

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use Total EMPA mark	
Examiner's Initials	
Section	Mark
Task 1	
Task 2	
Section A	
Section B	
Section C	
TOTAL EMPA MARK	



General Certificate of Education
Advanced Level Examination
June 2010

Chemistry

CHM6X

Unit 6X A2 Externally Marked Practical Assignment

Written Test

For submission by 15 May 2010

For this paper you must have:

- the Periodic Table / Data Sheet, provided as an insert (enclosed)
- your Task Sheets 1 and 2, including your own Candidate Results Sheets
- a ruler with millimetre measurements
- a calculator.

Time allowed

- 1 hour 20 minutes

Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 36.
- The Periodic Table / Data Sheet is provided as an insert.
- You will be marked on your ability to:
 - use good English
 - organise information clearly
 - use accurate scientific terminology.

Section A

These questions are about the task, the investigation of a hair bleach.

You should use Task Sheets 1 and 2, including your own Candidate Results Sheets, to answer them.

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

1 (a) Consider your results from Task 1. State **one** observation which enabled you to confirm that solution **A** contained an oxidising agent.

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(1 mark)

1 (b) State what you can deduce about solution **A** from your observations in Test 2.

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(1 mark)

2 In a further test, when solution **A** was added to iron(II) chloride solution, the mixture changed colour from green to yellow. When sodium hydroxide solution was added to this mixture, a precipitate was formed. Identify this precipitate and state its colour.

Precipitate

Colour of precipitate

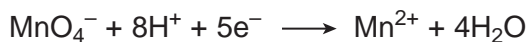
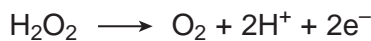
(2 marks)

3 Record the average titre from your Candidate Results Sheet for Task 2.

Average titre / cm³

(1 mark)

4 Half-equations for the redox reactions occurring in the reaction between hydrogen peroxide and potassium manganate(VII) are shown below.



Deduce an overall equation for the reaction between hydrogen peroxide and manganate(VII) ions in acidic solution.

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(1 mark)

5 The concentration of the potassium manganate(VII) solution used was 0.0200 mol dm⁻³. Use your answers from Questions 3 and 4 to calculate the amount, in moles, of hydrogen peroxide in 25.0 cm³ of the hair bleach solution provided for Task 2. Show your working.

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.....
.....

(2 marks)

6 Use your answer from Question 5 to calculate the concentration, in mol dm⁻³, of hydrogen peroxide in the hair bleach solution provided for Task 2. Give your answer to the appropriate precision.

.....
.....

(2 marks)

Turn over ►

7 Hydrogen peroxide is sold commercially as an aqueous solution containing approximately 60 g dm^{-3} of hydrogen peroxide.

7 (a) Use data from the Periodic Table to calculate the M_r of hydrogen peroxide. Give your answer to the appropriate precision.

.....
.....
(1 mark)

7 (b) Calculate the concentration, in mol dm^{-3} , of a solution containing 60.0 g dm^{-3} of hydrogen peroxide.

.....
.....
(1 mark)

7 (c) The concentration of hydrogen peroxide in a hair bleach is $0.050 \text{ mol dm}^{-3}$. Use your answer from Question **7 (b)** to calculate the dilution factor needed to make the commercial hydrogen peroxide solution suitable for use in this hair bleach. Show your working.

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(2 marks)

Turn over for the next question

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ANSWER IN THE SPACES PROVIDED**

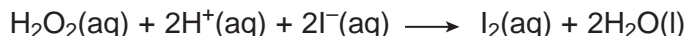
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Section B

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

Introduction

Hydrogen peroxide is a powerful oxidising agent. Acidified hydrogen peroxide reacts with iodide ions to form iodine according to the following equation.



The **initial rate** of this reaction is investigated by measuring the time taken to produce sufficient iodine to give a blue colour with starch solution.

A series of experiments was carried out, in which the concentration of iodide ions was varied, while keeping the concentrations of all of the other reagents the same. In each experiment the time taken (t) for the reaction mixture to turn blue was recorded.

The initial rate of the reaction can be represented as $\left(\frac{1}{t}\right)$, and the initial concentration of iodide ions can be represented by the volume of potassium iodide solution used.

A graph of $\log_{10} \left(\frac{1}{t}\right)$ on the y -axis against \log_{10} (volume of KI(aq)) is a straight line. The gradient of this straight line is equal to the order of the reaction with respect to iodide ions.

The results obtained are given in the table below. The time taken for each mixture to turn blue was recorded on a stopclock graduated in seconds.

Expt.	Volume of KI(aq) / cm ³	log ₁₀ (volume of KI(aq))	Time / s	log ₁₀ $\left(\frac{1}{t}\right)$
1	5	0.70	71	-1.85
2	8	0.90	46	-1.66
3	10	1.00	37	-1.57
4	15	1.18	25	-1.40
5	20	1.30	19	-1.28
6	25	1.40	14	-1.15

8 Use the results given in the table to plot a graph of $\log_{10} \left(\frac{1}{t}\right)$ on the y -axis against \log_{10} (volume of KI(aq)).

Draw a straight line of best fit on the graph, ignoring any anomalous points. (5 marks)

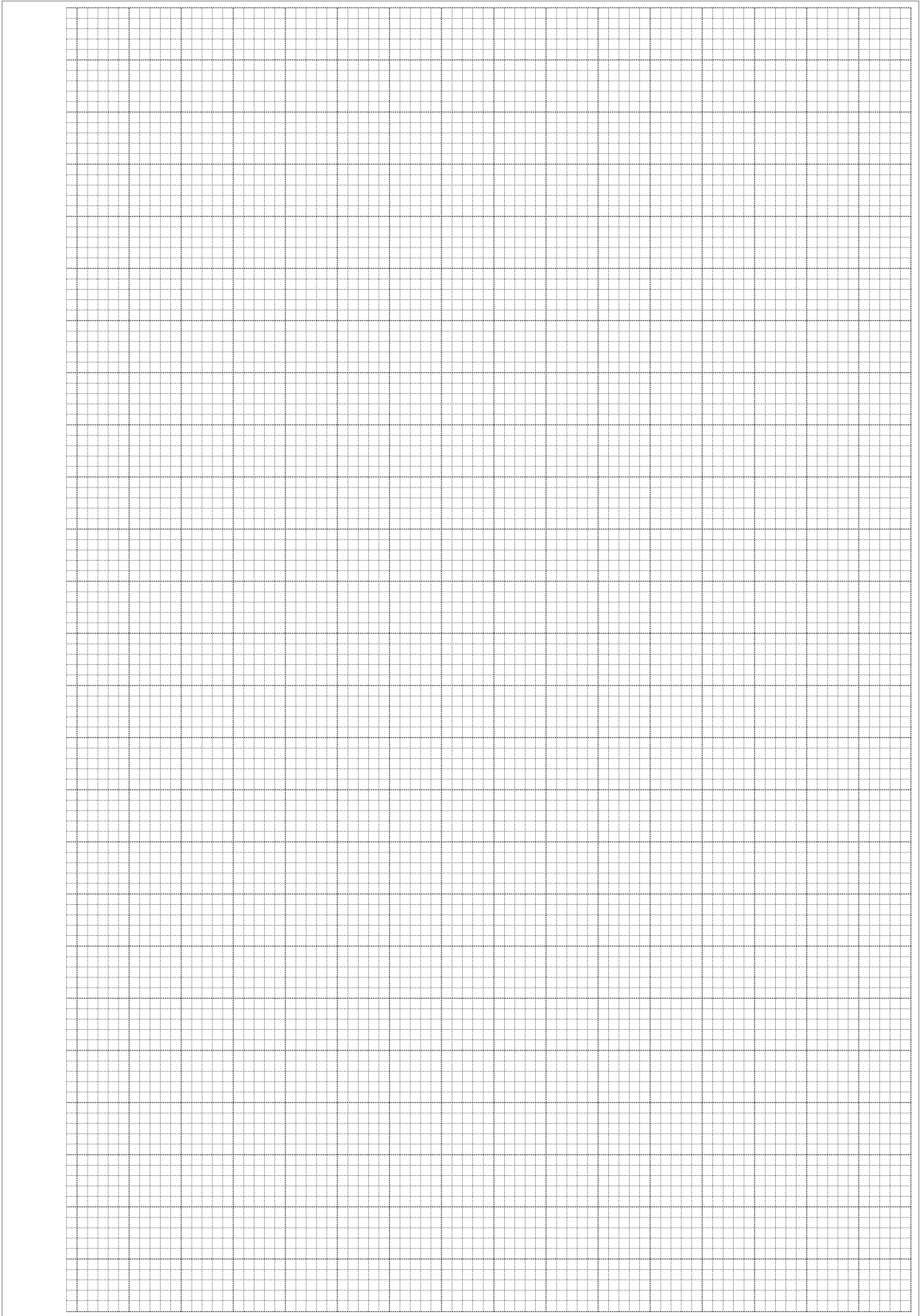
9 Determine the gradient of the line you have drawn. Give your answer to two decimal places. Show your working.

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.....

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(3 marks)



Turn over ►

10 Deduce the order of reaction with respect to iodide ions.

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(1 mark)

11 A student carried out the experiment using a flask on the laboratory bench. The student recorded the time taken for the reaction mixture to turn blue. State **one** way this method could be improved, other than by repeating the experiment or by improving the precision of time or volume measurements. Explain why the accuracy of the experiment would be improved.

Improvement

.....

Explanation

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(2 marks)

12 Pure hydrogen peroxide is a colourless liquid with a boiling point of 150 °C. Hydrogen peroxide was originally produced commercially in a two-stage process. In the first stage barium was heated in air to form barium peroxide. In the second stage barium peroxide was added to aqueous nitric acid. The equations for the reactions are shown below.

Stage 1 $Ba(s) + O_2(g) \longrightarrow BaO_2(s)$

Stage 2 $BaO_2(s) + 2HNO_3(aq) \longrightarrow H_2O_2(aq) + Ba(NO_3)_2(aq)$

12 (a) Suggest **one** method of separating hydrogen peroxide from the reaction mixture in Stage 2.

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(1 mark)

12 (b) Apart from cost, suggest **one** reason why nitric acid was eventually replaced by sulfuric acid in Stage 2.

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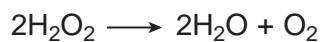
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(1 mark)

- 12 (c)** Suggest **one** reason why infrared spectroscopy could **not** be used to indicate the presence of a small amount of water in hydrogen peroxide.

.....
.....
(1 mark)

- 13** Hydrogen peroxide decomposes very slowly at room temperature. The equation for the reaction is shown below.



- 13 (a)** Suggest **one** reason why hydrogen peroxide decomposes more quickly if it is **not** stored in brown glass bottles.

.....
.....
(1 mark)

- 13 (b)** Despite the corrosive nature of hydrogen peroxide, suggest **one** reason why a spillage of a dilute solution of hydrogen peroxide presents little long-term danger to the environment.

.....
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(1 mark)

Turn over for the next question

Turn over ►

Section C

These questions test your understanding of the skills and techniques you have acquired during your A-level course.

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

- 14** Ethanal is prepared by heating ethanol with potassium dichromate(VI) in the presence of sulfuric acid. **Figures 1** and **2** show two possible ways of heating this reaction mixture.

Figure 1

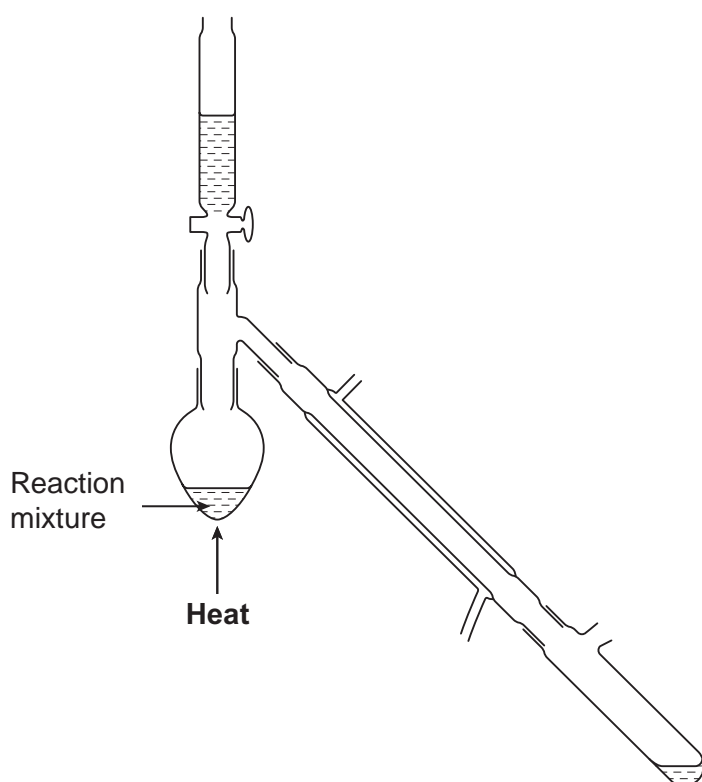
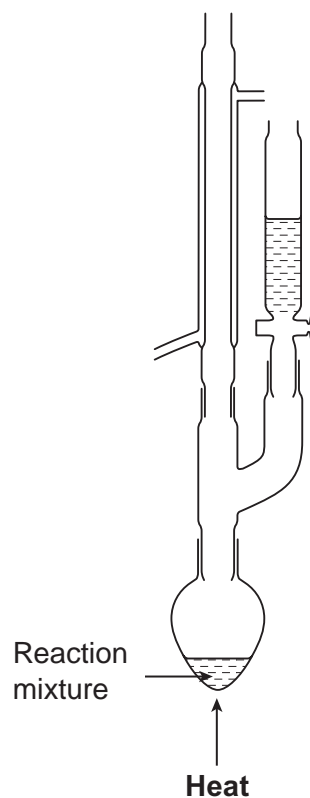


Figure 2



State which arrangement would **not** be suitable for the preparation of ethanal. Explain your answer.

Arrangement

Explanation

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(2 marks)

15 Describe briefly how you would ensure that a reading from a pH meter is accurate.

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(2 marks)

16 Describe briefly how you could measure the melting point of aspirin.

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.....
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(2 marks)

6

END OF QUESTIONS

There are no questions printed on this page

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