



General Certificate of Education  
Advanced Subsidiary Examination  
June 2014

**Chemistry**

**CHM3X/TN**

**Unit 3X AS Externally Marked Practical Assignment**

**Teachers' Notes**

**Confidential**

The Exams Officer should make two copies of these Teachers' Notes; one copy for the Head of A-level Chemistry and one for the technician. These copies can be released to the Head of A-level Chemistry and the technician at any point following publication but must be kept under secure conditions at all times. Teachers can have sight of the Teachers' Notes but no further copies should be made.

Estimated entries must be submitted to AQA in order for centres to receive hard copies of the materials to be used by candidates.

**CHM3X/TN**

**Teachers' Notes****Confidential**

These notes must be read in conjunction with the **Instructions for the Administration of the Externally Marked Practical Assignment: A-level Chemistry** published on the AQA Website. Please note that these have been revised for 2014.

**Task 1 Titration of succinic acid****A quantitative investigation of an additive used in foods**

Task 1 involves the preparation of a solution of an acid and its titration with sodium hydroxide solution.

**Task 1 Materials**

Each candidate should be provided with the following reagents in suitable closed containers.

Reagent	Concentration / mol dm <sup>-3</sup>	Volume / amount	Note
Succinic acid		1.4–1.6 g of solid	This should be provided in a weighing bottle and labelled ' <b>Succinic acid</b> '
Sodium hydroxide solution	0.095 – 0.105	200 cm <sup>3</sup>	Labelled ' <b>0.100 mol dm<sup>-3</sup> sodium hydroxide for Task 1</b> '
Phenolphthalein	Standard indicator		Individual supply <b>not</b> required

**General**

It is the responsibility of the centre to ensure that the investigation works with the materials provided to the candidates **before** candidates carry out the task.

Spare supplies of all reagents specified in these notes must be available.

## Task 1 Apparatus

Each candidate will require the following:

- 250 cm<sup>3</sup> volumetric flask with stopper
- 50 cm<sup>3</sup> burette and stand
- funnel suitable for filling a volumetric flask
- funnel suitable for filling a burette
- 25 cm<sup>3</sup> pipette
- stirring rod
- pipette filler
- 250 cm<sup>3</sup> conical flask
- dropping pipette
- two 250 cm<sup>3</sup> beakers
- wash bottle filled with distilled or deionised water
- access to an electronic balance (minimum 2 decimal places)
- plentiful supply of purified water (either distilled or deionised)
- eye protection.

## Balances

All candidates should have access to a 2 decimal place balance. Where centres do not have enough balances for large groups, they should split the groups accordingly.

## Mass of succinic acid

In the task, candidates are instructed to inform the teacher if the **measured** mass is not between 1.30 and 1.70 g. In this case, spare samples of **succinic acid** in a weighing bottle should be supplied. There is no penalty if a spare sample has to be provided and the centre is not required to inform AQA.

## Checking the burette reading

In the task, candidates are instructed to ask their teacher to check one of their final burette readings. If a candidate does not read the burette correctly, the teacher must tell the candidate the correct reading. There is no penalty for an incorrect reading. The centre is not required to inform AQA of an incorrect reading. This is to ensure that a candidate does not lose several accuracy marks because of an incorrect reading.

Turn over ►

## Task 2 Observation exercises

### A qualitative investigation of some additives used in foods

#### Task 2 Materials

Each candidate should be provided with the following reagents in suitable closed containers.

Reagent	Concentration / mol dm <sup>-3</sup>	Volume / cm <sup>3</sup>	Note
Magnesium chloride	0.1	10	Labelled ' <b>Solution P</b> '
Strontium nitrate	0.1	5	Labelled ' <b>Solution Q</b> '
Wooden splint soaked in strontium nitrate solution*	Saturated		Prepare one beaker of saturated strontium nitrate solution. In this solution, place one wooden splint for each member of the class (plus a few spares), labelled ' <b>Splints soaked in solution Q</b> '

\* The wooden splints will need to be set up about 12 hours before the practical to allow time for sufficient soaking. Ensure that the sample produces the expected red colour.

Each candidate will also need the following reagents. Individual supplies are **not** required.

Reagent	Concentration / mol dm <sup>-3</sup>	Volume / cm <sup>3</sup>	Note
Nitric acid	0.5	10	Labelled ' <b>Dilute nitric acid</b> '
Silver nitrate**	0.05	5	Labelled ' <b>Silver nitrate solution</b> '
Ammonia solution	1.0	10	Labelled ' <b>Dilute ammonia solution</b> '
Sulfuric acid	1.0	5	Labelled ' <b>Dilute sulfuric acid</b> '
Sodium hydroxide solution	0.4	5	Labelled ' <b>Sodium hydroxide solution for Task 2</b> '
Hydrochloric acid	0.5	5	Labelled ' <b>Dilute hydrochloric acid</b> '
Barium chloride***	0.1	5	Labelled ' <b>Barium chloride solution</b> '

\*\* Teachers should inform students of a suitable method for the safe disposal of silver nitrate residues.

\*\*\* Barium nitrate solution, of the same concentration, may be used in place of barium chloride. The sample should still be labelled 'barium chloride solution'.

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## Note

Centres are reminded that it is essential that contamination of shared reagents is avoided. One way to avoid cross-contamination of reagents is to attach a test tube containing a plastic dropping pipette to the reagent bottle using elastic bands or adhesive tape. This dropping pipette can then be returned to the test tube after use by the student.

## General

It is the responsibility of the centre to ensure that the investigation works with the materials provided to the candidates **before** candidates carry out the task.

Spare supplies of all reagents specified in these notes must be available.

## Task 2 Apparatus

Each candidate will require the following:

- four test tubes
- nine dropping pipettes
- test-tube rack
- Bunsen burner
- plentiful supply of purified water (either distilled or deionised)
- eye protection.

Only two dropping pipettes will be needed if the centre adopts the strategy to avoid contamination outlined in the note at the top of this page.

## Risk assessment and risk management

Risk assessment and risk management are the responsibility of the centre.

## Notes from CLEAPSS

Technicians/teachers should always follow the latest CLEAPSS Hazcards or safety data sheets provided by the supplier for guidance on handling reagents. The worldwide regulations covering the labelling of reagents by suppliers have changed. More details about these changes can be found in CLEAPSS secondary science guidance leaflets, including GL101, which is an introduction to classification, labelling and packaging (CLP): chemical hazard labelling.

Turn over ►

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## Additional information

AQA might publish additional information about an EMPA practical. This will be placed on e-AQA in Secure Key Materials. We will email Exams Officers who have downloaded the particular Teachers' Notes so they can print a copy for the Head of A-level Chemistry. Additional information may cover issues such as suitable suppliers or tips on getting a practical to work.

## Teacher results

A teacher must carry out the tasks, using similar apparatus and samples of the same stock solutions/chemicals as the candidates, in order to obtain teacher results. This must **not** be done in the presence of candidates.

Teacher results:

- are required for both tasks
- are required for each group of candidates
- must be recorded on the Teacher Results Sheets
- are used to assess the accuracy of candidates' results
- must be included with the scripts sent to the examiner.

In order to ensure that each candidate can be matched to the appropriate teacher results, teachers must:

- complete all details on each Teacher Results Sheet
- ensure that all candidates complete all details on the Candidate Results Sheets, clearly identifying their teaching group and/or teacher.

## Centres with more than one teaching set

Centres may wish to divide their candidates into manageable groups and to conduct the tasks at different times. However, each centre must arrange for all of their candidates to complete a particular EMPA Written Test on the same day within the assessment window.

## Assessment Advisers

If you have any queries about the practical work for the EMPA, please contact your Assessment Adviser. Contact details for your Assessment Adviser can be obtained by emailing your centre name and number to [science-gce@aqa.org.uk](mailto:science-gce@aqa.org.uk)

## Data Sheet

Centres should be aware that the three tables of data on the Data Sheet have been relabelled for the 2014 assessments. As a consequence, centres must ensure that candidates use the version provided as an insert and not any version previously supplied.

**Information to be given to candidates**

Candidates **must not** be given information about an EMPA assessment until 1 week before Task 1. One week before Task 1, candidates should be given the following information.

The aim of these tasks is to investigate some food additives by means of a titration with one additive and a series of observation exercises on two others.

The main areas of the specification in the Written Test include Section 3.1.2 (Amount of Substance), Section 3.2.1 (Energetics), Section 3.2.5 (Group 7(17), the Halogens), Section 3.2.6 (Group 2, the Alkaline Earth Metals), Section 3.2.9 (Alkenes) and Section 3.2.10 (Alcohols).

There **must** be no further discussion and candidates **must not** be given any further resources to prepare for the assessment.

**Turn over for the Teacher Results Sheets**

**Turn over ►**

### Teacher Results Sheet for Task 1

**A completed copy of this sheet must be included with the scripts sent to the examiner.**

Centre Number 

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Teacher Name ..... Teacher Group .....

### Results

Record your titration results in the tables below.

Mass of weighing bottle and succinic acid / g	
Mass of emptied weighing bottle / g	
Mass of succinic acid / g	

Final burette reading / cm <sup>3</sup>				
Initial burette reading / cm <sup>3</sup>				
Titre / cm <sup>3</sup>				
Tick the titres to be used for concordancy				

Average titre / cm<sup>3</sup> .....

**This sheet may be photocopied**



Teacher Results Sheet for Task 2

A completed copy of this sheet must be included with the scripts sent to the examiner.

Centre Number 

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 Teacher Name ..... Teacher Group .....

**Results**

Record your observations in the table below.

	Observations
Use a separate sample of solution <b>P</b> or <b>Q</b> as required in each of the following tests unless stated otherwise	
<b>Test 1(a) Test with dilute nitric acid and silver nitrate solution</b> Place about 10 drops of solution <b>P</b> in a clean test tube. Add about 10 drops of dilute nitric acid, followed by about 5 drops of silver nitrate solution. Shake the mixture. <b>Keep this mixture for Test 1(b).</b>	
<b>Test 1(b) Test with dilute ammonia solution</b> To your mixture from <b>Test 1(a)</b> , add dilute ammonia solution, dropwise with gentle shaking, until in excess. The test tube should <b>not</b> be more than half full.	
<b>Test 2 Test with dilute sulfuric acid</b> Place about 10 drops of solution <b>P</b> in a clean test tube. Add about 10 drops of dilute sulfuric acid. Shake the mixture.	
<b>Test 3 Test with sodium hydroxide solution</b> Place about 10 drops of solution <b>P</b> in a clean test tube. Add about 10 drops of sodium hydroxide solution for <b>Task 2</b> . Shake the mixture. Now continue to add this sodium hydroxide solution, dropwise with gentle shaking, until in excess. The test tube should <b>not</b> be more than half full.	
<b>Test 4 Test with dilute hydrochloric acid and barium chloride solution</b> Place about 10 drops of solution <b>Q</b> in a clean test tube. Add about 10 drops of dilute hydrochloric acid, followed by about 10 drops of barium chloride solution. Shake the mixture.	
<b>Test 5 Flame test</b> Take one of the wooden splints from the beaker labelled 'splints soaked in solution <b>Q</b> '. Adjust a Bunsen burner until the flame is blue but not roaring. Hold the splint in the Bunsen burner flame and record the colour observed. Ignore any orange/yellow colour caused by impurities containing sodium ions.	

**This sheet may be photocopied**

## A quantitative investigation of an additive used in foods

Succinic acid, also called 'Spirit of Amber', is an additive used as a sweetener in the food industry.

Succinic acid is a white crystalline solid that dissolves in water. Solutions of succinic acid can be neutralised by an alkali, such as sodium hydroxide.

### Task 1

You are provided with a sample of succinic acid in a weighing bottle.

The aim of Task 1 is to make a solution of succinic acid and to titrate it with a  $0.100 \text{ mol dm}^{-3}$  solution of sodium hydroxide.

### Procedure

- **Wear eye protection at all times.**
  - **Assume that all substances are toxic and corrosive.**
- 1 Weigh the weighing bottle and its contents to the precision of the balance. Record the **precise** mass in the table provided on the Candidate Results Sheet for Task 1.
  - 2 Add the contents of the weighing bottle to a  $250 \text{ cm}^3$  beaker and reweigh the empty weighing bottle. Record the **precise** mass in your table. Ignore any traces of succinic acid that remain in the weighing bottle.
  - 3 Calculate the mass of succinic acid that you have transferred to the beaker. Inform your teacher if your mass is not between 1.30 and 1.70 g.
  - 4 Add approximately  $100 \text{ cm}^3$  of distilled or deionised water to the beaker containing the solid. Use a stirring rod to stir the contents of the beaker until all of the succinic acid dissolves. This may take a few minutes.
  - 5 Use a wash bottle to rinse the surface of the stirring rod directly into the beaker. Use a funnel to transfer the contents of the beaker into a  $250 \text{ cm}^3$  volumetric (graduated) flask. Use the wash bottle to rinse the beaker and pour these washings into the volumetric flask.
  - 6 Make the volumetric flask up to the mark by adding distilled or deionised water from the wash bottle.
  - 7 Stopper the volumetric flask and invert it at least 20 times to ensure thorough mixing of the contents.
  - 8 Rinse a burette with the  $0.100 \text{ mol dm}^{-3}$  sodium hydroxide provided for Task 1. Set up the burette and use a funnel to fill it with this sodium hydroxide solution. Record the initial burette reading in a table of your own design on the Candidate Results Sheet for Task 1.

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- 9 Transfer some of the succinic acid solution you have prepared to a clean, dry 250 cm<sup>3</sup> beaker. Using a pipette filler, rinse a pipette with this solution. Use the pipette to transfer 25.0 cm<sup>3</sup> of the succinic acid solution to a 250 cm<sup>3</sup> conical flask.
  - 10 Add 3 or 4 drops of phenolphthalein indicator to the conical flask.
  - 11 Add the sodium hydroxide solution from the burette until the mixture in the conical flask just turns pink. The colour may fade on standing. You should therefore record the burette reading when the colour first changes and not add more sodium hydroxide solution.
  - 12 Rinse the conical flask with distilled or deionised water. Repeat the titration until you obtain **two** titres that are within 0.10 cm<sup>3</sup> of each other. You should do no more than five titrations.

**Have one of your final burette readings checked by your teacher.**

- 13 Calculate and record the average titre on the Candidate Results Sheet for Task 1. Show clearly the titres that you used in calculating this average titre.

You are **not** required to carry out any further calculations on the Candidate Results Sheet for Task 1.

You will use your results in **Section A** of the Written Test.

**Turn over for Task 2**

**Turn over ►**

## Task 2

### A qualitative investigation of some additives used in foods

Compounds **P** and **Q** are sometimes used as additives in baby foods.

You are provided with aqueous solutions of **P** and **Q**. The aim of Task 2 is to carry out a series of tests on solution **P**, and a different series of tests on solution **Q**.

For each of the following tests, record what you **observe** in a table of your own design on the Candidate Results Sheet for Task 2. Where no visible change is observed, write 'no visible change'.

You are **not** required to identify solutions **P** or **Q** or any of the reaction products in this task.

#### Procedure

- **Wear eye protection at all times.**
- **Assume that all solutions are toxic and corrosive.**

#### Tests on solution **P**

Use a separate sample of solution **P** as required in each of the following tests.

##### Test 1(a) Test with dilute nitric acid and silver nitrate solution

Place about 10 drops of solution **P** in a clean test tube.

Add about 10 drops of dilute nitric acid, followed by about 5 drops of silver nitrate solution. Shake the mixture.

**Keep this mixture for Test 1(b).**

##### Test 1(b) Test with dilute ammonia solution

To your mixture from **Test 1(a)**, add dilute ammonia solution, dropwise with gentle shaking, until in excess. The test tube should **not** be more than half full.

##### Test 2 Test with dilute sulfuric acid

Place about 10 drops of solution **P** in a clean test tube.

Add about 10 drops of dilute sulfuric acid. Shake the mixture.

##### Test 3 Test with sodium hydroxide solution

Place about 10 drops of solution **P** in a clean test tube.

Add about 10 drops of sodium hydroxide solution for Task 2. Shake the mixture.

Now continue to add this sodium hydroxide solution, dropwise with gentle shaking, until in excess. The test tube should **not** be more than half full.

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**Tests on solution Q****Test 4 Test with dilute hydrochloric acid and barium chloride solution**

Place about 10 drops of solution **Q** in a clean test tube. Add about 10 drops of dilute hydrochloric acid, followed by about 10 drops of barium chloride solution. Shake the mixture.

**Test 5 Flame test**

Take one of the wooden splints from the beaker labelled 'splints soaked in solution **Q**'. Adjust a Bunsen burner until the flame is blue but not roaring. Hold the splint in the Bunsen burner flame and record the colour observed. Ignore any orange/yellow colour caused by impurities containing sodium ions.

You will use your results in **Section A** of the Written Test.

Teacher use only