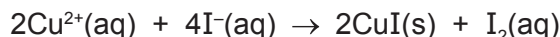
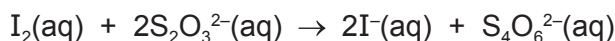


## EXPERIMENT NO. 6

- 1 In this experiment you will determine the value of  $x$  in the formula for hydrated copper(II) sulfate,  $\text{CuSO}_4 \cdot x\text{H}_2\text{O}$ . You will first react a solution of  $\text{Cu}^{2+}$  ions with excess iodide ions,  $\text{I}^-$ . This reaction produces iodine.



The amount of iodine produced can be determined by titrating with thiosulfate ions,  $\text{S}_2\text{O}_3^{2-}$ .



**FA 1** is  $0.150 \text{ mol dm}^{-3}$  sodium thiosulfate,  $\text{Na}_2\text{S}_2\text{O}_3$ .

**FA 2** is dilute sulfuric acid.

**FA 3** is  $1.00 \text{ mol dm}^{-3}$  potassium iodide,  $\text{KI}$ .

**FA 4** is a solution made by dissolving  $32.5 \text{ g}$  of  $\text{CuSO}_4 \cdot x\text{H}_2\text{O}$  in  $1.00 \text{ dm}^3$  of solution.  
starch indicator

### (a) Method

- Fill the burette with **FA 1**.
- Pipette  $25.0 \text{ cm}^3$  of **FA 4** into a conical flask.
- Use the measuring cylinder to add  $10 \text{ cm}^3$  of **FA 2** to the same conical flask.
- Use the measuring cylinder to add  $10 \text{ cm}^3$  of **FA 3** to the same conical flask. The mixture will become brown because of the formation of  $\text{I}_2$ , and will become cloudy because of the formation of the white precipitate of  $\text{CuI}$ .
- Add **FA 1** from the burette until the mixture becomes a light brown colour.
- Add 10 to 20 drops of starch indicator until the mixture becomes blue-black.
- Continue to titrate with **FA 1** until the blue-black colour disappears leaving a mixture with an off-white solid. This is the end-point.
- You should test that the end-point has been reached by adding 2 more drops of starch indicator. If the titration has reached the end-point the added starch indicator will cause no change in colour.
- Perform a rough titration and record your burette readings in the space below.

The rough titre is .....  $\text{cm}^3$ .

- 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 below all of your burette readings and the volume of **FA 1** added in each accurate titration.

I	
II	
III	
IV	
V	
VI	
VII	

[7]

- (b) From your accurate titration results, obtain a suitable value for the volume of **FA 1** to be used in your calculations.  
Show clearly how you obtained this value.

25.0 cm<sup>3</sup> of **FA 4** required ..... cm<sup>3</sup> of **FA 1**. [1]

**(c) Calculations**

Show your working and appropriate significant figures in the final answer to **each** step of your calculations.

- (i) Calculate the number of moles of thiosulfate ions in the volume of **FA 1** calculated in (b).

moles of S<sub>2</sub>O<sub>3</sub><sup>2-</sup> = ..... mol

- (ii) Using the equations on page 1, calculate the number of moles of copper(II) ions in 25.0 cm<sup>3</sup> of **FA 4**.

moles of Cu<sup>2+</sup> = ..... mol

- (iii) Calculate the concentration, in mol dm<sup>-3</sup>, of copper(II) ions in **FA 4**.

concentration of Cu<sup>2+</sup> in **FA 4** = ..... mol dm<sup>-3</sup>

- (iv) Calculate the value of **x** in CuSO<sub>4</sub>·**x**H<sub>2</sub>O.

**x** = .....

[5]

(d) (i) Calculate the maximum percentage error in one of your accurate titres.

maximum percentage error = ..... %

(ii) A student suggests that the experiment could be made more accurate if the volume of **FA 3** was measured using a burette.

Give a reason why the student might make this suggestion.

.....  
.....  
.....

Explain why this change would **not** improve the accuracy of the experiment.

.....  
.....

[3]

[Total: 16]

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