

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										



General Certificate of Education
Advanced Subsidiary Examination
June 2010

Chemistry

CHM3X

Unit 3X AS 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.

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	

Section A

These questions are about the task, the investigation of a glass cleaner.

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** Using your results recorded on the Candidate Results Sheet for Task 1, plot a graph of **temperature** (*y*-axis) against **time** on the graph paper below. Draw a line of best fit for the points before the fourth minute. Draw a second line of best fit for the points after the fourth minute. Extrapolate both lines to the fourth minute.

(5 marks)



- 2 Use your graph to determine an accurate value for the temperature of the glass cleaner at the fourth minute **before** mixing.

Temperature before mixing °C
(1 mark)

- 3 Use your answer from Question 2 and the temperature of the hydrochloric acid recorded on your Candidate Results Sheet for Task 1 to calculate the average value for the temperature of the two solutions before mixing (T_1).

Average temperature of the two solutions before mixing, $T_1 =$ °C
(1 mark)

- 4 Use your graph to determine an accurate value for the temperature of the reaction mixture at the fourth minute (T_2).

Temperature at the fourth minute, $T_2 =$ °C
(1 mark)

- 5 Determine an accurate value for the temperature rise at the fourth minute ($T_2 - T_1$). Record your value to the appropriate precision.

Temperature rise, $T_2 - T_1 =$ °C
(1 mark)

- 6 Use your answer from Question 5 to calculate the heat given out during this experiment. Assume that the reaction mixture has a density of 1.00 g cm^{-3} and a specific heat capacity of $4.18 \text{ J K}^{-1} \text{ g}^{-1}$. Show your working.

.....
.....
.....
(2 marks)

- 7 The hydrochloric acid, HCl used in Task 1 had a concentration of 1.00 mol dm^{-3} . Calculate the amount, in moles, of HCl present in 25.0 cm^3 of this acid.

.....
(1 mark)

- 8 Use your answers from Questions 6 and 7 to calculate the enthalpy change, in kJ mol^{-1} , for the reaction between one mole of HCl and the glass cleaner.

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

Turn over ►

- 9** Assume that the maximum total error in using the thermometer is $\pm 0.2\text{ }^{\circ}\text{C}$. This error takes into account multiple measurements. Use your answer from Question 5 to calculate the percentage error in your value for the temperature rise.

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

- 10** Consider your graph. State whether your lines of best fit are good enough for you to extrapolate with confidence. Explain your answer.

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.....
.....
(2 marks)

- 11** Explain why the experiment should be repeated several times in order to determine an accurate value for the enthalpy change.

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.....
(1 mark)

- 12** Apart from experimental errors and apparatus errors, suggest **one** reason why your value for the enthalpy change using the glass cleaner might differ from a data book value for the enthalpy change of neutralisation of ammonia.

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(1 mark)

- 13** Use your observations from Task 2 to identify the ammonium salt in the solution labelled **A**.

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(1 mark)

- 14** State **one** observation which enabled you to identify the negative ion in **A**.

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.....
(1 mark)

- 15** State **one** observation which suggests that **A** does not contain carbonate ions. Explain your answer.

Observation

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Explanation

.....

(2 marks)

- 16** Barium chloride is toxic. Suggest **one** safety precaution you would take to minimise this hazard.

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(1 mark)

Turn over for the next question

Turn over ►

Section B

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

Introduction

Ammonium salts such as ammonium nitrate are used in fertilisers. The ammonium nitrate content of a fertiliser can be determined by heating a sample of the fertiliser with an excess of sodium hydroxide solution. An equation for this reaction is shown below.



Heating ensures that all of the ammonia produced is given off as a gas. The unreacted sodium hydroxide remaining in the solution can be determined by a titration with standard hydrochloric acid.

- 17** Explain why it is necessary to remove all of the ammonia before titrating the unreacted sodium hydroxide.

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

- 18** Suggest why it is important to test samples from more than one batch of the fertiliser.

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.....
(1 mark)

- 19** Ammonium nitrate decomposes when heated to form water and one other product. Write an equation for this reaction.

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(1 mark)

- 20** The table below shows some information about three salts that could be used in fertilisers.

Salt	Nitrogen content by mass / %	Price per tonne / £
Ammonium chloride	26.2	134
Ammonium nitrate	35.0	175
Ammonium sulfate	21.2	111

- 20 (a)** Use the data in the table to determine the salt that offers the best value for money, based on nitrogen content. Show your working.

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(2 marks)

- 20 (b)** Ammonium nitrate is very soluble in water. Suggest **one** disadvantage of its high solubility when ammonium nitrate is used in a fertiliser.

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(1 mark)

- 21** A saturated solution of ammonia contains 300 g of ammonia in 1.00 dm³ of solution. Calculate the concentration, in mol dm⁻³, of ammonia in this solution.

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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 AS course.

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

- 22** In an experiment to determine the concentration of a solution of sodium hydroxide, 25.0 cm³ of 0.100 mol dm⁻³ hydrochloric acid were transferred to a conical flask. An indicator was added to the flask. The solution of sodium hydroxide was then added to the flask from a burette.

- 22 (a)** State a suitable amount of indicator solution that should be added to the flask.

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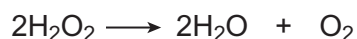
 (1 mark)

- 22 (b)** State why it is important to fill the space below the tap in the burette with alkali before beginning the titration.

.....

 (1 mark)

- 23** An equation for the decomposition of hydrogen peroxide is shown below.



State the measurements you would take in order to investigate the rate of this reaction.

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 (2 marks)

- 24** Ethanol can be oxidised slowly to ethanal. State how a sample of ethanol could be tested to confirm the presence of ethanal. State what you would observe.

Test

Observation

(2 marks)

END OF QUESTIONS