



# **GCE A LEVEL CHEMISTRY**

S21-A410

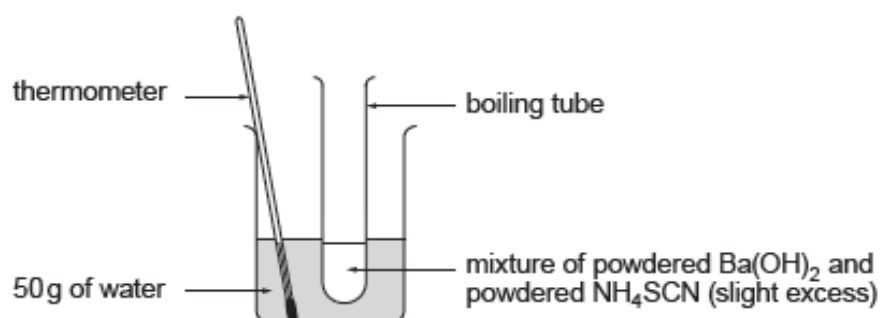
## **Assessment Resource C**

Chemistry in Practice

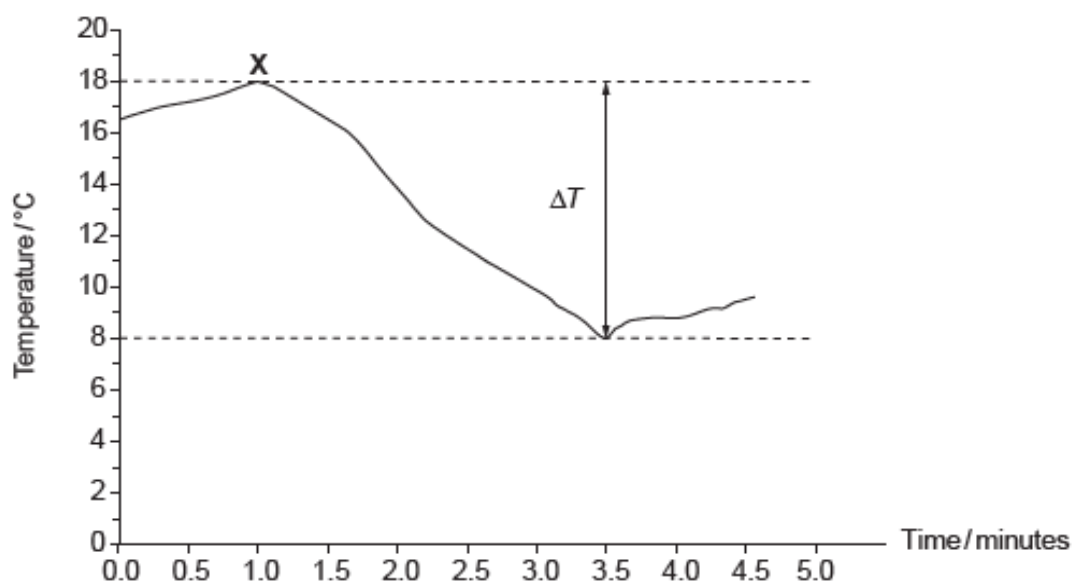
1. The reaction between solid barium hydroxide and solid ammonium thiocyanate is endothermic. The equation for the reaction is shown below.



A student carries out an experiment to determine the enthalpy change of reaction using the apparatus below.



The temperature / time curve shown below was plotted. A slight excess of ammonium thiocyanate was added to the barium hydroxide at point X.



- (a) The value of  $\Delta T$  obtained was much lower than expected.

Briefly indicate **three** possible sources of error in the  $\Delta T$  measurement from the information provided. [2]

Possible sources of error
1.
2.
3.

- (b) The student measured a  $10.0\text{ }^\circ\text{C}$  temperature change on mixing both solids and used this value to calculate the enthalpy change of reaction as  $+10.5\text{ kJ mol}^{-1}$ .

Calculate the mass of powdered  $\text{Ba}(\text{OH})_2$  used in the experiment. [2]

Mass = ..... g

- (c) Deduce the maximum temperature change if the experiment were repeated using 100g of water rather than the 50g used in the first experiment, with all other factors kept the same. Give a reason for your answer. [1]

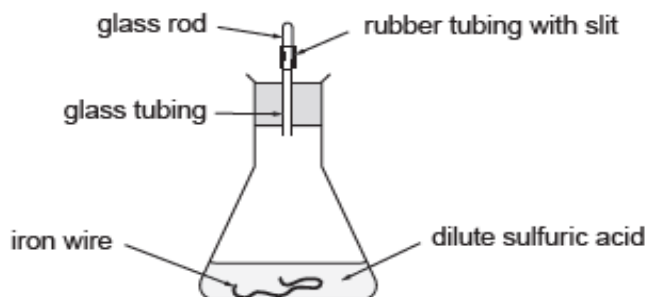
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2. A student carried out the following experiment to determine the percentage of iron in a wire.

Step 1 Preparation of a solution of iron(II) ions

2.78 g of the wire was placed in a conical flask. 100 cm<sup>3</sup> of dilute sulfuric acid (an excess) was added and the flask was warmed in order to maintain a steady reaction.

The diagram shows the apparatus used. The piece of rubber tubing with a slit in it lets hydrogen escape but stops any air entering the flask.



When all the iron had reacted the solution was transferred to a volumetric flask and made up to 500 cm<sup>3</sup> with deionised water.

(a) (i) Give the ionic equation for the reaction of iron with dilute acid. [1]

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(ii) Describe a chemical test to show that the solution contains iron(II) ions. [3]

Reagent(s) .....

Observation(s) .....

Ionic equation .....

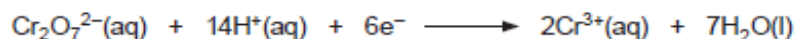
(b) Suggest why it was necessary to prevent any air from entering the flask. [1]

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Step 2 Titration of the iron(II) solution against a standard solution of potassium dichromate(VI)

Unlike manganate(VII), dichromate(VI) titrations require an indicator. One indicator that may be used is diphenylamine sulfonate. At the end-point, the indicator colour changes from green to violet on addition of one drop of the dichromate(VI) solution.



- (c) (i) The student was asked to prepare a  $0.0200 \text{ mol dm}^{-3}$  standard solution of potassium dichromate(VI),  $\text{K}_2\text{Cr}_2\text{O}_7$ . Calculate the mass of potassium dichromate(VI) needed to prepare  $250 \text{ cm}^3$  of this solution. [2]

Mass = ..... g

- (ii) The student pipetted  $25.0 \text{ cm}^3$  of the iron(II) solution into a conical flask. He added  $25 \text{ cm}^3$  of dilute sulfuric acid and titrated against the  $0.0200 \text{ mol dm}^{-3}$  potassium dichromate(VI) solution.

Describe how the student should perform one titration to find the volume of potassium dichromate(VI) needed for complete reaction. You can assume that the dichromate(VI) solution is already in the burette. [4]

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(d) Four  $25.0\text{ cm}^3$  samples of the iron(II) solution were acidified and titrated against the dichromate(VI) solution. The mean volume of dichromate(VI) required for complete reaction was  $19.85\text{ cm}^3$ .

(i) Why did the student carry out several titrations and then calculate a mean volume of potassium dichromate(VI) used? [1]

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(ii) Write the equation for the reaction of iron(II) ions with dichromate(VI) ions in acid solution. [1]

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(iii) Calculate the percentage of iron in the wire. [3]

Percentage = ..... %

(iv) The balance used in weighing the wire has an uncertainty for each reading of  $\pm 0.005\text{ g}$ . Estimate the maximum percentage error in weighing the wire. Show your working. [1]

Percentage error = ..... %

