1 FB 1 is an aqueous solution containing 100.00 g dm^{-3} of sodium thiosulphate, $Na_2S_2O_3.5H_2O$.
FB 2 is an aqueous solution containing 0.023 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, $Na_2S_2O_3.5H_2O$., 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.

$$2S_2O_3^{2-}(aq) \rightarrow S_4O_6^{2-}(aq) + 2e^-$$

$$I_2(aq) + 2e^- \rightarrow 2I^-(aq)$$

[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, I2, 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]