Candidate Name	Centre Number	Candidate Number
		2

GCE AS/A level

333/01

CHEMISTRY CH3a

P.M. MONDAY, 12 May 2008

45 minutes

FOR EXAMINER'S USE ONLY	
Question	Mark
1	
2	
3	
TOTAL MARK	

ADDITIONAL MATERIALS

In addition to this examination paper, you will need a:
- calculator;
- copy of the **Periodic Table** supplied by WJEC. Refer to it for any **relative atomic masses** you require.

INSTRUCTIONS TO CANDIDATES

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions in the spaces provided.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

The maximum mark for this paper is 30.

Your answers must be relevant and must make full use of the information given to be awarded full marks for a question.

You are reminded that marking will take into account the Quality of Written Communication used in all written answers.

Page 8 may be used for rough work.

Candidates are advised that answers to all questions should be brief and concise; lengthy extended responses are not required.

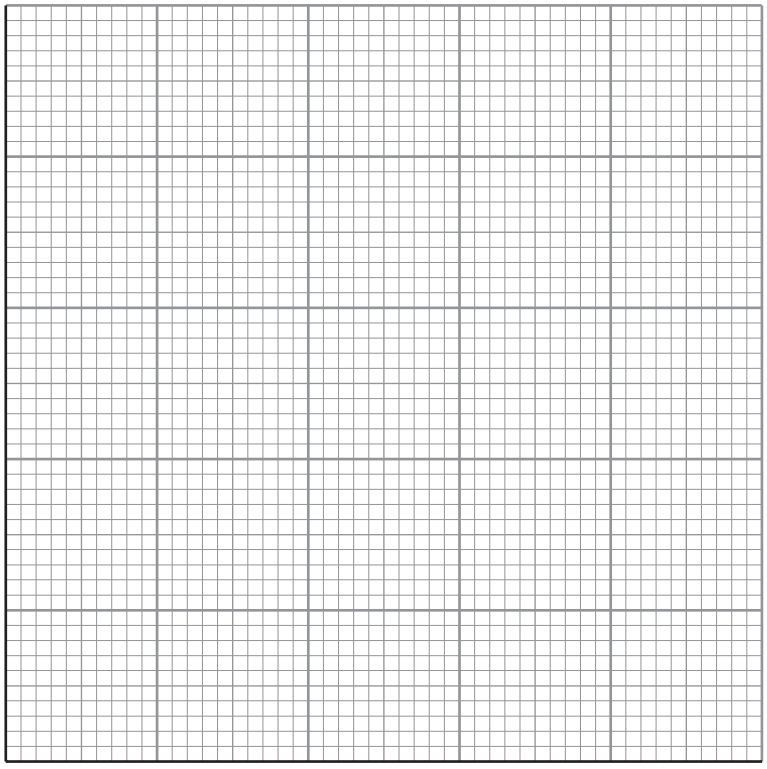
1. The results below were obtained in an experiment to measure the rate of oxidation of iodide ion by hydrogen peroxide in acid solution as given by the following equation.

$$H_2O_2 + 2H^+ + 2I^- \longrightarrow I_2(\text{brown}) + 2H_2O$$

Time / s	0	100	200	300	400	500
Concentration of I_2 / mol dm^{-3}	0	0·011	0·022	0·034	0·042	0·050

(a) (i) Plot these results on the grid below, labelling each axis and choosing suitable scales that make full use of the grid. [4]

(ii) Draw the line that best fits the points. [1]



(iii) Calculate the initial rate of reaction from the graph and give the units. [2]

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Rate = ... Units .....

(b) Describe briefly how you could carry out this experiment to enable you to obtain a set of results as shown in the table on page 2. [2]

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(c) Describe briefly how you could study the effect of changing the iodide ion concentration on the rate of the above reaction. [2]

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(d) State why it is necessary to keep the temperature constant during rate measurements. [1]

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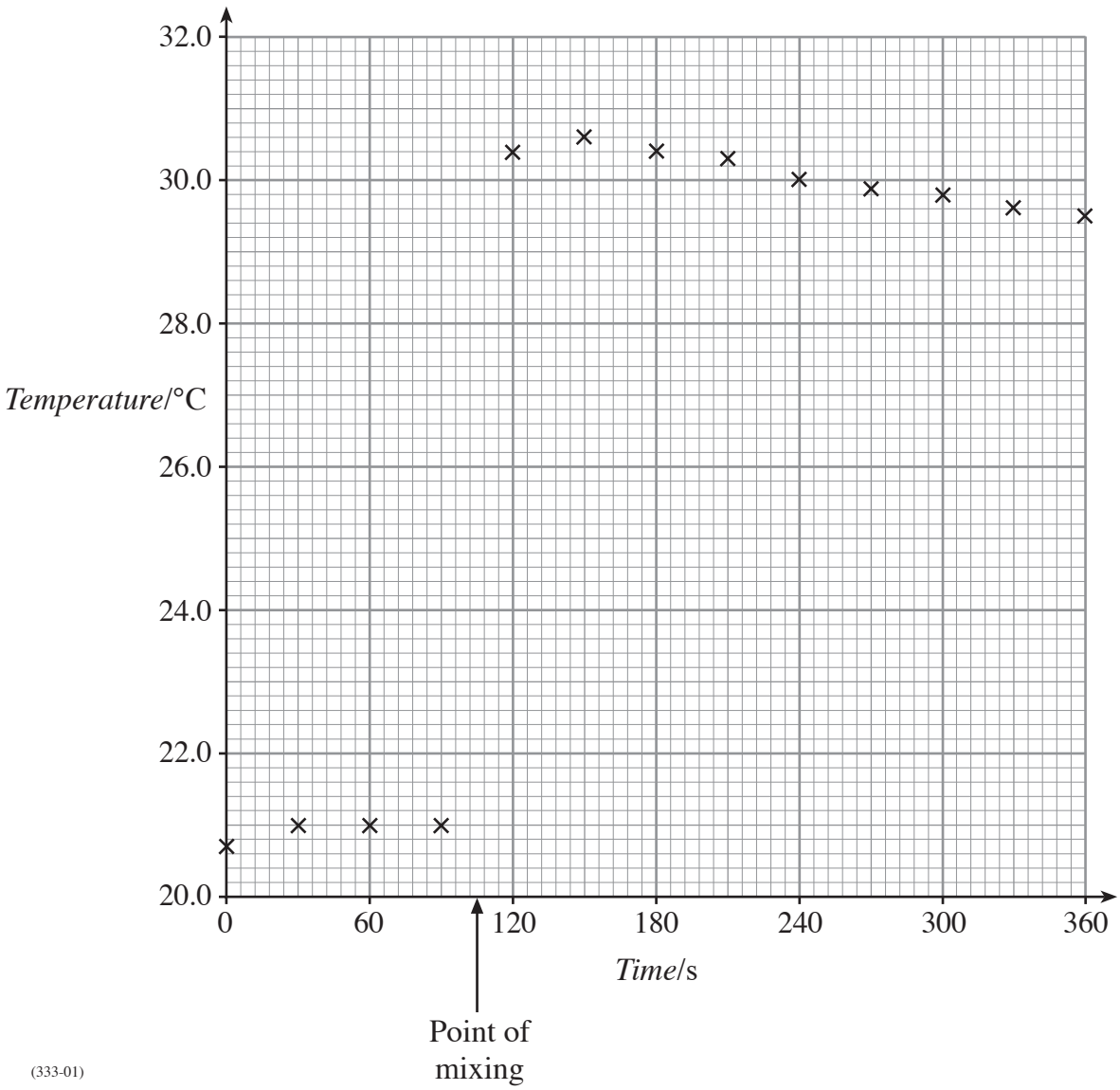
Total [12]

2. *(a)* Give a labelled diagram of a simple apparatus that could be used to measure the enthalpy change of the reaction of solid zinc with copper sulphate solution as in the following equation.

$$Zn(s) + CuSO_4(aq) \longrightarrow Cu(s) + ZnSO_4(aq)$$

Label all the parts of your diagram. [4]

(b) The results obtained in such an experiment have been plotted on the graph below.



(i) Determine the maximum temperature **change** by drawing lines to complete the graph. Label this measurement on your graph and record its value there. [3]

(ii) This experiment used 0·65 g of zinc (A_r = 65) and 50 g of copper sulphate solution (an excess). Calculate the enthalpy change for this reaction using your value for ΔT, the data above and the equation provided below, giving units.

$$\Delta H = \frac{-4.18 m \Delta T}{n}$$

where m is the mass of copper sulphate solution and n is the number of moles of zinc used. [3]

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ΔH = ... Units .....

(c) Explain why it is better to use zinc powder than a piece of solid zinc in this experiment. [1]

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Total [11]

3. Sodium hydroxide solutions may absorb carbon dioxide from the air to form carbonate. Such a solution will then contain both hydroxide and carbonate ions. One way to analyse the solution for hydroxide and carbonate ions is by a two-part experiment as follows.

Part 1

Excess barium chloride solution is added to one portion to precipitate all the carbonate before titrating the hydroxide with standard acid solution.

$$Na_2CO_3 + BaCl_2 \longrightarrow BaCO_3(s) + 2NaCl \quad \textbf{(A)}$$

$$NaOH + HCl \longrightarrow NaCl + H_2O \quad \textbf{(B)}$$

Part 2

A second portion is titrated with the standard acid so that the HCl reacts with both the hydroxide and carbonate ions.

$$NaOH + HCl \longrightarrow NaCl + H_2O \quad \textbf{(B)}$$

$$Na_2CO_3 + 2HCl \longrightarrow 2NaCl + H_2O + CO_2 \quad \textbf{(C)}$$

The titration in **Part 1** gives the hydroxide concentration. The titration in **Part 2** involves both hydroxide and carbonate.

In the first titration, 25·0 cm^3 of solution needed 14·0 cm^3 of 1·00 mol dm^{-3} HCl and in the second titration, 25·0 cm^3 of solution needed 22·0 cm^3 of 1·00 mol dm^{-3} HCl.

(a) (i) Use the data from the first titration and equation **(B)** to calculate the hydroxide ion concentration. [2]

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(ii) In the second titration,

$$\text{moles HCl used} = \text{moles of } OH^- + 2(\text{moles of } CO_3^{2-})$$

Calculate the concentration of the carbonate ions in the solution. [2]

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(b) Use the chemical equations on page 6 to explain why the statement in section *(a)*(ii) is true. [1]

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(c) State how you could test to check that all the carbonate has been removed from the solution before the first titration. [1]

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(d) Suggest another method by which the concentration of carbonate in the solution could be found, based on an equation on page 6 but without using any titration. [1]

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Total [7]

Rough Work