Centre Number						Candidate Number				
Surname						Other Names				

Notice to Candidate. The work you submit for assessment must be your own. If you copy from someone else or allow another candidate to copy from you, or if you cheat in any other way, you may be disqualified.

Candidate Declaration. I have read and understood the Notice to Candidate and can confirm that I have produced the attached work without assistance other than that which is acceptable under the scheme of assessment.

Candidate Signature		Date	

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	

AQA

General Certificate of Education
Advanced Level Examination
June 2014

Chemistry CHM6X

Unit 6X A2 Externally Marked Practical Assignment

Written Test

For submission by 15 May 2014

For this paper you must have:	**Time allowed**
• 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.	• 1 hour 20 minutes
Instructions	**Information**
• 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.	• The marks for questions are shown in brackets. • The maximum mark for this paper is 36. • You are expected to use a calculator where appropriate. • You will be marked on your ability to: – organise information clearly – use scientific terminology accurately.

Details of additional assistance (if any). Did the candidate receive any help or information in the production of this work? If you answer yes give the details below or on a separate page.

Yes ☐ No ☐

Teacher Declaration:

I confirm that the candidate has met the requirements of the practical skills verification (PSV) in accordance with the instructions and criteria in section 3.8 of the specification.

Practical Skills Verification	**Yes** ☐

Signature of teacher ..... Date .....

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Section A

These questions are about the tasks, which were investigations of some salt solutions.

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

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

1 Record the average titre from your Candidate Results Sheet for Task 1.

[1 mark]

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2 (a) The concentration of the potassium manganate(VII) solution used was 0.0200 mol dm^{-3}.

Use your answer to Question **1** to calculate the amount, in moles, of iron(II) ions in 25.0 cm^3 of solution **X** for Task 1.
Show your working.

[2 marks]

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2 (b) Use your answer to Question **2 (a)** to calculate the amount, in moles, of iron(II) ions in 250 cm^3 of solution **X** for Task 1.

[1 mark]

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3 The salt made by the chemist was a pure sample of a hydrated iron(II) sulfate.
The number of moles of water of crystallisation was not known. The formula of this unknown salt can be represented as $FeSO_4.nH_2O$

3 (a) Use data from the Periodic Table to calculate the M_r of anhydrous iron(II) sulfate ($FeSO_4$).
Give your answer to the appropriate precision.

[1 mark]

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3 (b) Use your answers to Questions **2 (b)** and **3 (a)** to calculate the mass of $FeSO_4$ in the original 5.60 g of hydrated iron(II) sulfate crystals.

[1 mark]

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3 (c) Use your answer to Question **3 (b)** to calculate the amount, in moles, of water in the 5.60 g of hydrated iron(II) sulfate crystals. Hence calculate the value of *n* in $FeSO_4.nH_2O$
Give your answer to the nearest whole number.
Show your working.

(If you were unable to complete Question **3 (b)** or if your answer to Question **3 (b)** was greater than 5.60 g then you may assume that the answer to Question **3 (b)** is 2.60 g. This is **not** the correct answer.)

[3 marks]

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4 In each titration, the volume of sulfuric acid was measured approximately with a measuring cylinder.

Suggest why this approximate measure did **not** affect the accuracy of the titre.

[1 mark]

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5 Identify a reagent that could be used to show that solution **X** is **not** contaminated with iodide ions.
Describe what you would observe.

[2 marks]

Reagent .....

Observation .....

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6 Copper(II) ions can be reduced by iodide ions to form copper(I) iodide.

$$2Cu^{2+}(aq) + 4I^{-}(aq) \longrightarrow 2CuI(s) + I_2(aq)$$

6 (a) Use this equation to explain your observations in **Test 2** of Task 2 when potassium iodide solution was added to solution **Z**.

[2 marks]

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6 (b) **Table 1** contains some electrode potential data.

Table 1

	$E^{\ominus}$ / V
$Cu^{2+}(aq) + e^{-} \longrightarrow Cu^{+}(aq)$	+0.15
$\frac{1}{2}I_2(aq) + e^{-} \longrightarrow I^{-}(aq)$	+0.54

Use the data from **Table 1** to explain why the following reaction does **not** occur.

$$2Cu^{2+}(aq) + 2I^{-}(aq) \longrightarrow 2Cu^{+}(aq) + I_2(aq)$$

[2 marks]

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7 Use your observations from **Test 1** in Task 2 to suggest the identity of a metal ion in solution **Y**.

[1 mark]

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17

Turn over for the next question

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Section B

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

8 When iodine molecules are dissolved in aqueous solutions containing iodide ions, they react to form triiodide ions (I_3^-).

$$I_2 + I^- \longrightarrow I_3^-$$

The rate of the oxidation of iodide ions to iodine by peroxodisulfate(VI) ions ($S_2O_8^{2-}$) was studied by measuring the concentration of the I_3^- ions at different times, starting at time = 0, when the reactants were mixed together. The concentration of the I_3^- ions was determined by measuring the absorption of light using a spectrometer.

Table 2 shows the results.

Table 2

Time / s	Concentration of I_3^- / mol dm^{-3}
10	0.23
20	0.34
30	0.39
40	0.42
50	0.47
60	0.44
70	0.45

8 (a) Plot the values of the concentration of I_3^- (*y*-axis) against time on the grid on page 7.

[2 marks]

8 (b) A graph of these results should include an additional point. On the grid, draw a ring around this additional point.

[1 mark]

8 (c) Draw a best-fit curve on the grid, **including the extra point from Question 8 (b)**.

[2 marks]

8 (d) Draw a tangent to your curve at time = 30 seconds. Calculate the slope (gradient) of this tangent and hence the rate of reaction at 30 seconds. Include units with your final answer.
Show your working.

[4 marks]

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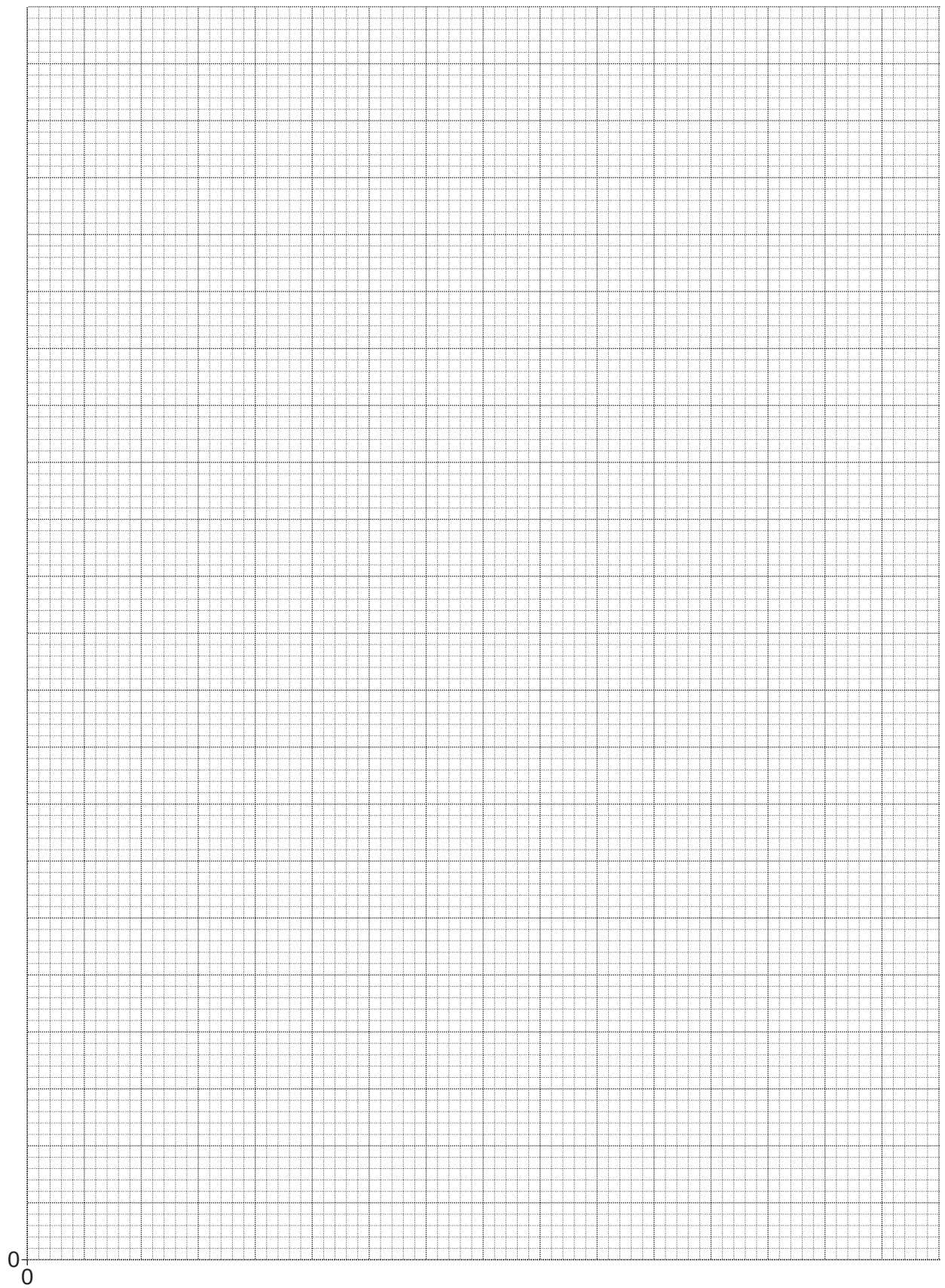

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9 The reaction in Question **8** between I^- ions and $S_2O_8^{2-}$ ions has a high activation energy and $S_2O_8^{2-}$ ions are only reduced slowly to SO_4^{2-} ions.
The reaction is catalysed by Fe^{2+} ions.

9 (a) Explain why the reaction between I^- ions and $S_2O_8^{2-}$ ions is slow.

[1 mark]

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9 (b) Other than having variable oxidation states, explain why Fe^{2+} ions are good catalysts for this reaction.

[1 mark]

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9 (c) Write a half-equation for the reduction of $S_2O_8^{2-}$ ions to SO_4^{2-} ions.

[1 mark]

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9 (d) Construct an overall equation for the reaction between $S_2O_8^{2-}$ ions and I^- ions.

[1 mark]

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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.

10 During the preparation of aspirin, it is necessary to filter the crude product under reduced pressure.

Draw a diagram to show the apparatus you would use to filter the crude product under reduced pressure. (Do **not** include the vacuum pump.)

[2 marks]

11 You are provided with a small sample of pure aspirin in a melting point tube. Describe briefly how you would determine an accurate value for the melting point of aspirin.

[2 marks]

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Turn over for the next question

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12 In a titration, it is important to wash the inside of the titration flask with distilled or deionised water as you approach the end-point.

12 (a) Suggest **one** reason why it is important to wash the inside of the flask.

[1 mark]

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12 (b) Washing with water decreases the concentration of the reagents in the titration flask.

Suggest why washing with water does **not** affect the titre value.

[1 mark]

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6

END OF QUESTIONS

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