

**-SQA-SCOTTISH QUALIFICATIONS AUTHORITY**

**Hanover House  
24 Douglas Street  
GLASGOW G2 7NQ**

---

**NATIONAL CERTIFICATE MODULE DESCRIPTOR**

---

**-Module Number-** 7310511 **-Session-1991-92**  
**-Superclass-** RH

---

**-Title-** **INTRODUCING MICROBIOLOGY**

---

**-DESCRIPTION-**

**Purpose** This module is designed to introduce the student to the features of microorganisms and enable them to develop the skills necessary for carrying out aseptic transfer under supervision. It is suitable for any student requiring an introduction to microbiology as part of a general biology, microbiology or biotechnology programme.

The module could be offered in conjunction with 7310521 Introducing Microbiological Techniques and other Stage 1 Biology or Science modules.

---

**Preferred Entry Level** Standard Grade Biology at Grade 3/4.

---

**Outcomes** The student should:

1. outline the features of microorganisms;
2. describe beneficial and detrimental effects of microorganisms;
3. sample the environment for microorganisms;
4. produce an uncontaminated pure culture on a solid medium from a given stock culture also on a solid medium.

---

**Assessment Procedures** Acceptable performance in the module will be satisfactory achievement of all the Performance Criteria specified for each Outcome.

The following abbreviations are used below:  
PC Performance Criteria  
IA Instrument of Assessment

**Note:** The Outcomes and PCs are mandatory and cannot be altered. The IA may be altered by arrangement with SQA. (Where a range of performance is indicated, this should be regarded as an extension of the PCs and is therefore mandatory.)

## **OUTCOME 1      OUTLINE THE FEATURES OF MICROORGANISMS**

PCs

- (a) The categorisation of microorganisms into algae, bacteria, fungi, protozoa, and viruses is correct with respect to:
- (i) morphological features;
  - (ii) the reasons given for each designation.
- (b) The description of the culture requirements of algae, bacteria, fungi, and protozoa is correct with respect to each of the following:
- (i) nutrition;
  - (ii) light;
  - (iii) temperature;
  - (iv) moisture.

and for viruses is correct with respect to their need for living cells.

### **IA      Restricted Response and Grid Question**

6 restricted response questions and 7 grid questions to assess the student's ability to outline the features of microorganisms under closed book conditions.

The restricted response questions should be allocated to Performance Criterion (a). The student will be required to categorise 6 given unlabelled specimens and/or scaled photographs which include at least one from each category of microorganism. The student must state for each specimen ONE reason, evident from the specimens, as to why the categorisation was made.

The grid questions should be allocated to Performance Criterion (b). The student will be presented with a grid of the five group names, algae, bacteria, fungi, protozoa, viruses, together with a list of seven related statements. Each statement should contain at least two cultural requirements which when taken together allows identification of a group of microorganism presented in the grid.

Satisfactory achievement of the Outcome will be demonstrated by the student achieving 5 correct responses for (a) (including one valid reason for each categorisation) and 5 correct responses for (b) (covering at least one answer for each of the five group names).

**OUTCOME 2                    DESCRIBE BENEFICIAL AND DETRIMENTAL EFFECTS OF MICROORGANISMS**

- PCs
- (a) The description of the usefulness of microorganisms is complete in terms of:
    - (i) a named organism from each of the groups;
    - (ii) the way in which each organism is exploited.
  - (b) The description of the detrimental effects of microorganisms is complete in terms of:
    - (i) a named organism from each of the groups;
    - (ii) the way in which each organism is deemed to be detrimental.

IA    Restricted Response Questions

10 restricted response questions to assess the student's ability to describe the beneficial and detrimental effects of microorganisms under closed book conditions.

Questions should be selected so as to include representation from each of the five groups listed in Outcome 1.

Satisfactory achievement of the Outcome will be demonstrated by the student correctly answering 8 of the questions.

**OUTCOME 3                    SAMPLE THE ENVIRONMENT FOR MICROORGANISMS**

- PCs
- (a) The preparation for each procedure used to take samples of air and surfaces is:
    - (i) in accordance with given specifications;
    - (ii) correct with respect to selection of sampling site.
  - (b) The procedures used to take samples of air and surfaces are:
    - (i) in accordance with current safe practices;
    - (ii) correct with respect to use of equipment.

- (c) The recorded results are in an appropriate format.
- (d) The interpretation of results is correct with respect to identification of factors that might affect the samples.
- (e) The conclusions drawn are valid.

#### IA Practical Exercises

4 practical exercises to assess the student's ability to use the correct procedures to sample the environment for microorganisms.

The student will be required to take air samples from TWO different locations using sterile prepared Nutrient Agar plates, and surface samples from TWO different locations using sterile prepared Nutrient Agar plates.

A checklist should be devised to ensure a reliable interpretation of the student's performance in all practical activities.

Satisfactory achievement of the Outcome will be demonstrated by the student achieving all Performance Criteria for all FOUR samples.

#### OUTCOME 4

#### **PRODUCE AN UNCONTAMINATED PURE CULTURE ON A SOLID MEDIUM FROM A GIVEN STOCK CULTURE ALSO ON A SOLID MEDIUM**

PCs

- (a) The preparation for the procedure is correct with respect to:
  - (i) personal preparation (hand washing, hair tying, protective clothing);
  - (ii) preparation of work surface;
  - (iii) preparation of equipment.
- (b) The procedure used to obtain an uncontaminated inoculum is correct with respect to:
  - (i) use of aseptic techniques;
  - (ii) use of inoculating loop;
  - (iii) plate inoculation;
  - (iv) sterilisation of inoculating loop after use.
- (c) The procedure used to produce an uncontaminated subculture from the inoculum is correct with respect to:
  - (i) use of aseptic technique;
  - (ii) closing and labelling of subculture;
  - (iii) incubation of subculture.

- (d) The subculture produced is uncontaminated.
- (e) The procedures used are in accordance with current safe practices.

IA Practical Exercise

A practical exercise to assess the student's ability to use the correct procedures to produce ONE uncontaminated subculture from a given pure culture.

A checklist should be devised to ensure a reliable interpretation of the student's performance in all practical activities and should include a visual check for contamination.

Satisfactory achievement of the Outcome will be demonstrated by the student meeting all the Performance Criteria.

**The following sections of the descriptor are offered as guidance.  
They are not mandatory.**

### CONTENT/CONTEXT

Corresponding to Outcomes 1-4:

1. The definition and range of microorganisms (algae, bacteria, fungi, protozoa, and viruses) should be established. Classification should be restricted to the main features of each of the groups and include morphological features of major taxonomic importance eg. the type of cell wall, presence of chloroplasts etc. Detail such as that needed for classification at the species level is not required. Cultural requirements should be mentioned where these are of fundamental importance to the group eg. algae, usually aquatic, photosynthetic; fungi, usually saprophytic; viruses, parasitic etc.

Emphasis should be placed on those organisms which are of economic or medical importance as exemplars of the groups listed in Outcome 1 eg. sources of mycoproteins, antibiotics, causes of diseases, rots, roles in nutrient cycles, industrial applications etc.

3. The aim of this Outcome is to demonstrate the ubiquity of microorganisms and to illustrate the need in Outcome 4 for good aseptic techniques to avoid contamination.

Sampling should only be attempted once a clear understanding of safe and unsafe sites has been established.

Under no circumstances should samples be taken from areas such as human/animal body surfaces, body fluids or secretions, lavatories, animal cages/aquaria, meat/meat products, eggs, milk, mud, and other similar places likely to present a high risk of yielding pathogens.

Samples should be taken using both sterile swabs and settle plates and these techniques related to their particular uses.

4. Proper aseptic techniques should be established from the outset. All aspects of good microbiological practice should be constantly enforced, beginning with hand washing and bench preparation at the start of the practical session, through to writing up evidence at the end. On no account should any hand to mouth operations be permitted in the laboratory and nothing other than proper microbiological procedures should be adopted. The use of Nutrient Agar should be related to Outcome 1.

### SUGGESTED LEARNING AND TEACHING APPROACHES

This module could be integrated with 7310521 Introducing Microbiological Techniques to provide a programme for developing basic laboratory skills in microbiology. It might also be appropriate to integrate the module with 7310501 Introducing Biotechnology in order to provide a lead into the vocational areas of biotechnology.

The emphasis in the delivery of the module should be in the development of safe, consistent, practical skills and the student should have several opportunities to practise his/her skills. It is expected that formative assessment will be carried out throughout this module and that the student will be presented with summative assessment at the stage of which he/she is showing consistent competence, reliability, and awareness of safe practices. The Outcomes of the module should be integrated so as to develop a general awareness of the range of microorganisms and the need for a disciplined approach to working with microorganisms.

Relating to Outcomes 1-4:

- 1&2. The student's awareness of microbiology and microbiological techniques should be developed along with a sound understanding of the reasons for good aseptic techniques. A variety of approaches could be adopted depending upon resources. A student-centred approach is recommended for this module using prepared slides and photomicrographs, videos, guest speakers, industrial visits, and individual assignments. A series of simple practical demonstrations could illustrate the differing cultural requirements of some of the groups, while the conditions required by the others could be found by reference to appropriate texts.
3. At all times account must be taken of current safety guidelines and the risk of accidentally culturing pathogenic organisms. It is essential therefore, that prior to the student undertaking the sampling exercises this Outcome is approached by means of group discussion to establish the criteria for safe and unsafe sampling sites. There is no need for the students to have prepared the media or to have poured the plates themselves. The various uses of the sampling techniques, settle plate and surface sampling, and their limitations could be established by group discussion once the results of the exercise are seen.
4. A laboratory exercise. The techniques to be used should be demonstrated in a sequential manner with brief explanations at each step. Questioning of the students as they undertake the exercise would help to ensure understanding.

It is recommended that where possible students should be given their own stock culture from which they are to subculture. It is essential that only pure stock cultures are used.