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	

General Certificate of Education
Advanced Level Examination
June 2012

Chemistry CHM6X

Unit 6X A2 Externally Marked Practical Assignment

Written Test

For submission by 15 May 2012

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.
- 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 ....

Section A

These questions are about the tasks, an investigation of rates of reaction and a study of some catalysts.

Use your Task Sheets 1 and 2, including your own Candidate Results Sheets, to answer them.

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

1 Use your results from Task 1 on your Candidate Results Sheet to complete the **Time** column in the following table.

Calculate values for the columns headed $\mathbf{log_{10}}\boldsymbol{V}$ and $\mathbf{log_{10}}\left(\frac{\mathbf{1}}{\boldsymbol{t}}\right)$.

Give your values to 3 significant figures.

Experiment	Volume, V, of potassium iodide solution / cm^3	$\log_{10}V$	Time, t / s	$\log_{10}\left(\frac{1}{t}\right)$
1	5			
2	10			
3	15			
4	20			
5	25			

(2 marks)

2 A graph of $\mathbf{log_{10}}\left(\frac{\mathbf{1}}{\boldsymbol{t}}\right)$ against $\mathbf{log_{10}}\boldsymbol{V}$ should give a straight line. The order of the reaction with respect to iodide ions is equal to the gradient of this line.

2 (a) Plot a graph of $\mathbf{log_{10}}\left(\frac{\mathbf{1}}{\boldsymbol{t}}\right)$ on the *y*-axis against $\mathbf{log_{10}}\boldsymbol{V}$ on the grid opposite.

Label the axes. Draw a best-fit straight line through the points.

(4 marks)

2 (b) Use your graph to determine the gradient of the straight line that you have drawn.
Give your answer to two decimal places.
Show your working.

....

....

(2 marks)

2 (c) Use your graph to deduce the time, ***t***, value that would be expected for a similar experiment in which the volume of potassium iodide solution was 17 cm^3 and the volume of water was 8 cm^3.

....

(1 mark)

3 In **Test 1** of **Task 2**, the black insoluble solid is a catalyst in the reaction. Other than by investigating the rate of reaction, suggest what practical steps you could take in the test to show that this solid is a catalyst.

....

....

....

....

....

....

(3 marks)

4 In **Test 2** of **Task 2**, iodide ions and peroxodisulfate(VI) ions ($S_2O_8^{2-}$) are helped to react by the addition of solution **E** containing iron(III) nitrate.
Suggest **one** other reagent, not containing iron(III) ions, that could have been used in solution **E**.

....

(1 mark)

5 Thiosulfate ions ($S_2O_3^{2-}$) react slowly with H^+ ions in **Test 3** of **Task 2**.
The products of the reaction include the gas SO_2 and a solid.
By balancing the equation for the reaction, or otherwise, identify the solid produced by the reaction.

....

....

(1 mark)

6 The catalyst used in **Test 5** of **Task 2** is a solution of cobalt(II) chloride. Catalytic activity due to variable oxidation states is one of the typical properties of transition metals. Give **one** observation that suggests that the oxidation state of cobalt has changed during this reaction.

....

....

(1 mark)

15

Section B

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

7 The experiment in **Task 1** was designed to allow you to determine the order of reaction with respect to iodide ions in the reaction below.

$$H_2O_2(aq) + 2H^+(aq) + 2I^-(aq) \longrightarrow I_2(aq) + 2H_2O(l)$$

Outline the changes that you would make to the task so that the order of reaction with respect to hydrogen peroxide could be determined.

....

....

....

....

(2 marks)

8 (a) The reaction between hydrogen peroxide and iodide ions in acidic solution is first order with respect to hydrogen peroxide. In an experiment to determine the order of this reaction a value of 0.963 was obtained.
Calculate the percentage error in this result.

....

....

(1 mark)

8 (b) The experimental error resulting from the use of the apparatus was determined to be 2.1%. Explain what this means in relation to the practical technique used.

....

....

....

(1 mark)

9 A proposed mechanism for the reaction between iodide ions and acidified hydrogen peroxide is given below.

$$H_2O_2(aq) + I^-(aq) \longrightarrow IO^-(aq) + H_2O(l) \quad \text{slow}$$

$$IO^-(aq) + H^+(aq) \longrightarrow HOI(aq) \quad \text{fast}$$

$$HOI(aq) + I^-(aq) + H^+(aq) \longrightarrow I_2(aq) + H_2O(l) \quad \text{fast}$$

9 (a) Use this mechanism to deduce the order of the overall reaction with respect to hydrogen ions, $H^+(aq)$.

....

(1 mark)

9 (b) **Task 1** was redesigned to determine the order of reaction with respect to hydrogen ions, $H^+(aq)$.

Sketch the graph of $\log_{10}\left(\frac{1}{t}\right)$ against $\log_{10}$(volume of acid) you would expect to be produced.

(1 mark)

10 The slowing down of chemical processes is important in food storage. Over time, fats may become rancid. This involves the formation of compounds that have unpleasant odours and flavours within the food.
Hydrolysis of fats is one way in which rancid flavours are formed. Fats break down to long-chain carboxylic (fatty) acids and glycerol.

10 (a) Complete the right-hand side of the equation below to show how hydrolysis affects the molecule of fat shown.

$$\begin{array}{l} CH_3(CH_2)_{14}COOCH_2 \\ \qquad\qquad\qquad\quad | \\ CH_3(CH_2)_{14}COOCH \quad + \quad 3H_2O \longrightarrow 3 \text{ .... } + \text{ ....} \\ \qquad\qquad\qquad\quad | \\ CH_3(CH_2)_{14}COOCH_2 \end{array}$$

(2 marks)

10 (b) Other than by cooling, suggest **one** method that would decrease the rate of hydrolysis of fats.

....

....

....

(1 mark)

10 (c) Food can also acquire unpleasant flavours when the fatty acids, produced by hydrolysis of fats, are oxidised by air. This oxidation occurs by a free-radical mechanism. Chemicals called anti-oxidants can be added to food to slow down the oxidation. Suggest why anti-oxidants are **not** regarded as catalysts.

....

....

....

....

(2 marks)

10 (d) A student investigated the extent of hydrolysis in an old sample of the fat in part **10 (a)**. The carboxylic acid extracted from a 2.78 g sample of this fat (M_r = 806.0) reacted with 24.5 cm^3 of a 0.150 mol dm^{-3} solution of NaOH.
Calculate the percentage of the fat that had hydrolysed.
Show your working.

....

....

....

....

....

....

....

....

(4 marks)

15

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.

---

11 When using potassium manganate(VII) in redox titrations with iron(II) ions it is essential that the reaction mixture is acidified. Normally, dilute sulfuric acid is used.

11 (a) State why an excess of hydrogen ions is added to the reaction mixture.

....

....

(1 mark)

11 (b) State why the acid used must **not** be ethanoic acid.

....

....

(1 mark)

11 (c) Explain why an indicator is **not** needed in this redox titration.

....

....

(1 mark)

12 A student prepared a sample of aspirin (melting point 135 °C) in the laboratory and attempted to purify it by recrystallisation. To check the purity of the aspirin the student determined its melting point.

12 (a) State **two** observations, during this melting point determination, that would indicate that the sample is **not** pure.

Observation 1 ....

....

Observation 2 ....

....

(2 marks)

12 (b) Suggest why a pure sample of aspirin may sometimes appear to melt at a temperature different from 135 ^{o}C.

....

....
(1 mark)

6

END OF QUESTIONS

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED