

**GENERAL CERTIFICATE OF SECONDARY EDUCATION**

**TWENTY FIRST CENTURY SCIENCE**

**ADDITIONAL SCIENCE A**

Unit A154: controlled assessment

**A154**

**CHEMISTRY A**

Unit A174: controlled assessment

**A174**

**Factors that affect how calcium carbonate is dissolved by acid**

**Information for teachers**

This is the only task available as Specimen Assessment Materials for Chemistry A (Unit 174). In actual examination series, two tasks will be available.

**Marks from this specimen task must not be submitted to OCR.**

There are two documents provided for candidates:

- **Information for Candidates (1)** defines the topic of the investigation and places it into a relevant context. This should be issued to candidates at the start of the task.
- **Information for Candidates (2)** provides some secondary data to supplement that which candidates collect for themselves. It should be issued to candidates only on completion of the data collection part of their investigation.

## Information for teachers

**Specimen controlled assessment task:****Investigating factors that affect how calcium carbonate is dissolved by acid**

These notes provide background information for the preparation of candidates for this task and advice on the assessment of the practical investigation report.

Reference should also be made to Section 5 of the specification for Chemistry A and the '*Guide for controlled assessment for GCSE Twenty First Century Science*'.

## General guidance for teachers

Task setting is under high control. Tasks are therefore set by OCR. Where appropriate, this task may be contextualised by individual centres to take account of local circumstances including availability of resources and the needs of candidates. However, assessments must be based on the published marking criteria (within Section 5 of the specification). If there is any doubt about whether a contextualised task sufficiently matches the criteria, centres should seek confirmation from OCR that the task is valid.

## Preparation of candidates

It is expected that before candidates attempt this controlled assessment task they will have received general preparation in their lessons. Learning activities to develop the relevant skills should have been provided and the broad requirements of the assessment made clear to candidates. More specific details of practical techniques, the development of skills associated with these techniques, and possible methods and choice of equipment for the task should be covered when teaching the relevant part(s) of the specification, and must be completed prior to setting the task.

The context for this investigation is a study of how to remove deposits of calcium carbonate ('fur' in kettles, or 'scale' in boilers and hot water pipes). From their work for 'Module C3: Chemicals in our lives – risks and benefits' and 'Module C6: Chemical synthesis' candidates should be familiar with the reaction of acids with carbonates, properties of strong and weak acids, and the principles of reaction rates.

A number of methods to monitor acid-carbonate reactions are available. Examples include measuring loss of mass at regular intervals, measuring the time for all solid to disappear, measuring the time taken for the mixture to stop bubbling, measuring the time taken to collect a fixed volume of gas (eg to fill an inverted test tube or a fixed volume in a measuring cylinder), and measuring the volume of gas collected at regular intervals (using an inverted measuring cylinder or a gas syringe).

## Assessment of the quality of written communication (QWC)

The quality of written communication is assessed in Strands S and R of this controlled assessment task. Candidates should be advised that the quality of written communication will be assessed. Further information about the assessment of QWC may be found in the specification.

## Risk assessment

It is the centre's responsibility to ensure the safety of all candidates. Teachers are responsible for making their own risk assessment for the task prior to candidates attempting the practical work and for ensuring that appropriate health and safety procedures are carried out. However, teachers must not provide candidates with a risk assessment since this is included in the marking criteria for Strand Sb. If candidates require additional guidance on managing safety once the task has started then this will need to be reflected in the marks awarded.

## Guidance on assessment

All assessment of the practical investigation is based on the final report submitted by the candidates.

The marking procedure and marking criteria are described in detail within Section 5 of the Chemistry specification. Marking decisions should be recorded on the respective cover sheets (available to download from [www.ocr.org.uk](http://www.ocr.org.uk) and included in the '*Guide for controlled assessment for GCSE Twenty First Century Science*'). Candidates' reports should be annotated to show how marks have been awarded in relation to the marking criteria.

## Additional guidance on marking criteria

### Strand S

There is no task-specific guidance for this strand, as candidates' plans and hypotheses/predictions will depend upon the contextualisation of the task by centres and the choices made by candidates.

### Strand C

There is no task-specific guidance for this strand, as candidates' data will depend upon the contextualisation of the task by centres and the plans developed by candidates.

### Strand A

Candidates working at higher levels should carry out calculations relating to the rate of the reaction.

Data should be displayed in tables and appropriate graphs. While bar charts will be used to display data obtained from the investigation of the effect of different acids on the reaction rate, data obtained should be the subject of statistical analysis for those candidates working at higher levels.

Candidates working at higher levels could proceed to consider various methods to measure the spread of data around their calculated means. This could extend from the range indicated by error bars on graphs, inter-quartile ranges, box and whisker plots (boxplots), and variance and standard deviation. Tests of significance, eg the Student's t-test, could be used to analyse apparent differences between sets of data, helping to support or reject candidates' initial hypotheses.

### Strand E

There is no task-specific guidance for this strand, as the evaluation which may be carried out will depend upon the contextualisation of the task by centres and the plans developed by candidates.

## Strand R

At a basic level, candidates could compare their results with those from other groups in the class that have carried out an identical investigation. Candidates could use internet and textbook sources to supplement their data.

Further analysis could be undertaken using the data provided by OCR. The data can be used by candidates across the mark range, with candidates providing simple interpretations at lower levels, through to a more rigorous analysis necessitating the collection of further information.

Candidates could discuss the effects of concentrations of different acids, the effect of temperature, and of the different acids themselves (candidates could carry out further research to find out more about these acids). In order to allow access to ideas about weak and strong acids, it would be advisable to schedule this investigation after modules C6.1 and C6.2 have been taught.

Candidates working at higher levels might relate the solubility of organic calcium salts to trends in the data for the reactions of calcium carbonate. The corrosiveness of different acids could be discussed in connection with the acids used in the home and on an industrial scale.

For the secondary data provided by OCR, candidates should appreciate the limitations of comparisons with secondary data, and of the secondary data itself.

## Guidance for technicians

In this assessed investigation, candidates will be offered a choice between different methods for studying the reaction between marble chippings and an acid.

The factors under investigation include temperature, the concentration of acid, and/or the type of acid. Suitable acids include hydrochloric acid, citric acid and ethanoic acid.

### Suggested equipment

#### All investigations:

Dilute acids (2-3 dm<sup>3</sup> per class; candidates could make up their own solutions of citric acid and produce other acid solutions by diluting the stock acid solution; when providing acids it is advisable to make up at least the total volume required in one batch so that the concentration will not vary between lessons)

Marble chippings (these should all be as nearly as possible the same size; it may be helpful to use a sieve when selecting from the main stock bottle, so that fine dust or small broken pieces are removed)

Top pan balances (to weigh samples of chippings)

Stop clocks or watches

Measuring cylinders (10 cm<sup>3</sup>, 25 cm<sup>3</sup> and/or 50 cm<sup>3</sup>)

#### Time to dissolve chippings:

Beakers or large test-tubes or conical flasks (various sizes)

Cotton wool (to put in necks of flasks to prevent loss of acid spray)

Filter papers (to cover beakers to prevent loss of spray)

**Loss of mass during reaction:**

Beakers or conical flasks (various sizes)

Cotton wool (to put in neck of flasks to prevent loss of acid spray)

Filter papers (to cover beakers to prevent loss of spray)

**Volume of gas evolved during reaction:**

Beakers or large test-tubes or conical flasks (various sizes)

Bungs with delivery tubes (various shapes) to fit conical flasks

Small troughs or dishes to be filled with water

Test tubes, measuring cylinders or gas syringes (to collect gas)

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