

GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE

A144

SCIENCE A

Unit A144 (Controlled Assessment)

Practical Data Analysis

Information for teachers

This is the only task available as Specimen Assessment Materials for the Practical Data Analysis element of Science A (Unit A144). In actual examination series, three tasks will be available.

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

There is one document provided for candidates for each Practical Data Analysis task:

- **Information for Candidates** provides the hypothesis that is to be tested and places it into a relevant context. It should be issued to candidates at the start of the task.

Information for teachers

Specimen controlled assessment task for the Practical Data Analysis testing the hypothesis:

Different fuels transfer different amounts of energy when they burn because of the different numbers of carbon atoms in the fuel molecules.

These notes provide background information for the preparation of candidates for this task and advice on the assessment of the Practical Data Analysis report.

Reference should also be made to Section 5 of the specification for Science 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, tasks 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 specifications). If there is any doubt about whether a contextualised task still sufficiently matches the criteria, centres should seek confirmation from OCR that the task is still 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.

From their work for 'Module C1: Air quality', candidates will be familiar with the context within which this task is set. In addition, they will be expected to be familiar with the concepts and terminology of Ideas about Science. The Ideas about Science are described in detail in Appendix B of the specification.

For this task, preparation of candidates prior to the start of the controlled assessment will need to cover specific heat capacity since candidates will need to provide a quantitative evaluation of the data collected. They will therefore need to have an understanding of specific heat capacity and know how to apply it in the context of this task. They should be given the formula:

energy = mass x specific heat capacity x change in temperature

In addition, candidates should be given the formulae of the fuels they have been provided with, or appropriate reference materials.

A number of methods to measure the energy released when a sample of alcohol is burned are available, typically involving heating of a known volume of water. Suitable apparatus can include spirit burners or small, fireproof containers with ceramic wool. A comparison of various alcohols as fuels can be made by calculating the quantity of energy transferred to the water.

Assessment of the quality of written communication (QWC)

The quality of written communication is assessed in Strand G of this controlled assessment task. Candidates should be advised that their 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 D. 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 Data Analysis task 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 specifications. Marking decisions should be recorded on the respective cover sheets (available to download from 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 D

Candidates' choices of equipment and techniques will depend upon the contextualisation of the task by centres and the choices made by candidates. Candidates working at higher levels will show scientific understanding in making choices about ways in which heat losses can be minimised. Candidates working at higher levels will show scientific understanding in making choices about the range of fuels used; the accuracy of measurements made of mass or volume of fuel and volume of water; the number of replicates; the volume of water used; how long to leave the fuels burning; whether to replace the water/tube after each trial. Risks of handling flammable materials will be understood and all appropriate steps taken to reduce risks. Standard laboratory safety procedures such as eye protection and heat mats are required for this practical.

Strand E

Candidates working at higher levels will calculate average energy values per gram or cm³ of fuel tested correctly. A graph will be drawn with correct scales and accurate plotting with well positioned line of best fit, where appropriate, to show relationship between energy and number of carbon atoms.

Strand F

Candidates working at higher levels will provide a quantitative treatment of spread of data and thus level of uncertainty, for example using range bars on the graph used to assess uncertainty of data on energy values. Appropriate comments will be made about the uncertainty of the experimental results. A detailed explanation will be given of how some energy from the fuels is not transferred to the water and suggestions made to reduce these losses. Inaccuracies in measurements of mass/volume and temperature will be quantified and discussed.

Strand G

Candidates working at higher levels will consider the correlation or absence of correlation between energy values and number of carbon atoms, interpreted correctly. They will consider alternative hypotheses that might better fit the experimental data, for example a correlation with molecular masses.

Guidance for technicians

Apparatus suggested

- Access to top pan balances including one that records to 0.05 g, if possible.

For each candidate or group of candidates

- stand, clamp and boss
- heat proof mat
- boiling tubes and test tubes
- measuring cylinders, including 50 cm³
- thermometer
- crucible or similar small, fireproof container with supply of ceramic (rocksil) wool, or alternatively a spirit burner
- plastic disposable pipette with graduations
- access to fuels which will burn safely, for example: ethanol, propanol, butanol, pentanol and hexanol.

Candidates plan their own investigation and may therefore require access to other apparatus at the discretion of the centre.

Notes to help teachers and technicians with this controlled assessment

If possible, provide spirit burners which have removable glass caps or, if using crucibles, provide lids. This makes it easier and safer to extinguish the flames. Fill and label spirit burners or dropper bottles with alcohols in advance of the lesson. Ensure any excess alcohol is wiped off the side of the burners or dropper bottles. Keep bottles of alcohol well away from flames.

Careful consideration must be given to how the candidates will ignite the alcohols. They could be given matches. Alternatively, a single Bunsen burner could be provided at the front of the lab (well away from the spirit burners or dropper bottles) and the candidates given access to wooden spills.

Teachers are advised to try out the experiment prior to candidates undertaking the task.

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