

National Unit Specification: general information

UNIT	Living Cells (Intermediate 2)
NUMBER	D026 11
COURSE	Biology (Intermediate 2)

SUMMARY

The unit seeks to develop knowledge and understanding, problem solving and practical abilities in the context of cell structure, diffusion and osmosis, enzyme action, aerobic and anaerobic respiration, and photosynthesis. This is a component unit of Intermediate 2 Biology.

OUTCOMES

- 1 Demonstrate knowledge and understanding related to living cells.
- 2 Solve problems related to living cells.
- 3 Collect and analyse information related to Intermediate 2 Biology obtained by experiment.

RECOMMENDED ENTRY

While entry is at the discretion of the centre, candidates would normally be expected to have attained one of the following:

- Standard Grade Biology with Knowledge and Understanding and Problem Solving at grades 3 or 4
- Intermediate 1 Biology or its component units.

Previous biology experience is not a requirement. The unit is therefore also suitable for those wishing to study biology for the first time, eg adult returners and those with Standard Grade Physics, Chemistry or Science with Knowledge and Understanding and Problem Solving at grades 1-3.

Administrative Information

Superclass:	RH
Publication date:	June 2002
Source:	Scottish Qualifications Authority
Version:	04

© Scottish Qualifications Authority 2002

This publication may be reproduced in whole or in part for educational purposes provided that no profit is derived from reproduction and that, if reproduced in part, the source is acknowledged.

Additional copies of this unit can be purchased from the Scottish Qualifications Authority. The cost for each unit specification is £2.50 (minimum order £5).

National Unit Specification: general information (cont)

UNIT Living Cells (Intermediate 2)

CREDIT VALUE

1 credit at Intermediate 2.

CORE SKILLS

Core skills for this qualification remain subject to confirmation and details will be available at a later date.

Additional information about core skills is published in the *Catalogue of Core Skills in National Qualifications* (SQA, 2001).

National Unit Specification: statement of standards

UNIT Living Cells (Intermediate 2)

Acceptable performance in this unit will be the satisfactory achievement of the standards set out in this part of the unit specification. All sections of the statement of standards are mandatory and cannot be altered without reference to the Scottish Qualifications Authority.

OUTCOME 1

Demonstrate knowledge and understanding related to living cells.

Performance criteria

- (a) A variety of cells is described correctly in relation to their structure and function.
- (b) Diffusion and osmosis are described correctly in relation to their effects in plant and animal cells.
- (c) Enzyme action is explained correctly in terms of enzyme properties and factors affecting activity.
- (d) Aerobic and anaerobic respiration are compared correctly in terms of energy release and products.
- (e) Photosynthesis is described correctly in terms of energy fixation and factors affecting rate.

Evidence requirements

Evidence of an appropriate level of achievement must be generated from a closed-book assessment with items covering all the above performance criteria.

OUTCOME 2

Solve problems related to living cells.

Performance criteria

- (a) Relevant information is selected and presented in an appropriate format.
- (b) Information is accurately processed, using calculations where appropriate.
- (c) Conclusions drawn are valid and explanations given are supported by evidence.
- (d) Experimental procedures are planned, designed and evaluated appropriately.
- (e) Predictions and generalisations made are based on available evidence.

Evidence requirements

Evidence of an appropriate level of achievement must be generated from a closed-book assessment with items covering all the above performance criteria, with problems set in the context of cell structure and function, diffusion and osmosis, enzyme action, aerobic and anaerobic respiration or photosynthesis.

National Unit Specification: statement of standards (cont)

UNIT Living Cells (Intermediate 2)

OUTCOME 3

Collect and analyse information related to Intermediate 2 Biology obtained by experiment.

Performance criteria

- (a) The information is collected by active participation in the experiment.
- (b) The experimental procedures are described accurately.
- (c) Relevant measurements and observations are recorded in an appropriate format.
- (d) Recorded experimental information is analysed and presented in an appropriate format.
- (e) Conclusions drawn are valid.
- (f) The experimental procedures are evaluated with supporting argument.

Evidence requirements

A report of one experimental activity is required, covering the above performance criteria in relation to the contents and notes specified for Intermediate 2 Biology.

The teacher/lecturer responsible must attest that the report is the individual work of the candidate derived from active participation in an experiment involving the candidate in planning the experiment; deciding how it is managed; identifying and obtaining the necessary resources, some of which must be unfamiliar; and carrying out the experiment. Depending on the activity, the collection of the information may be group work.

Evidence submitted in support of attainment of PC (d) must be in the format of a table or graph(s) as appropriate. Conclusions drawn should be justified by reference to supporting evidence.

The evaluation should cover all stages of the experiment, including the initial analysis of the situation and planning and organising the experimental procedure.

National Unit Specification: support notes

UNIT Living Cells (Intermediate 2)

This part of the unit specification is offered as guidance. The support notes are not mandatory.

While the time allocated to this unit is at the discretion of the centre, the notional design length is 40 hours.

GUIDANCE ON CONTENT AND CONTEXT FOR THIS UNIT

Outcome 1

a) Cell structure and function

- i Similarities and differences between animal, plant and microbial cells.
- ii Function of cell structures.
- iii Commercial and industrial uses of cells.
Bread making.
Alcohol production.
Antibiotic production.
Yoghurt production
Alternative fuel production.

b) Diffusion and osmosis in plant and animal cells

- i Diffusion as the movement of substances from a high concentration to a low concentration down a concentration gradient.
- ii The importance of diffusion to cells.
- iii Osmosis as a 'special case' of diffusion of water.
- iv Osmotic effects in plant and animal cells.

c) Enzyme action

1 Enzyme properties

- i Properties of catalysts and enzymes.
- ii Specificity of enzymes for their substrates.
- iii Enzymes involved in degradation and in synthesis.

2 Factors affecting activity

d) Aerobic and anaerobic respiration

1 Energy release

- i Glucose as a source of energy in the cell.
- ii Role of ATP.
- iii Comparison of energy yield in aerobic and anaerobic respiration.

2 Products

- i Aerobic Pathway.
- ii Anaerobic Pathway.

National Unit Specification: support notes

UNIT Living Cells (Intermediate 2)

e) Photosynthesis

1 Energy Fixation

- i Sunlight as the source of energy.
- ii Summary equation for photosynthesis.
- iii Photosynthesis as a set of two summary reactions: photolysis followed by carbon fixation.
- iv Conversion of glucose to other carbohydrates.

2 Factors affecting rate of photosynthesis

- i Limiting factors.
- ii Production of early crops in horticulture.

Further detail is given in the supplementary notes in the course content section of the course specification.

Outcome 2

Examples of learning activities which provide suitable contexts for the development of problem solving skills include:

- select and present data on the commercial and industrial uses of micro-organisms
- plan and design an investigation into the influence of temperature and pH on enzyme activity
- select and present data on the energy content of foods
- plan and design an investigation into anaerobic respiration in yeast.

Outcome 3

Suitable experiments include:

- carry out an experiment to demonstrate lactic acid production by yoghurt bacteria
- carry out an experiment to demonstrate osmosis using Visking tubing model cells and potato or other plant material
- carry out an experiment to demonstrate the specificity of enzymes
- carry out an experiment to compare photosynthesis in light and dark conditions and in the presence and absence of carbon dioxide.

Candidates or centres could devise other appropriate experiments in the context of cell structure and function, diffusion and osmosis, enzyme action, aerobic and anaerobic respiration or photosynthesis.

The experiments chosen should allow all the performance criteria for this outcome to be achieved within any single report.

National Unit Specification: support notes (cont)

UNIT Living Cells (Intermediate 2)

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

Details of suitable approaches are detailed in the course specification.

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

It is recommended that a holistic approach is taken to assessment, eg Outcomes 1 and 2 could be assessed by an integrated end of unit test with questions covering all the performance criteria for knowledge and understanding and problem solving.

Outcome 2

Test items should be constructed to allow candidates to generate evidence relating to the performance criteria as follows:

- a) Selecting and presenting information:
 - sources of information to include: texts, tables, charts, graphs and diagrams
 - formats of presentation to include: written summaries, extended writing, tables and graphs.
- b) Calculations to include: percentages, averages, ratios. Significant figures and units should be used appropriately.
- c) Conclusions drawn should include some justification and explanations should be supported by evidence. Conclusions should contain a comment on trends or patterns and/or connections between variables and controls.
- d) Candidates could plan and design procedures to test given hypotheses or to illustrate particular effects. This could include identification of variables, controls and measurements or observations required. The evaluation of given experimental procedures may include situations which are unfamiliar to candidates and could test the candidates' ability to comment on the purpose of approach or the suitability of given experimental procedures. Candidates could comment on the limitations of the set-up, apparatus, suggested measurements or observations, limitations of equipment, appropriateness of controls, sources of error and possible improvements.
- e) Candidates could make predictions and generalisations from given experimental results or, given situations, predict what the results might be.

Outcome 3

Type of experimental activity

The teacher/lecturer should ensure that the experimental activity to be undertaken in connection with Outcome 3 affords opportunity for the candidate to demonstrate the ability to undertake the planning and organising of an experimental activity at an appropriate level of demand. The activity must relate to the Course content and candidates should be made aware of the range of skills which must be demonstrated to ensure attainment of Outcome 3.

National Unit Specification: support notes (cont)

UNIT Living Cells (Intermediate 2)

Assessment of Outcome 3

Candidates are only required to produce one report for Outcome 3 in relation to the contexts and notes specified for Intermediate 2 Biology. This report can then be used as evidence for Outcome 3 for the other units of the course.

In relation to PC (a), the teacher/lecturer checks by observation that the candidate participates in the collection of the experimental information by playing an active part in planning the experiment, deciding how it will be managed, identifying and obtaining resources (some of which must be unfamiliar to the candidate), and carrying out the experiment.

National Unit Specification: support notes (cont)

UNIT Living Cells (Intermediate 2)

Candidates should provide a report with an appropriate title. The report should relate to the performance criteria as follows:

<p>(b) The experimental procedures are described accurately.</p>	<p>A clear statement of the aim of the experiment. A few brief concise sentences including as appropriate:</p> <ul style="list-style-type: none"> • a labelled diagram or brief description of apparatus or instruments used • how the independent variable was altered • control measure used • how measurements were taken or observations made. <p>There is no need for a detailed description. The use of the impersonal passive voice is to be encouraged as an example of good practice but this is not mandatory for meeting the performance criteria.</p>
<p>(c) Relevant measurements and observations are recorded in an appropriate format.</p>	<p>Readings or observations (raw data) must be recorded in a clear table with correct headings, appropriate units and results/ readings entered correctly.</p>
<p>(d) Recorded experimental information is analysed and presented in an appropriate format.</p>	<p>Data should be analysed and presented in tabular, graphical format or as a scatter diagram or equivalent, as appropriate:</p> <ul style="list-style-type: none"> • for a tabular presentation this may be an extension of the table used for PC (c) above, and must include: suitable headings and units showing averages or other appropriate computations • for a graphical presentation this must include: data presented as a histogram, bar chart, connected points or line of best fit as appropriate, with suitable scales and axes labelled with variable and units and with data correctly plotted.
<p>(e) Conclusions drawn are valid.</p>	<p>Conclusions should use evidence from the experiment and relate back to the aim of the experiment. At least one of the following should be included:</p> <ul style="list-style-type: none"> • overall pattern to readings or observations (raw data) • trends in analysed information or results • connection between variables and controls.
<p>(f) The experimental procedures are evaluated with supporting argument.</p>	<p>The evaluation could cover all stages of the activity including preparing for the activity, analysis of the activity and the results of the activity. The evaluation must include supporting argument in at least one of the following:</p> <ul style="list-style-type: none"> • effectiveness of procedures • control of variables • limitations of equipment • possible sources of error • possible improvements.

National Unit Specification: support notes (cont)

UNIT Living Cells (Intermediate 2)

The bullet points under each performance criterion give an indication of what should be addressed to achieve a pass. The relevance of the bullet points will vary according to the experiment. These bullet points are intended as helpful guidance. The decision of pass or fail is to be made by the professional judgement of the presenting centre (subject to moderation) against the performance criteria. It is appropriate to support candidates in producing a report to meet the performance criteria. Re-drafting of a report after necessary supportive criticism is to be encouraged, both as part of the learning and teaching process and to produce evidence for assessment. Redrafting and resubmission is only required for the specific performance criterion identified in need of further attention ie the entire report does not need to be rewritten.

Conditions required to complete the report

Candidates may complete their reports outwith class time provided reasonable measures are taken to ensure that the report is the individual work of the candidate.

Teachers and lecturers may wish candidates to write up reports under their direct supervision so that they can provide appropriate advice and support. However, they may feel confident that any redrafting required need not be undertaken under such close supervision as it will be evident in the candidate's response that it is his or her unaided work. Under such circumstances it would be acceptable for such redrafting to take place outwith class time.

Use of IT

Candidates may, if they wish, present their reports in a word-processed format. Candidates may use Excel (or any other suitable data analysis software) when tackling Outcome 3. However, candidates must not be given a spreadsheet with pre-prepared column headings nor formulae, as they are being assessed on their ability to enter quantities and units into a table and to make decisions about appropriate scales and labels on graph axes. The use of clip art or images captured by digital camera may also be used in recording details of experimental methods.

Transfer of evidence

Candidates may transfer evidence for Outcome 3 from one level to the one below provided the experiment is in the context of the course concerned.

Candidates, who are repeating a course, may carry forward evidence of an appropriate standard, generated in a previous year.

SPECIAL NEEDS

This unit specification is intended to ensure that there are no artificial barriers to learning or assessment. Special needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments or considering alternative outcomes for units. For information on these, please refer to the SQA document *Guidance on Special Assessment Arrangements* (SQA, 2001).