| 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 Subsidiary Examination
June 2011

# Chemistry CHM3X

## Unit 3X AS Externally Marked Practical Assignment

## For submission by 15 May 2011

| **For this paper you must have:** | **Time allowed** |
|---|---|
| • the Periodic Table/Data Sheet provided as an insert (enclosed)<br>• your Task Sheets 1 and 2, including your own Candidate Results Sheets<br>• a ruler with millimetre measurements<br>• a calculator. | • 1 hour 20 minutes |
| **Instructions** | **Information** |
| • Use black ink or black ball-point pen.<br>• Fill in the boxes at the top of this page.<br>• Answer **all** questions.<br>• You must answer the questions in the space provided. Do not write outside the box around each page or on blank pages.<br>• 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.<br>• The maximum mark for this paper is 36.<br>• You will be marked on your ability to:<br>– organise information clearly<br>– 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 investigation of a food preservative and of a moss killer.

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

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

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

Average titre .....

*(1 mark)*

**2** The unknown acid in the preservative can be represented as HA.
Write an equation for the reaction between HA and sodium hydroxide.

.....

.....

*(1 mark)*

**3** The concentration of the sodium hydroxide solution used was 0.100 mol $dm^{-3}$.
Calculate the amount, in moles, of NaOH in 25.0 $cm^3$ of this sodium hydroxide solution.

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*(1 mark)*

**4** Use your answers from Questions **1**, **2** and **3** to calculate the concentration, in mol $dm^{-3}$, of the unknown acid in the preservative.
Give your answer to the appropriate precision.

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*(3 marks)*

**5** The preservative solution was prepared by dissolving 8.00 g of the acid supplied by a manufacturer and making up to 1.00 $dm^3$ of solution with water.

Use your answer from Question **4** to calculate the $M_r$ of the acid. Assume that the solution is made from a pure sample of the acid.
Give your answer to one decimal place.

(If you could not complete the calculation in Question **4**, assume that the concentration of the acid is 0.106 mol $dm^{-3}$. This is not the correct value.)

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*(1 mark)*

**6** The acid HA can be represented by the formula $C_nH_{2n+1}COOH$, where $n$ is a whole number. Use your answer from Question **5** and data from the Periodic Table to suggest a value for $n$.

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.....

.....

.....

*(1 mark)*

**7** The maximum total errors for the pipette and the burette are shown below. These errors take into account multiple measurements.

pipette ± 0.05 $cm^3$
burette ± 0.15 $cm^3$

Estimate the maximum percentage error in using each of these pieces of apparatus. Use the average titre from Question **1** to calculate the percentage error in using the burette. Show your working.

pipette .....

.....

burette .....

.....

*(2 marks)*

**Turn over ▶**

**8** A solution of barium hydroxide is often used for the titration of organic acids. A suitable indicator for the titration is thymol blue. Thymol blue is yellow in acid and blue in alkali. In a titration a solution of an organic acid was added from a burette to a conical flask containing 25.0 $cm^3$ of a barium hydroxide solution and a few drops of thymol blue.

**8 (a)** Describe in full the colour change at the end-point of this titration.

.....

*(1 mark)*

**8 (b)** Thymol blue is an acid. State how the average titre would change if a few $cm^3$, rather than a few drops, of the indicator were used by mistake in this titration.

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*(1 mark)*

**8 (c)** Barium hydroxide is toxic. Suggest **one** safety precaution you would take to minimise this hazard when wiping up a spillage of barium hydroxide solution.

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*(1 mark)*

**8 (d)** Suggest **one** reason why a 250 $cm^3$ conical flask is preferred to a 250 $cm^3$ beaker for a titration.

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*(1 mark)*

**8 (e)** Suggest **one** reason why repeating a titration can improve its reliability.

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*(1 mark)*

**9** Solubility data for barium hydroxide and calcium hydroxide are given in the table below.

| Compound | Solubility at 20 °C / g $dm^{-3}$ |
|---|---|
| barium hydroxide | 38.9 |
| calcium hydroxide | 1.73 |

**9 (a)** Use the data given in the table to calculate the concentration, in mol $dm^{-3}$, of a saturated solution of calcium hydroxide ($M_r$ = 74.1) at 20 °C.

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*(1 mark)*

**9 (b)** Suggest **one** reason why calcium hydroxide solution is **not** used in the titration of a 0.200 mol $dm^{-3}$ solution of an acid.

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*(1 mark)*

**10** Use your observations from Task 2 to identify the metal ion in the solution labelled **A**.
State **one** observation that helped you to identify this metal ion.

Identity .....

Observation .....

.....

*(2 marks)*

**11** The manufacturer of the salt used in the moss killer claims that there are no magnesium ions present in the salt.
Deduce whether or not you can use your observations from Task 2 to confirm this claim.
State **one** observation that supports your deduction. Explain your answer.

Deduction .....

Observation .....

.....

Explanation .....

.....

*(2 marks)*

**21**

**Turn over ▶**

## Section B

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

### Introduction

In an experiment to determine its solubility in water, solid barium hydroxide was added to 100 $cm^3$ of water until there was an excess of the solid. The mixture was filtered and an excess of sulfuric acid was added to the filtrate. The barium sulfate produced was obtained from the reaction mixture, washed with cold water and dried. The mass of barium sulfate was then recorded.

**12** Explain why the mixture was filtered before the addition of sulfuric acid.

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*(1 mark)*

**13** State how the barium sulfate produced was obtained from the reaction mixture.

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*(1 mark)*

**14** Explain why the barium sulfate was washed before it was dried.

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*(1 mark)*

**15** Write an equation for the reaction between barium hydroxide and sulfuric acid.

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*(1 mark)*

**16** In an experiment, 4.25 g of barium sulfate were formed when an excess of sulfuric acid was added to 100 $cm^3$ of a saturated solution of barium hydroxide.

**16 (a)** Use data from the Periodic Table to calculate the $M_r$ of barium sulfate.
Give your answer to one decimal place.

.....

*(1 mark)*

**16 (b)** Calculate the amount, in moles, of $BaSO_4$ in 4.25 g of barium sulfate.

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*(1 mark)*

*Do not write outside the box*

**16 (c)** Use your answer from part (**b**) to calculate the mass of barium hydroxide ($M_r$ = 171.3) present in 1 $dm^3$ of saturated solution. Show your working.

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*(2 marks)*

**17** Barium sulfate is taken by mouth by patients so that an outline of a human digestive system can be viewed using X-rays. Explain why patients do **not** suffer any adverse effects from barium sulfate when it is known that solutions containing barium ions are toxic.

.....

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*(1 mark)*

**9**

**Turn over for the next question**

## 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.

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**18** A sample of an alcohol was thought to be contaminated with an alkene. Give a reagent that could be used to confirm the presence of an alkene. State what you would observe.

Reagent .....

Observation .....

*(2 marks)*

**19** A chemist was asked to prepare a standard solution of sodium carbonate.
The chemist dissolved an accurately known mass of sodium carbonate in a small amount of water in a conical flask. The chemist then poured the solution into a 250 $cm^3$ graduated flask and made the solution up to the mark. Suggest **one** improvement to the chemist's procedure.

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*(1 mark)*

**20** The presence of halide ions in solution can be detected by adding silver nitrate solution and dilute nitric acid.

**20 (a)** State the purpose of the nitric acid in this test.

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*(1 mark)*

**20 (b)** Explain how the addition of an ammonia solution can be used to confirm that a precipitate is silver bromide.

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*(2 marks)*

**END OF QUESTIONS**

6