National Unit Specification: general information

UNIT Laboratory Science: Practical Skills (SCQF level 5)

CODE F86M 11

SUMMARY

This Unit has been designed as a mandatory Unit of the SCQF level 5 Skills for Work Laboratory Science Course and has been designed to be taken as part of that Course. It can also be taken as a free-standing Unit. It is suited to candidates who have an interest in, and may be considering a career in laboratory science, as well as those whose interest is more general.

The Unit provides candidates with the opportunity to learn and develop the skills most commonly used in laboratories. The health and safety issues of working in a laboratory are integral to the Unit. Candidates will learn how to work safely with potentially hazardous materials such as microorganisms and will measure radioactivity, as well as developing competence in the use of various types of instrumentation found in laboratories. Skills in performing a titration are also developed.

OUTCOMES

1 Work safely with microorganisms in a laboratory setting.
2 Measure radioactivity in a laboratory setting.
3 Use scientific instrumentation for a specified task in a laboratory setting.
4 Perform a titration.

RECOMMENDED ENTRY

While entry is at the discretion of the centre, it would be helpful if candidates have attained or are studying one of the following, or equivalent:

- Standard Grade General or Credit in Biology, Chemistry, Physics or Science
- SCQF level 4 Units in Biology, Chemistry or Physics
- SCQF level 5 Units in Biology, Chemistry or Physics
  together with
- Standard Grade General or Credit, or SCQF level 4 or SCQF level 5 Units in Mathematics

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Administrative Information

Superclass: RA

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National Unit Specification: general information (cont)

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CREDIT VALUE

1 credit at SCQF level 5 (6 SCQF credit points at SCQF level 5*).

**SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from Access 1 to Doctorates*

CORE SKILLS

There is no automatic certification of Core Skills or Core Skill components in this Unit. Opportunities for developing aspects of Core Skills are highlighted in the *Support Notes* of this Unit Specification.

National Unit Specification: statement of standards

UNIT Laboratory Science: Practical Skills (SCQF level 5)

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 SQA.

OUTCOME 1

Work safely with microorganisms in a laboratory setting.

Performance Criteria

(a) Pour agar plates using aseptic technique.
(b) Subculture microorganisms using aseptic technique.
(c) Prepare wet and dry mounts to observe using a microscope.
(d) Work safely throughout.

OUTCOME 2

Measure radioactivity in a laboratory setting.

Performance Criteria

(a) Detect and measure radioactivity using an appropriate instrument.
(b) Explain the requirements of working safely with radioactivity.
(c) Work safely throughout.

OUTCOME 3

Use scientific instrumentation for specified tasks in a laboratory setting.

Performance Criteria

(a) Select the appropriate instrument for each specified task.
(b) Operate each instrument following instructions.
(c) Record results accurately from each scientific instrument.
(d) Work safely throughout each task.

OUTCOME 4

Perform a titration.

Performance Criteria

(a) Set up appropriate equipment for a titration correctly.
(b) Use an indicator to determine the end point of a titration.
(c) Record volumes using correct notation.
(d) Work safely throughout.

National Unit Specification: statement of standards (cont)

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EVIDENCE REQUIREMENTS FOR THIS UNIT

Performance evidence and written/oral recorded evidence which covers all the Outcomes and Performance Criteria is required for this Unit.

Outcome 1: Performance evidence

Candidates will work safely with microorganisms in a laboratory setting.

Candidates will be required to demonstrate by practical activity that they are able to:

- pour agar plates using asceptic technique to a satisfactory standard

- subculture microorganisms (bacteria, yeast **and** mould) using asceptic technique without contamination. Candidates must subculture **each** microorganism type using **one** of the following subculture techniques:
  - liquid to solid
  - solid to liquid
  - liquid to liquid
  - solid to solid

- prepare wet and dry mounts to a satisfactory standard

The preparation is in accordance with given instructions and the mounted material is clearly visible when viewed using a microscope.

- work safely throughout.

An assessor observation checklist must be used to provide evidence of performance.

Outcome 2: Performance evidence and written and/or oral evidence

Candidates will measure radioactivity in a laboratory setting.

Candidates will be required to demonstrate by practical activity that they are able to:

- use an appropriate instrument to detect and measure radiation levels.
- work safely throughout the practical activity.

An assessor observation checklist must be used to provide evidence of performance.

Candidates will be required to explain the requirements of working safely with radioactivity.

This must include:

- protective clothing
- use of forceps or lifting tool
- limiting the time of exposure
- shielding and positioning of source
- the use of the radioactive hazard symbol

Evidence must be gathered in supervised open-book conditions.

National Unit Specification: statement of standards (cont)

UNIT Laboratory Science: Practical Skills (SCQF level 5)

Candidates must use scientific instrumentation for specified tasks in a laboratory setting.

Candidates will be required to undertake **two** practical activities using a different type of instrument for each activity. Each instrument must cover a different scientific application.

Candidates will be required to demonstrate that they are able to:

- select an instrument from the following list which is appropriate for each specified task:
  — colorimeter
  — GC
  — HPLC
  — electrical meters
  — laser
  — melting point apparatus
  — oscilloscope
  — spectrophotometer
  — spectroscope
- operate each instrument following instructions
- record accurately results from these scientific instruments
- work safely throughout each specified task.

An assessor observation checklist must be used to provide evidence of performance. In addition, written/oral evidence is required from the candidate in order to meet the criteria for PC (c).

Outcome 4: Performance evidence and written and/or oral evidence

Candidates will perform a titration.

Candidates will be required to demonstrate by practical activity that they are able to:

- set up appropriate equipment for a titration correctly
- use an indicator to determine the end point of a titration
- record volumes using the correct SI units to the appropriate number of decimal places
- work safely throughout.

An assessor observation checklist must be used to provide evidence of PC (a), (b) and (d). Written and/or oral evidence is required from the candidate in order to meet the criteria for PC (c).

The National Assessment Bank (NAB) pack for this Unit provides assessor observation checklists for each Outcome. Centres wishing to develop their own assessments must refer to the NAB to ensure that they are of a comparable standard.

National Unit Specification: support notes

UNIT Laboratory Science: Practical Skills (SCQF level 5)

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 THE CONTENT AND CONTEXT FOR THIS UNIT

The Unit has been designed as a mandatory Unit of the SCQF level 5 Skills for Work Laboratory Science Course and has been designed to be taken as part of that Course. It can also be taken as a free-standing Unit. It is suited to candidates who have an interest in, and may be considering a career in laboratory science, as well as those whose interest is more general.

The Unit provides candidates with the opportunity to learn and develop the skills most commonly used in laboratories. The health and safety issues of working in a laboratory are integral to the Unit. Candidates will learn how to work safely with potentially hazardous materials such as microorganisms and will measure radioactivity, as well as developing competence in the use of various types of instrumentation found in laboratories. Skills in performing a titration are also developed.

During this Unit, candidates should be encouraged to develop a positive approach to the employability skills and attitudes identified by employers. These should be taught as an integral part of the Unit. In addition to the specific vocational skills developed and assessed, candidates will have the opportunity to develop the following employability skills:

- ability to follow instructions*
- awareness of health and safety in a laboratory*
- appropriate use of resources*
- positive attitude to learning*
- flexible approach to problem solving
- confidence to set goals, reflect and learn from experience
- time management skills
- communication skills*
- presentation skills
- numeracy skills*
- practical skills of weighing*, measuring*, preparing solutions
- working co-operatively with others
- confidence to seek feedback
- review and self-evaluation skills
- working independently

Development of these employability skills (those marked with an asterisk*) will be clearly identified as a result of the evidence generated through the assessment activities for this Unit. There are opportunities in the Unit to develop the remaining skills.

National Unit Specification: support notes (cont)

UNIT Laboratory Science: Practical Skills (SCQF level 5)

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

The requirements of this Unit should be discussed with candidates as part of the induction to the Unit. The main approach to teaching and learning should be experiential, practical and candidate-centred. Candidates should have the opportunity to learn and develop practical skills in a laboratory environment where they will experience workplace conditions and will learn how to work co-operatively with others. Each part of the teaching/learning should incorporate both theory and practice, and it is recommended that to facilitate learning this Unit is delivered in conjunction with *Laboratory Science: Working in a Laboratory* (SCQF level 5). This would also optimise the number of practical activities required to generate sufficient evidence.

When delivering this Unit Outcomes can be taught and assessed in any sequence.

Outcome 1

Candidates will be required to demonstrate competence in their ability to carry out the most common microbiological techniques used in a laboratory such as pouring media plates, subculture of microbes, preparing slides for microscopy and an awareness of appropriate safe disposal. As well as developing aseptic technique, candidates must also demonstrate an awareness of relevant aspects of health and safety. Practical demonstration followed by supported formative work should be used to enhance candidates' skills. Each part of the learning/teaching should incorporate both theory and practical to facilitate learning. This is especially true of the health and safety requirements where relevant points should be integrated into each technique to enable candidates to understand and remember the relevance more easily.

Outcome 2

Here candidates will be required to demonstrate competence in their ability to detect and measure radiation levels safely. As well as correct use of the instrument, candidates must also describe the safety precautions necessary when working with radioactive substances. The safety precautions will include protective clothing, use of forceps or lifting tool, shielding and positioning of source, the use of the radioactive hazard symbol. Candidates may require some background theory on radiation as part of their induction. A candidate-centred practical approach to teaching and learning should be employed.

Examples of relevant practical activities which could be in a real or simulated environment could include:

- measuring background radiation
- measuring the radioactivity from naturally occurring sources, eg brazil nuts; coffee beans

Outcome 3

Candidates will select and operate instruments safely for two specified tasks. The instruments must cover a range of scientific applications as given in the Evidence Requirements:

Colorimeter, electrical meters, GC, HPLC, laser, melting point apparatus, oscilloscope, spectrophotometer, spectroscope.

National Unit Specification: support notes (cont)

UNIT Laboratory Science: Practical Skills (SCQF level 5)

Candidates must record results from the scientific instruments, thereby developing skills in written and/or oral communication and should be encouraged to use appropriate scientific notation including the relevant number of significant figures and units of measurement.

When using instrumentation candidates must follow instructions and health and safety issues must be considered. Whilst this may vary from instrument to instrument, in general terms it could encompass calibration, use of blanks, use of standards, replicate readings, acceptable range of values, currency of portable appliance testing, checking for visual defects (eg frayed cables, loose wires etc.) cleaning and maintenance of equipment, completion of user log manuals and equilibration of machines.

Centres are strongly advised to give candidates opportunities to practise operating scientific instruments, with appropriate support, before undertaking the specified tasks.

Outcome 4

When carrying out a titration candidates must ensure appropriate health and safety precautions are followed, including wearing appropriate personal protective equipment, demonstrating proper handling of chemicals and proper use of a burette.

Candidates must provide written evidence of their ability to record volumes using the correct SI units and the appropriate number of decimal places.

In any scientific laboratory it is a requirement that employees keep a record of activity and results in a lab diary/log book. Such good working practice should be encouraged in this practical Unit.

OPPORTUNITIES FOR CORE SKILL DEVELOPMENT

In this Unit candidates will carry out a range of practical activities which involve following instructions, recording data and seeking advice. These are good opportunities for developing aspects of the Core Skill of *Communication*. In recording results candidates will be handling data and this offers scope to develop aspects of the Core Skill of *Numeracy*. If the candidate uses a computer while undertaking any part of the Unit (for example: in operating a particular instrument such as HPLC) they will have the opportunity to develop aspects of the Core Skill of *Information and Communication Technology*. There may be opportunities within the scope of this Unit for candidates to work with others, which would enable them to develop effective interpersonal skills.

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

The Evidence Requirements are fully expressed in the mandatory section of this Unit Specification.

When delivering this Unit Outcomes can be taught and assessed in any sequence. Performance evidence for all Outcomes should be gathered over a realistic timeframe which gives candidates the opportunity to practise and develop their practical skills throughout the Unit. It is recommended that multiple opportunities for formative assessment should exist throughout the Unit before candidates are assessed as competent in the relevant practical skills.

Centres will be responsible for identifying suitable tasks for Outcome 3.

National Unit Specification: support notes (cont)

UNIT Laboratory Science: Practical Skills (SCQF level 5)

Assessor observation checklists must be used when gathering evidence of performance for Outcome 1, Outcome 2 PC (a) and (c), Outcome 3 PC (a) (b) and (d) and Outcome 4 PC (a) (b) and (d).

The assessor observation checklists must be retained.

The written and/or oral evidence of measurements and results recorded for Outcome 2 PC (b), Outcome 3 PC (c) and Outcome 4 PC (c) must also be retained.

The National Assessment Bank (NAB) pack for this Unit provides assessor observation checklists for each Outcome. Centres wishing to develop their own assessments must refer to the NAB to ensure that they are of a comparable standard.

Opportunities for the use of e-assessment

E-assessment may be appropriate for some assessments in this Unit. By e-assessment we mean assessment which is supported by information and communications technology (ICT), such as e-testing or the use of e-portfolios or e-checklists. Centres which wish to use e-assessment must ensure that the national standard is applied to all candidate evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. Further advice is available in *SQA Guidelines on Online Assessment for Further Education (AA1641, March 2003), SQA Guidelines on e-assessment for Schools (BD2625, June 2005)*.

DISABLED CANDIDATES AND/OR THOSE WITH ADDITIONAL SUPPORT NEEDS

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments, or considering whether any reasonable adjustments may be required. Further advice can be found on our website **www.sqa.org.uk/assessmentarrangements**