-SQA-SCOTTISH QUALIFICATIONS AUTHORITY

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NATIONAL CERTIFICATE MODULE DESCRIPTOR

-Module Number- **7310521** **-Session-1991-92**
-Superclass- **RH**

-Title- **INTRODUCING MICROBIOLOGICAL TECHNIQUES**

-DESCRIPTION-

Purpose

This module is designed to enable the student to acquire some of the fundamental skills needed for work in microbiology. It is suitable for any student requiring an introduction to microbiology as part of a general biology, microbiology or biotechnology programme.

It could be offered in conjunction with 7310511 Introducing Microbiology and other Stage 1 Biology or Science modules.

Preferred Entry Level

7310511 Introducing Microbiology. Standard Grade Biology at Grade 3/4, or equivalent competence.

Outcomes

The student should:

1. make poured plates for the culture of microorganisms;

2. subculture microrganisms;

3. investigate the effects of environmental conditions on the growth of microorganisms;

4. categorise microorganisms using data from a range of sources.

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 **MAKE POURED PLATES FOR THE CULTURE OF MICROORGANISMS**

PCs

(a) The preparation for pouring plates is in accordance with given specifications.

(b) The pouring is correct in terms of:

- (i) agar cooled before pouring;
- (ii) aseptic technique;
- (iii) poured without splashing.

(c) The plate is correct in terms of:

- (i) smooth surface;
- (ii) uniform thickness;
- (iii) base of plate is covered;
- (iv) labelling;
- (v) no growth occurs on plate after incubation.

(d) The technique is correct in terms of current safe practices.

IA Practical Exercise

A practical exercise to assess the student's ability to make poured plates which are suitable for the culture of microorganisms.

The student will be required to use one type of given sterile medium to make poured plates which are then incubated for a minimum of 24 hours at 25°C or room temperature for 48 hours.

A checklist should be devised to ensure a reliable interpretation of the student's practical performance. Tutors are required to carry out a visual check for contamination.

Satisfactory performance of the Outcome will be achievement of all the Performance Criteria for TWO plates.

OUTCOME 2 SUBCULTURE MICROORGANISMS

Pcs

(a) The preparation for taking an inoculum is correct.
(b) The removal of inoculum from stock culture is correct.
(c) The transfer of inoculum to culture medium is correct.
(d) The incubation of subculture is in accordance with instructions.
(e) The recorded results are in an appropriate format.

IA Practical Exercise

A practical exercise to assess the student's ability to use the correct procedure to produce ONE viable, visibly uncontaminated, subculture from a given stock culture involving EACH of the following transfers:

(i) solid to solid;
(ii) solid to liquid;
(iii) liquid to solid;
(iv) liquid to liquid.

A checklist should be devised to ensure a reliable interpretation of the student's performance in all practical activities. Tutors are required to carry out at least a visual check for contamination.

Satisfactory achievement of the Outcome will be demonstrated by the student meeting all the Performance Criteria for EACH of the FOUR subcultures and must include at least TWO of the main groups of microorganisms.

OUTCOME 3 INVESTIGATE THE EFFECTS OF ENVIRONMENTAL CONDITIONS ON THE GROWTH OF MICROORGANISMS

PCs

(a) The preparation for the investigation is in accordance with agreed procedures.
(b) The investigation carried out is in accordance with:

(i) current safe practices;
(ii) given specifications.

(c) The recorded results are:

(i) in an appropriate format;
(ii) correct with respect to environmental conditions;
(iii) correct with respect to the growth of microorganisms;

(iv) to the specified accuracy.

(d) The interpretation of the recorded data is correct with respect to:

(i) identification of possible sources of error;
(ii) validity of conclusions drawn from data obtained.

IA Practical Exercise

A practical investigation to assess the student's ability to determine the effects of environmental conditions on microorganisms.

The student will investigate the effects of an environmental condition selected from: temperature, nutrient, light, pH, or salinity, and culture a given microorganism under supervision in THREE different conditions of the factors selected. The effect of the environmental condition on the growth of the microorganism should be deduced from the data obtained.

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 meeting all the Performance Criteria.

OUTCOME 4 CATEGORISE MICROORGANISMS USING DATA FROM A RANGE OF SOURCES

PCs

(a) The interpretation of data relating to morphology is correct.
(b) The interpretation of data relating to staining is correct.
(c) The interpretation of data relating to biochemical tests is correct.
(d) The identification of microorganisms based on data provided is correct.

IA Restricted Response Question

A restricted response question to assess the student's ability to categorise microorganisms using data from a range of sources under closed book conditions.

Given sets of data relating to 12 microorganisms which should include at least TWO from each of the groups given below:

Algae
Bacteria
Fungi
Protozoa
Viruses

The student will be required to use data relating to:

(i) cell shape, size and gross morphology;
(ii) staining;
(iii) the results of simple biochemical tests;

to assign the organisms to their appropriate category, giving the group name and at least one attribute eg. a rod bacterium.

Satisfactory achievment of the Outcome will be demonstrated by the student correctly assigning TEN microorganisms using the data provided.

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

CONTENT/CONTEXT

Corresponding Outcomes 1-4:

1. Properties of agar; melting and setting temperatures. Good technique; lighted Bunsen, flaming of mouths of flasks and bottles, manipulation of bungs etc., prevention of condensation, prevention of contamination.

2. Content should be confined to the techniques of subculturing and prevention of contamination and infection during these processes. Prepared media should be supplied where possible as the preparation of the media is not under test. The techniques used should be those normally used in a microbiology laboratory for the transfer of inoculum from solid or liquid stocks using implements which can be flame sterilised.

3. The differing growth requirements of each of the groups of microorganisms should be compared. After appropriate discussion the student should design an experiment of his/her own to show what effect, if any, the variation of an environmental parameter has on the growth of a named microorganism.

   Suitable environmental parameters would include the following: salinity, osmotic potential, pH, temperature, and light. Consideration should be given in the design to the control and monitoring of the parameter where appropriate. The preferred nutrient requirements, recording of the growth or assessment of the final cultures and methods of data handling.

   The normal growth curve of a microbiological culture should be considered in terms of phases eg. lag, exponential (log), stationary, and decline, and this curve related to the availability of resources. The way in which this curve can be influenced by environmental conditions should be explored. Reference should be made to the effects of the environmental parameters listed above. The student should interpret data on the effects of a number of parameters that affect growth. This data should be supplied as separate tables as it is not expected that students at this stage could cope with multifactorial experiments.

4. The range of microorganisms should be established (algae, bacteria, fungi, protozoa, and viruses), and the student introduced to a number of techniques which can be used to differentiate between these groups of organisms. The techniques should cover the range of those normally used for this purpose ie. morphological features, stains, biochemical tests and selective growth media. The student should be able
   to interpret the results of the tests and categorise microorganisms using this type of data.

   Suggested content: morphological features including; chloroplasts, pyrenoids, flagellae, cilia, cell walls, reproductive structures, endospores, clustering.

Stains including; negative, Grams, acid-fast, capsule, flagella, endospore, polychromatics for eukaryote/prokaryotes.

Biochemical tests including; fermentation, selective/enrichment media, citrate test, antibiotic sensitivity.

SUGGESTED LEARNING AND TEACHING APPROACHES

The main purpose of this module is to provide the student with the basic skills required of a laboratory technician working under full supervision, and to enable the student to appreciate the nature of microorganisms and their growth requirements in the laboratory.

This module could be integrated with 7310511 Introducing Microbiology to provide a programme for developing basic laboratory skills in microbiology.

The Outcomes can be achieved by a combination of group discussion, resource-based learning and student-centred methodologies, formal instruction and practical work.

The emphasis in the delivery of the module should be on the development of safe, consistent, practical skills and students should have several opportunities to practise their skills. It is expected that formative assessment will be carried out throughout the module and that the student will be presented with summative assessment at the stage at which he/she is showing consistent competence, reliability and awareness of safe practices. The Outcomes 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.

It is recommended that the investigation suggested for Outcome 3 be developed from small group discussion or tutorials and should serve to integrate the skills and knowledge developed in the remaining Outcomes.

The design and planning of experiments for Outcome 3 should initially be carried out in the form of a paper exercise and students only allowed to proceed once the tutor has agreed. At all times tutors must ensure that students are working according to current safe practices in microbiology.

A laboratory notebook should be kept by students in which they record all details of experimental work they have undertaken. A suitable format for such a record would be to list the aims, materials, methods, results and conclusions for each experiment.