

National Unit Specification: general information

UNIT The Biology of Micro-organisms (Intermediate 2)

NUMBER DF5F 11

COURSE Biotechnology (Intermediate 2)

SUMMARY

This unit seeks to develop knowledge and understanding, problem solving and practical abilities in the context of the structure and reproduction, biochemistry and ecology of micro-organisms. This is a component unit of Intermediate 2 Biotechnology.

OUTCOMES

- 1 Demonstrate knowledge and understanding related to the Biology of Micro-organisms.
- 2 Solve problems related to the Biology of Micro-organisms.
- 3 Solve problems related to Intermediate 2 Biotechnology.

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
- Intermediate 1 Biology.

Previous biology experience is not an absolute requirement and the course is therefore also suitable for those wishing to study biotechnology with a background in other sciences.

Administrative Information

Superclass: RH

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National Unit Specification: statement of standards

UNIT The Biology of Micro-organisms (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 the Biology of Micro-organisms.

Performance criteria

- (a) The biology of micro-organisms is described correctly in relation to their structure and reproduction.
- (b) The biology of micro-organisms is described correctly in relation to their biochemistry.
- (c) The biology of micro-organisms is described correctly in relation to their ecology.

Evidence requirements

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

OUTCOME 2

Solve problems related to the Biology of Micro-organisms.

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 test with items covering all the above performance criteria in the context of the structure and reproduction, biochemistry or the ecology of micro-organisms.

National Unit Specification: statement of standards (cont)

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OUTCOME 3

Solve problems related to Intermediate 2 Biotechnology.

Performance criteria

- (a) The problem to be solved is identified.
- (b) Resources required to solve the problem are identified and obtained.
- (c) Procedures appropriate to solving the problem are planned and designed.
- (d) The planned procedures are carried out.
- (e) The problem solving procedure is evaluated.

Evidence requirements

A report of one problem solving activity covering the above performance criteria in relation to the content and notes specified for Intermediate 2 Biotechnology. The report must be the individual work of the candidate. Depending on the activity, the problem solving may be groupwork.

National Unit Specification: support notes

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

While the exact 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) Structure and reproduction of micro-organisms

- i Bacteria.
Cellular structure and function.
Shape.
Reproduction.
- ii Viruses.
Structure.
Replication.
- iii Fungi.
Cellular structure of fungi as exemplified by yeast and *Mucor*.
Reproduction in yeast and *Mucor*.
- iv Algae.
Cellular structure and function in unicellular algae as exemplified by *Chlorella*
Reproduction.
- v Protozoa.
Cellular structure and function in protozoa.
Reproduction.

b) Biochemistry in micro-organisms

- i Photosynthesis.
- ii Mineral nutrition.
- iii Enzymes.
- iv Respiration.
- v Biochemical synthesis.

c) Ecology of micro-organisms

- i Nutrition.
Saprophytic nutrition.
Parasitic nutrition.
Mycorrhizal associations.
Root nodules.
- ii Nutrient cycling.
The carbon cycle.
The nitrogen cycle.

National Unit Specification: support notes (cont)

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

Outcomes 2 and 3

Suitable learning activities for the development of problem solving skills for Outcome 2 and for the purposes of Outcome 3 include:

- investigate the growth and/or productivity of a *Chlorella* culture under different light conditions
- investigate the limiting factors of photosynthesis using a *Chlorella* culture
- investigate the effects of mineral deficiency in a *Chlorella* culture
- investigate the effects of nutrient enrichment on the growth of yeast cultures
- carry out an assay of extracellular enzyme activity, eg Amylase activity of *B. subtilis*
- test for end products of yeast and *Lactobacilli* fermentations
- carry out an assay for antibiotics produced by *Penicillium*
- observe succession of fruiting bodies on decaying organic matter
- measure temperature changes in compost heap due to thermophilous fungi
- measure the rate of decay of malt extract by the loss of weight in a yeast culture
- carry out an assay of cellulase activity in soil using cellulose strips.

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

Details of suitable approaches are provided 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.

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- 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

This involves the submission of one report of a problem solving activity related to Intermediate 2 Biotechnology.

Candidates are only required to produce one report on a problem solving activity for Intermediate 2 Biotechnology. This report can be used as evidence for Outcome 3 in the 'The Biology of Micro-organisms' and for Outcome 2 in 'Biotechnology Processes'.

The 'Outcome 2: Teacher/lecturer guide' is provided to indicate what might be addressed to achieve a specific performance criterion. The relevance of the items will vary according to the problem solving activity being undertaken eg bullet points which refer to variables would not apply in a case study type problem solving activity. The professional judgement of the teacher/lecturer will be important in deciding if a performance criterion has been met for a particular activity.

National Unit Specification: support notes (cont)

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Outcome 2: Teacher/Lecturer guide

All the performance criteria given in the left-hand column must be achieved in order to attain the outcome. The right-hand column gives suggestions which might aid the professional judgement of the assessor.

Performance criteria	Suggestions to aid professional judgement
(a) The problem to be solved is identified.	Main features of the problem are identified.
(b) Resources required to solve the problem are identified and obtained.	Resources might include: <ul style="list-style-type: none"> • sources of information • set procedures • people • equipment/physical resources • materials
(c) Procedures appropriate to solving the problem are planned and designed.	The plan might include: <ul style="list-style-type: none"> • what is to be measured/collected • variable altered • variable kept constant • how many readings/measurements/observations/subjects • equipment/resources required • how data will be recorded, analysed and presented
(d) The planned procedures are carried out.	This would include a record of the data collected, analysis and presentation of data. Data should be analysed and presented in tabular, graphical format or as a scatter diagram or equivalent as appropriate: <ul style="list-style-type: none"> • for tabular presentation this must include: suitable headings and units showing averages or other appropriate computations • for graphical presentation this must include: data presented as a histogram, bar chart, connected points, line of best fit as appropriate, with suitable scales and axes labelled with quantities and units and with data correctly plotted.
(c) The problem solving procedure is evaluated.	The evaluation might include: <ul style="list-style-type: none"> • an assessment of the effectiveness of the procedure including: planning and organising and the outcome of the activity • drawing valid conclusions, which make use of the presented evidence • suggestions for alternative or modified strategies, further work, predictions or generalisations • an assessment/explanation of the relevance of the results

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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, 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).