OCR
RECOGNISING ACHIEVEMENT

SPECIMEN

GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE

ADDITIONAL SCIENCE A **A154**

Unit A154: Controlled assessment

BIOLOGY A **A164**

Unit A164: Controlled assessment

Factors that affect the rate of fermentation

Information for teachers

This is one of two tasks available as Specimen Assessment Materials for Additional Science A (Unit 154). In actual examination series, six tasks will be available.

This is the only task available as Specimen Assessment Materials for Biology A (Unit 164). 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 a factor that affects the rate of fermentation of yeast.

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 Additional Science A or Biology 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 specifications). If there is any doubt about whether a contextualised task 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.

From their work for 'Module B4: The processes of life', candidates should be familiar with the principles of enzyme action and a range of possible approaches for measuring the rate of fermentation, including the rate of production of ethanol or carbon dioxide. Measuring changes in yeast cell counts or yeast cell mass may also yield relevant data.

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.

A number of methods to measure carbon dioxide production are available. Examples include simple bubble counts or the use of gas syringes, displacement of water from inverted measuring cylinders, movement of water bubbles in graduated pipettes within sealed systems, and pressure sensors and data-logging equipment. Yeast cell counts can be made using a haemocytometer (although a 10- or 100-fold dilution may be required), or indirectly by measuring turbidity with a colorimeter.

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 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 S

Candidates working at lower levels will make predictions that are not justified by reference to underlying science knowledge and understanding. Candidates progressing further will formulate hypotheses that are supported and use these to make predictions that will be tested during the investigation. Higher level predictions will be expressed quantitatively where underlying principles of knowledge and understanding are appropriate for this (e.g. Q10 for the effect of temperature on rate of reactions within a limited range) or, in the case of discrete factors such as respiratory substrate, will attempt to rank the alternatives by the size of their effects. In all cases, the judgement of the level achieved is to take account of the quality of the underlying use of science knowledge and understanding that could be expected of a candidate at GCSE level, rather than the match to the correct outcome.

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 could calculate the **rate** of increase of carbon dioxide production / yeast cell numbers / cell mass over the duration of the investigation or over phases of the growth curve.

While bar charts will be used to display data obtained from the investigation of the effect of different sugars on fermentation, data obtained should be the subject of statistical analysis for those candidates working at higher levels.

Candidates working at the highest 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, e.g., the Student's t-test, could be used to analyse apparent differences between sets of data, helping to support or reject candidates' initial hypothesis.

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

On 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 discuss the effects of glucose concentration on ethanol production, referring to enzyme-controlled reactions during respiration and fermentation. Yeast fermentations in high concentrations of respiratory substrates may be subject to catabolite repression but, in this instance, it would be reasonable to suggest that fermentation is reduced because of osmotic effects on the yeast cells. Candidates will have suitable opportunities to demonstrate their understanding of osmosis.

Candidates investigating the effects of different respiratory substrates on yeast fermentation will have the opportunity to take their investigations a stage further using the OCR secondary data. It is likely that they will need to undertake research on the chemistry of the sources of carbohydrate cited in the study. Graphical or other analysis of the data will show that the uptake of sugars is sequential, and candidates could discuss this in the light of their investigation. They should appreciate that dextrins (long chain glucose polymers) are not taken up by yeast cells, and could discuss this in relation to molecular size and cell permeability.

Investigations on factors such as temperature and pH can be discussed in terms of enzyme-controlled reactions and the lock and key model. At higher levels, candidates might also explore relevant areas other than enzymes, such as whether effects on the cell membrane are likely to be of significance.

For the secondary data provided by OCR, there are considerations of practical and measuring techniques which may affect comparability, e.g. the range of factors involved, such as the strain of yeast used and the temperature of fermentation, and the many alternative methods that can be used as an index of fermentation rate.

Guidance for technicians

In this assessed investigation, candidates may be offered a choice between different methods for studying the rate of fermentation.

The factors under investigation could include temperature, the carbohydrate available as a respiratory substrate, the concentration of the respiratory substrate, pH and the effect of concentration.

Suggested equipment

All investigations:

yeast suspension, 5% in water

solid sugars, or 5% solutions (e.g. glucose, fructose, lactose, maltose and sucrose)

starch solution (1%)

fermentation vessel or equivalent (e.g. conical flasks)

water baths at appropriate temperatures

buffer solutions across range of pH values

Bubble counts or volume of carbon dioxide:

conical flasks or boiling tubes with side arm

delivery tubes

boiling tubes

gas syringes

measuring cylinders

syringes (5 cm3)

graduated pipettes (1 cm3)

rubber tubing

Cell counts:

haemocytometers

microscopes

pasteur pipettes

Dilutions:

volumetric flasks (10 cm3 or 100 cm3)

pipettes (1 cm3 or 10 cm^3)

Data-logging:

pressure sensors and data-logging equipment

fermentation vessel with airtight lid

BLANK PAGE

PLEASE DO NOT WRITE ON THIS PAGE

BLANK PAGE

PLEASE DO NOT WRITE ON THIS PAGE

PLEASE DO NOT WRITE ON THIS PAGE