placing a tick under the readings in Table 1.2.

(c) Calculate the concentration in mol dm^{-3} of sodium thiosulphate, $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$, in **FB1**.

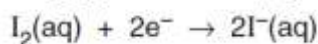
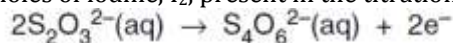
[Na, 23.0; S, 32.1; O, 16.0; H, 1.0.]

[1]

(d) Calculate the concentration in mol dm^{-3} of sodium thiosulphate in the diluted solution **FB 3**.

[1]

(e) Calculate the number of moles of sodium thiosulphate run into the flask during the titration and use this figure and the equations below to calculate the moles of iodine, I_2 , present in the titration flask.



[2]

(f) Calculate the number of moles of CrO_4^{2-} ion pipetted into the titration flask.

[1]

(g) Calculate the number of moles of iodine, I_2 , produced by 1 mole of CrO_4^{2-}

[1]

(h) Use your answer to **(g)** and oxidation numbers to show that CrO_4^{2-} has been reduced to Cr^{3+} .

[2]

[Total 20]