Unit Specification

Unit title: Laboratory Science: Practical Skills (National 5)

Unit code: HN9Y 75

Superclass: RA

Publication date: June 2017

Source: Scottish Qualifications Authority

Version: 1.0

Unit purpose

This unit has been designed as a mandatory unit of the National 5 Laboratory Science Skills for Work 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 learners 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 learners 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. Learners 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

On successful completion of the unit the learner will be able to:

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.

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Credit points and level

1 National unit credit at SCQF level 5: (6 SCQF credit points at SCQF level 5)

Recommended entry to the unit

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

- National 4 Science
- National 4 or 5 in Biology, Chemistry or Physics
- SCQF level 4 units in Biology, Chemistry or Physics
- SCQF level 5 units in Biology, Chemistry or Physics

together with

- National 4 or 5, or SCQF level 4 or SCQF level 5 units in Mathematics

Core Skills

Opportunities to develop aspects of Core Skills are highlighted in the support notes for this unit specification.

There is no automatic certification of Core Skills or Core Skill components in this unit.

Context for delivery

If this unit is delivered as part of a course, it is recommended that it should be taught and assessed within the subject area of the course to which it contributes.

The assessment support pack (ASP) for this unit provides assessment and marking guidelines that exemplify the national standard for achievement. Centres wishing to develop their own assessments should refer to the ASP to ensure a comparable standard. A list of existing ASPs is available to download from SQA's website **(http://www.sqa.org.uk/sqa/46233.2769.html)**.

Equality and inclusion

This unit specification has been designed to ensure that there are no unnecessary barriers to learning or assessment. The individual needs of learners should be taken into account when planning learning experiences, selecting assessment methods or considering alternative evidence.

Further advice can be found on our website **www.sqa.org.uk/assessmentarrangements**.

National unit specification: Statement of standards

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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

Evidence is required to demonstrate that learners have achieved all outcomes and performance criteria.

Outcome 1 — Performance evidence

Learners will work safely with microorganisms in a laboratory setting.

Learners 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. Learners 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

Learners will measure radioactivity in a laboratory setting.

Learners 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.

Learners 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

National unit specification: Statement of standards (cont)

Unit title: Laboratory Science: Practical Skills (National 5)

Outcome 3 — Performance evidence and written and/or oral evidence

Evidence must be gathered in supervised open-book conditions.

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

Learners 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.

Learners 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 learner in order to meet the criteria for PC (c).

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

Learners will perform a titration.

Learners 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.

National unit specification: Statement of standards (cont)

Unit title: Laboratory Science: Practical Skills (National 5)

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 learner in order to meet the criteria for PC (c).

The Assessment Support Pack (ASP) for this unit provides assessor observation checklists for each outcome. Centres wishing to develop their own assessments must refer to the ASP to ensure that they are of a comparable standard.

Development of skills for learning, skills for life and skills for work

It is expected that learners will develop broad, generic skills through this unit. Employability is a key aspect of Skills for Work and is present throughout the unit. In addition, there are a number of other skills that learners will be expected to improve on and develop as they undertake this unit, these can be drawn from the main skills areas listed below. These must be built into the unit where there are appropriate opportunities.

2 Numeracy
2.1 Number processes
2.2 Money, time and measurement

5 Thinking Skills
5.1 Remembering
5.2 Understanding

Amplification of these is given in SQA's *Skills Framework: Skills for Learning, Skills for Life and Skills for Work.* The level of these skills should be at the same SCQF level as the unit and be consistent with the SCQF level descriptor. Further information on building in skills for learning, skills for life and skills for work is given in the national unit support notes.

National unit support notes

Unit title: Laboratory Science: Practical Skills (National 5)

Unit support notes are offered as guidance and 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 National 5 Laboratory Science Skills for Work 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 learners 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 learners 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. Learners 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, learners 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, learners 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 support notes (cont)

Unit title: Laboratory Science: Practical Skills (National 5)

Guidance on approaches to delivery of this unit

The requirements of this unit should be discussed with learners as part of the induction to the unit. The main approach to teaching and learning should be experiential, practical and learner-centred. Learners 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 the unit *Laboratory Science: Working in a Laboratory* (National 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

Learners 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, learners must also demonstrate an awareness of relevant aspects of health and safety. Practical demonstration followed by supported formative work should be used to enhance learners' 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 learners to understand and remember the relevance more easily.

Outcome 2

Learners will be required to demonstrate competence in their ability to detect and measure radiation levels safely. As well as correct use of the instrument, learners 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. Learners may require some background theory on radiation as part of their induction. A learner-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

National unit support notes (cont)

Unit title: Laboratory Science: Practical Skills (National 5)

Outcome 3

Learners 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.

Learners 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 learners 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 learners opportunities to practise operating scientific instruments, with appropriate support, before undertaking the specified tasks.

Outcome 4

When carrying out a titration learners 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.

Learners 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.

National unit support notes (cont)

Unit title: Laboratory Science: Practical Skills (National 5)

Guidance on approaches to assessment of this unit

Evidence can be generated using different types of assessment. The following are suggestions only. There may be other methods that would be more suitable to learners.

Centres are reminded that prior verification of centre-devised assessments would help to ensure that the national standard is being met. Where learners experience a range of assessment methods, this helps them to develop different skills that should be transferable to work or further and higher education.

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 learners 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 learners are assessed as competent in the relevant practical skills.

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

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 Assessment Support Pack (ASP) this unit provides assessor observation checklists for each outcome. Centres wishing to develop their own assessments must refer to the ASP to ensure that they are of a comparable standard.

Opportunities for 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 Communication Technology (ICT), such as e-testing or the use of e-portfolios or social software.

Centres which wish to use e-assessment must ensure that the national standard is applied to all learner evidence and that conditions of assessment as specified in the evidence requirements are met, regardless of the mode of gathering evidence. The most up-to-date guidance on the use of e-assessment to support SQA's qualifications is available at **www.sqa.org.uk/e-assessment**.

National unit support notes (cont)

Unit title: Laboratory Science: Practical Skills (National 5)

Opportunities for developing Core Skills

In this unit learners 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 learners will be handling data and this offers scope to develop aspects of the Core Skill of Numeracy. If the learner 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 learners to work with others, which would enable them to develop effective interpersonal skills.

General information for learners

Unit title: Laboratory Science: Practical Skills (National 5)

This section will help you decide whether this is the unit for you by explaining what the unit is about, what you should know or be able to do before you start, what you will need to do during the unit and opportunities for further learning and employment.

In this unit you will learn and develop the skills most commonly used in laboratories. You will learn how to safely work with microorganisms including how to prepare agar plates, sub-culture microorganisms and prepare microscope slides. You will learn how to safely measure radioactivity and record your results. You will gain competence in carrying out measurements using two different types of instruments found in laboratories. Scientific and numeracy skills will also be developed when you carry out titrations.

You 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 you will be handling data and this offers scope to develop aspects of the Core Skill of Numeracy. If you use a computer while undertaking any part of the unit (for example: in operating a particular instrument such as HPLC) you 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 learners to work with others, which would enable you to develop effective interpersonal skills.

Administrative information

Published: June 2017

Superclass: RA

History of changes to National Unit Specification

Version	Description of change	Date