



LABORATORY SCIENCE
at SCQF level 5

First edition — published February 2010



National Course Specification

Laboratory Science (SCQF level 5)

COURSE CODE C266 11

COURSE STRUCTURE

This Course has four mandatory Units.

The mandatory Units are:

F86K 11	<i>Laboratory Science: Careers using Laboratory Science</i>	1 credit (40 hours)
F86L 11	<i>Laboratory Science: Working in a Laboratory</i>	1 credit (40 hours)
F86M 11	<i>Laboratory Science: Practical Skills</i>	1 credit (40 hours)
F86N 11	<i>Laboratory Science: Practical Investigation</i>	1 credit (40 hours)

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

PROGRESSION

This Course or its Units may provide progression to:

- ◆ National Certificate Group Awards in Applied Science
- ◆ Suitable training/employment in science laboratories
- ◆ Further/Higher Education

Administrative Information

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National Course Specification: Course details (cont)

COURSE Laboratory Science (SCQF level 5)

Laboratory Science: Practical Skills (SCQF level 5) broadly reflects the following aspects:

- ◆ maintaining health and safety in a laboratory environment (CA)
- ◆ assisting with the preparation of microbiological specimens and samples for laboratory investigations (CA)
- ◆ assisting with the processing of liquid compounds and samples using manual laboratory techniques (CA)
- ◆ following aseptic procedures in the laboratory environment (CA)
- ◆ communicating laboratory information to authorised personnel under supervision (CA)
- ◆ perform manual laboratory techniques (CLS)
- ◆ work in aseptic and clean room conditions (Bioscience)
- ◆ preparing culture media and solutions for laboratory use (CA)

Laboratory Science: Practical Investigation (SCQF level 5) broadly reflects the following aspects:

- ◆ maintaining health and safety in a laboratory environment (CA)
- ◆ maintaining effective and efficient working relationships in the laboratory (CLS)
- ◆ working effectively in a team (Bioscience)

RATIONALE FOR SKILLS FOR WORK COURSES

Skills for Work Courses are designed to provide candidates with opportunities for developing:

- ◆ skills and knowledge in a broad vocational area
- ◆ Core Skills
- ◆ an understanding of the workplace
- ◆ positive attitudes to learning
- ◆ skills and attitudes for employability

A key feature of these Courses is the emphasis on *experiential learning*. This means learning through practical experience and learning by reflecting on experience.

Learning through practical experience

- ◆ Teaching/learning programmes should include some or all of the following:
 - learning in real or simulated workplace settings
 - learning through role play activities in vocational contexts
 - carrying out case study work
 - planning and carrying out practical tasks and assignments

Learning through reflecting at all stages of the experience

- ◆ Teaching/learning programmes should include some or all of the following:
 - preparing and planning for the experience
 - taking stock throughout the experience — reviewing and adapting as necessary
 - reflecting after the activity has been completed — evaluating and identifying learning points

National Course Specification: Course details (cont)

COURSE Laboratory Science (SCQF level 5)

Core Skills

The **five** Core Skills are:

- ◆ *Communication*
- ◆ *Numeracy*
- ◆ *Information and Communication Technology*
- ◆ *Problem Solving*
- ◆ *Working with Others*

Employability

The skills and attitudes for employability, including self-employment, are outlined below:

- ◆ *generic skills/attitudes valued by employers*
 - understanding of the workplace and the employee's responsibilities, for example time-keeping, appearance, customer care
 - self-evaluation skills
 - positive attitude to learning
 - flexible approaches to solving problems
 - adaptability and positive attitude to change
 - confidence to set goals, reflect and learn from experience
- ◆ *specific vocational skills/knowledge*
 - Course Specifications highlight the links to National Occupational Standards in the vocational area and identify progression opportunities

Opportunities for developing these skills and attitudes are highlighted in each of the Course and Unit Specifications. These opportunities include giving young people direct access to workplace experiences or, through partnership arrangements, providing different learning environments and experiences which simulate aspects of the workplace. These experiences might include visits, visiting speakers, role play and other practical activities.

A Curriculum for Excellence (Scottish Executive 2004) identifies aspirations for every young person. These are that they should become:

- ◆ successful learners
- ◆ confident individuals
- ◆ responsible citizens
- ◆ effective contributors

The learning environments, the focus on experiential learning and the opportunities to develop employability and Core Skills in these Courses contribute to meeting these aspirations.

National Course Specification: Course details (cont)

COURSE Laboratory Science (SCQF level 5)

RATIONALE FOR SKILLS FOR WORK: LABORATORY SCIENCE COURSE

Science is an important discipline that has been identified by the Scottish Government and Scottish Enterprise as vital to the prosperity of the Scottish Economy. The Sector Skills Councils related to the science disciplines have identified a future need for recruitment due to retirement and expansion of the industries using scientific skills both at technician and graduate level. Research has informed the content of this Course, thus providing a course that is relevant to the sector.

The Laboratory Science (SCQF level 5) Course is designed to introduce candidates to the knowledge and skills which are required for employment/further study in the wide range of industries and services using laboratory science, and to develop an awareness of the opportunities and range of employment within the sector. The primary target group for this Course is school candidates from third year in secondary education and above. However, the Course is also suitable for adult candidates who are seeking to enhance their employability and vocational skills in laboratory science. 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 at Credit, or SCQF level 4 or SCQF level 5 Units in Mathematics. However if candidates have no prior knowledge and understanding of practical science, it is suggested that appropriate support is provided.

The general aims of the Course are to:

- ◆ widen participation in vocationally-related learning for school candidates
- ◆ allow candidates to experience vocationally-related learning
- ◆ provide candidates with an introduction to working in a laboratory
- ◆ encourage candidates to foster a good work ethic, including time management, a positive attitude and other relevant employability skills and attitudes
- ◆ provide opportunities to develop a range of Core Skills through practical experience in a vocational environment
- ◆ encourage candidates to take charge of their own learning and development
- ◆ provide a range of teaching, learning and assessment styles to motivate candidates to achieve their full potential
- ◆ facilitate progression to further/higher education and training
- ◆ help build candidates' confidence.

The specific aims of the Course are to:

- ◆ encourage candidates to consider a career in industries and services using laboratory science
- ◆ develop an awareness of the opportunities there may be within sectors in terms of the types and range of career options
- ◆ develop the basic skills of measuring, weighing and preparing compounds and solutions for laboratory use
- ◆ develop the skills of communicating laboratory information
- ◆ develop candidates understanding and use of the requirements of maintaining health and safety in a laboratory environment
- ◆ develop problem solving and numeracy skills in the context of a laboratory
- ◆ provide opportunities for the personal development of skills and attitudes which will improve the candidates' employment potential within a sector
- ◆ develop the candidates' awareness of their individual strengths and weaknesses in relation to the requirements of a sector, and to reflect on how this affects their employability potential.

National Course Specification: Course details (cont)

COURSE Laboratory Science (SCQF level 5)

It is anticipated that the Course will build on existing partnerships between schools, colleges, employers and other training providers. This will enable the Course to be delivered in a range of appropriate learning environments while having access to relevant teaching expertise and laboratories.

Opportunities for candidates to improve their skills in the areas of communication, numeracy, working with others, planning and organising, problem solving, self review and evaluation are to be developed within the four Units of the Course.

COURSE CONTENT

Summary of Course content

The Course provides a broad experiential introduction to laboratory science.

Candidates will explore a variety and range of industries and services and the career opportunities, in science laboratories, in a local, national and global setting. Candidates will have the opportunity to develop the basic practical skills for working in a laboratory: measuring, weighing and preparing compounds and solutions, and to understand and implement the health and safety requirements for a safe working environment. The specific practical skills related to microbiology, radioactivity, chemical handling and laboratory instrumentation are developed. Candidates will work with others to produce a plan to undertake a practical investigation to test scientific hypotheses related to a scientific topic. This will also involve reporting of the results, conclusions and evaluations of the investigation.

The Course places emphasis throughout all Units on the employability skills and attitudes valued by employers which will help to prepare candidates for the workplace. Employability skills are reviewed by the candidates and they will seek feedback from their peers and teaching staff as appropriate. Candidates will evaluate their own strengths and weaknesses thus enabling a review of personal skills, qualifications and experience against career options to be carried out.

The employability skills assessed in this Course are:

- ◆ 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

National Course Specification: Course details (cont)

COURSE Laboratory Science (SCQF level 5)

Summary of Unit content

Laboratory Science: Careers using Laboratory Science SCQF level 5 1 credit (40 hours)

This Unit introduces candidates to the wide range of industries and services which use scientific knowledge and laboratory skills. Candidates will learn about the variety of ways in which science and laboratory skills are used in different industries and services and about the job roles which use these skills. Candidates will investigate a range of career opportunities within industries and services which use laboratory science and investigate the skills, qualifications and experience required for a job role of personal interest within the field of laboratory science.

Candidates will have the opportunity to reflect on and evaluate their own employability skills and attributes.

Laboratory Science: Working in a Laboratory SCQF level 5 1 credit (40 hours)

This Unit provides candidates with the opportunity to gain practical experience in measuring and weighing quantities, basic laboratory skills such as handling chemicals, preparing solutions, and in calculating and presenting results of practical work. Safety and security procedures are addressed to enable candidates to maintain health and safety while working in a laboratory environment and a risk assessment is carried out. Opportunities arise for the development of numeracy and communication skills when recording and reporting practical work.

Laboratory Science: Practical Skills SCQF level 5 1 credit (40 hours)

This 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.

Laboratory Science: Practical Investigation SCQF level 5 1 credit (40 hours)

In this Unit candidates will work with others to produce a plan to investigate a scientific topic using practical procedures. Candidates working as part of a group will identify a hypothesis to investigate. Methods for testing the hypothesis using practical procedures are devised and tasks are allocated to each member of the group. Candidates will be assessed on their ability to carry out an allocated task competently and in a safe manner. Candidates will present their findings to members of the group and will produce a scientific report with their individual analysis and evaluation of the information gathered. Candidates will then review and evaluate their own and group contribution to the investigation.

National Course Specification: Course details (cont)

COURSE Laboratory Science (SCQF level 5)

ASSESSMENT

To achieve the Course award candidates must successfully achieve all the Units which make up the Course.

Assessment objectives

Assessment across the Units of this Course will allow candidates to demonstrate:

- ◆ laboratory practical skills: measurement, preparation of solutions, instrumentation
- ◆ scientific data collection and reporting skills
- ◆ health and safety procedures
- ◆ knowledge and understanding in relation to working in a laboratory
- ◆ generic and specific employability skills and attitudes valued by employers
- ◆ skills associated with planning and investigating
- ◆ review and evaluation skills
- ◆ working with others in teams
- ◆ self-evaluation skills

Assessment of the Course is through a range of methods including candidate folio of written and/or oral evidence, practical activities supported by assessor observation checklists as well as self-evaluation.

Unit assessment

Laboratory Science: Careers using Laboratory Science (SCQF level 5) 1 credit

Written and/or oral evidence is required for this Unit.

Written and/or oral evidence is required to evidence candidates' knowledge of different industries and services, job roles, career options and the skills, qualifications and experience needed for a job role of personal interest within the field of laboratory science. This will take the form of a folio that the candidate will gather in open-book conditions at appropriate points throughout the Unit and submit as evidence.

Evidence of self-review and evaluation will be gathered in a folio that will hold three reviews of their employability skills. These reviews will be completed at appropriate times throughout the entire Course. Candidates will gather feedback from the teacher/lecturer on two occasions and another person on one occasion. The other person can be, for example, another candidate or placement supervisor who has observed the candidate.

Laboratory Science: Working in a Laboratory (SCQF level 5) 1 credit

Performance and written and/or oral evidence are required for this Unit.

Evidence for the three Outcomes will be gathered in a folio in open-book conditions throughout the Unit with the final selection of items for inclusion taking place towards the end of the Unit.

National Course Specification: Course details (cont)

COURSE Laboratory Science (SCQF level 5)

Performance evidence must be gathered to show that candidates are able to work safely handling chemicals in a laboratory setting on a minimum of two occasions when preparing a chemical solution and dealing with a simulated chemical spill. Candidates will also undertake practical activities to take measurements of mass and volume. Assessor observation checklists must be used to provide evidence of performance.

Written and/or oral evidence is required which demonstrates that candidates can carry out a risk assessment in a scientific laboratory, record measurements taken and perform a range of calculations on these measurements.

Laboratory Science: Practical Skills (SCQF level 5)

1 credit

Performance and written and/or oral evidence are required for this Unit.

Performance evidence obtained during a range of practical activities is required. Working safely with microorganisms in a laboratory setting requires candidates to pour agar plates using aseptic techniques, subculture micro organisms, and prepare wet and dry mounts. Radioactivity is to be measured and detected using the appropriate instrumentation. Two types of instrumentation each covering a different scientific application are to be used appropriately in two separate practical activities. A titration is to be performed safely using appropriate equipment. Assessor observation checklists must be used to provide evidence of performance.

Written and/or oral evidence is also required which demonstrates that candidates can describe the safety requirements when working with radioactive materials and can accurately record measurements.

Laboratory Science: Practical Investigation (SCQF level 5)

1 credit

Performance and written and/or oral evidence are required for this Unit.

Written and/or oral evidence is required to demonstrate that candidates can plan a practical investigation while working with others. The assessor must use a checklist to confirm that each candidate has contributed constructively to the group planning discussions throughout and that all performance criteria have been achieved. Evidence is also required to demonstrate that candidates can record results and observations in an appropriate format which will include the correct use of SI units. A written and/or oral report of the analysis, conclusion and evaluation of all of the results and observations from the investigation is required. Candidates should be given suitable templates for the plan and the report to help them produce their evidence in supervised conditions.

Performance evidence supported by an assessor observation checklist is required to demonstrate that the candidate can carry out the allocated practical task in accordance with the investigation plan safely. This evidence will be produced under controlled supervised conditions. Performance evidence supported by an assessor observation checklist is required to demonstrate that candidates can organise and present findings to others in relation to their allocated practical task.

Candidates will be required to identify strengths and areas for improvement in terms of their own contribution to the planning and implementation of the investigation, taken account of feedback from others as part of this review, and identify action points using a candidate review sheet.

National Course Specification: Course details (cont)

COURSE Laboratory Science (SCQF level 5)

Further details about Unit assessment for this Course can be found in the Unit Specifications and the National Assessment Bank (NAB) materials. The NAB packs for these Units illustrate the standard that should be applied. If a centre wishes to design its own assessments for these Units they should be of a comparable standard.

QUALITY ASSURANCE

The Units of all National Courses are subject to internal verification and may also be chosen for external verification by SQA. This is to ensure that national standards are being applied across all subjects.

To assist centres, Internal Assessment reports are published on SQA's website www.sqa.org.uk

GUIDANCE ON LEARNING/TEACHING AND ASSESSMENT APPROACHES FOR THIS COURSE

Suggested order/sequence of delivery

Centres should ensure that an induction to the Course is given, which will enable candidates to understand fully what is required and the approaches to be adopted. It is important that employability skills, both generic and specific to the industries and services using laboratory science are emphasised at this time.

While individual centres should decide the sequence of delivery which is most appropriate to them it is suggested that the Unit *Laboratory Science: Careers using Laboratory Science* (SCQF level 5) is introduced early in the Course to enable candidates to be aware of the broad range of industries and services using laboratory science and hence the variety of career opportunities that can arise when working in a laboratory. Outcome 3 of this Unit requires candidates to review their own employability skills and assessment of this should take place throughout the Course. This Unit can be linked to the other Units and it is anticipated that some evidence for this Outcome will be gathered throughout the Course.

It would also be appropriate that the Unit *Laboratory Science: Working in a Laboratory* (SCQF level 5) is offered early in the Course in order to help candidates understand the requirements of health and safety to enable a safe environment to be maintained in the Units *Laboratory Science: Practical Skills* (SCQF level 5) and *Laboratory Science: Practical Investigation* (SCQF level 5). Also the skills developed in this Unit can be reinforced in these two practical Units. It would be beneficial for candidates if the Unit *Laboratory Science: Practical Investigation* (SCQF level 5) is delivered towards the end of the Course as candidates will be required to build on skills covered in *Laboratory Science: Working in a Laboratory* (SCQF level 5) and *Laboratory Science: Practical Skills* (SCQF level 5).

Learning and Teaching

The main approaches to learning in this Course should be experiential and candidate centred. Candidates should have the opportunity to learn and develop practical skills in a laboratory and if possible in a realistic work environment. Given the practical nature of teaching/learning and assessment, centres should ensure that teaching blocks are of sufficient time to allow a meaningful experience for candidates.

National Course Specification: Course details (cont)

COURSE Laboratory Science (SCQF level 5)

Candidates will achieve maximum benefit from this Course if schools can work in partnership with colleges and employers. By allowing candidates to access a real working environment, they will gain a much broader understanding of what working in a laboratory entails whilst helping to develop positive attitudes towards the workplace.

Centres should provide an induction to each Unit as well as the induction to the Course as a whole. This will help candidates to understand what is required of them for each Unit and the approaches to be taken.

Teaching and learning should encourage candidates to take responsibility for their own learning and development. In the practical Units of the Course, candidates need to carry out checks on their own work. This provides a good opportunity to motivate candidates to take pride in their own work. The integration of employability skills, in particular self-evaluation skills, will allow candidates to take responsibility for seeking feedback and identifying action points for improvement in their own performance. This should help to develop confidence in taking advice and in asking for direction and assistance where necessary.

As the Course is designed to be practical, each part of the learning and teaching should incorporate both theory and practice, to facilitate learning. This will assist candidates in understanding the relevance of knowledge and understanding to practical tasks. Health and safety is integral to all practical tasks and should be emphasised at the start of, and throughout, each session.

Opportunities to develop aspects of additional components of Core Skills, where they arise naturally, should be taken. For example, in order to carry out the activities in the practical Units, aspects of numeracy will be developed when making calculations and in the analysis of results. Communication skills will be developed in a written and/or oral format when recording results, conclusions and evaluations of the investigations, as well as in written and/or oral format when working in a group and communicating with others.

Candidates should be encouraged throughout the Course to use as many methods as possible to gain the information required. They should make full use of the internet, journals (on-line and printed), books, national and local newspapers, friends and family who have knowledge or experience of industries and services using science and site visits. Candidates should be encouraged to play an active part in their own learning by discussing their own views and thoughts on science, industries and services using laboratory science, careers and personal preferences with peers and teaching staff.

Unit assessment

Further details about Unit assessment for this Course can be found in the Unit Specifications and the National Assessment Bank (NAB) materials.

Practical work

Within the skills-specific practical Units, candidates will produce evidence as a natural part of the teaching and learning process. Candidates will first learn and practise the correct techniques and methods for each of the skills they undertake. Assessment of the various practical skills will take place at appropriate points throughout the Course.

Each Unit will be supported by a NAB pack which will provide exemplar assessment instruments with the assessor observational checklists that exemplify national standards.

National Course Specification: Course details (cont)

COURSE Laboratory Science (SCQF level 5)

Visiting speakers/visits to laboratories

Centres are encouraged to develop links with employers and industry representatives who may be able to offer support in terms of visiting speakers and arranging a visit to a laboratory. This is particular relevant to the Unit *Laboratory Science: Careers using Laboratory Science* (SCQF level 5). Such visits will be helpful when investigating the different job roles within industries and services and will provide candidates with a realistic view of jobs, roles and responsibilities, and conditions within laboratory science.

Health and Safety

Compliance with current relevant health and safety regulation is of paramount importance in this Course. Owing to the health and safety implications involved in working in laboratories, the practical Units have been designed so they can be taught and assessed in a laboratory environment.

It is a centre's responsibility to produce risk assessments which set out the safe working/teaching and learning arrangements for teachers, support staff and candidates. Centres will be familiar with the requirements of the Health and Safety at Work Act (HASAW), the Management of Health and Safety at Work Regulations (MHSWR), Control of Substances Hazardous to Health (COSHH), Provision and Use of Work Equipment Regulations (PUWER) and other legislative requirements where risk assessments are necessary. This list of statutes is not intended to be exhaustive, and centres must comply with all current relevant legislation whether listed or otherwise.

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

National Course Specification: Course details (cont)

COURSE Laboratory Science (SCQF level 5)

Appendix: Employability Skills Profile

In addition to the specific, vocational skills developed and assessed in this Course, employability skills are addressed as detailed in the table below. For the purposes of the table, the Units are referred to as A, B, C and D as indicated.

Laboratory Science: Careers using Laboratory Science	= A
Laboratory Science: Working in a Laboratory	= B
Laboratory Science: Practical Skills	= C
Laboratory Science: Practical Investigation	= D

Employability skill/attitude	Evidence
◆ Ability to follow instructions	A, C, D
◆ Awareness of health and safety in a laboratory	A, B, C, D
◆ Appropriate use of resources	A, C, D
◆ Positive attitude to learning	A, C, D
◆ Flexible approach to problem solving	A, D
◆ Confidence to set goals, reflect and learn from experience	A, D
◆ Time management skills	A, D
◆ Communication skills	A, B, C, D
◆ Presentation skills	A, D
◆ Numeracy skills	A, B, C
◆ Practical skills of weighing, measuring, preparing solutions	A, B, C
◆ Working co-operatively with others	A, D
◆ Confidence to seek feedback	A, D
◆ Review and self-evaluation skills	A, D
◆ Working independently	A, D

Assessment evidence in all Units:

- A = Candidate folio, candidate review sheet.
- B = Candidate folio, assessor observation checklist, written and/or oral evidence.
- C = Assessor observation checklists, written/oral evidence
- D = Candidate folio of written and/or oral assessment, assessor observation checklists, candidate review sheet



National Unit Specification: general information

UNIT Laboratory Science: Careers using Laboratory Science
(SCQF level 5)

CODE F86K 11

SUMMARY

This Unit has been designed as a mandatory Unit of the Skills for Work Laboratory Science Course at SCQF level 5 and has been designed to be taken as part of that Course. It can also be taken as a freestanding 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 introduces candidates to the wide range of industries and services which use scientific knowledge and laboratory skills. Candidates will learn about the variety of ways in which science and laboratory skills are used in different industries and services and about the job roles which use these skills. Candidates will investigate a range of career opportunities within industries and services which use laboratory science and investigate the skills, qualifications and experience required for a job role of personal interest within the field of laboratory science.

Candidates will have the opportunity to reflect on and evaluate their own employability skills and attributes.

OUTCOMES

- 1 Investigate the use of laboratory science within different industries and/or services.
- 2 Investigate a range of careers within industries and/or services which use laboratory science.
- 3 Review and evaluate own performance in specified employability skills.

RECOMMENDED ENTRY

Entry is at the discretion of the centre.

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.*

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National Unit Specification: general information (cont)

UNIT Laboratory Science: Careers using Laboratory Science
(SCQF level 5)

CORE SKILLS

There is no automatic certification of Core Skills within this Unit.

Opportunities for developing aspects of Core Skills are highlighted in the *Support Notes* for this Unit Specification.

National Unit Specification: statement of standards

UNIT Laboratory Science: Careers using Laboratory Science (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

Investigate the use of laboratory science within different industries and/or services.

Performance Criteria

- (a) Identify a range of industries and/or services which use laboratory science.
- (b) Explain why laboratory science is relevant to the identified industries and/or services.
- (c) Explain how laboratory science is used in the identified industries and/or services.
- (d) Organise and present findings in an appropriate format.

OUTCOME 2

Investigate a range of careers within industries and/or services which use laboratory science.

Performance Criteria

- (a) Identify current career opportunities in laboratory science.
- (b) Identify and describe job roles and responsibilities in laboratory science.
- (c) Describe the skills, qualifications and experience required for a job role.
- (d) Organise and present findings in an appropriate format.

OUTCOME 3

Review and evaluate own performance in specified employability skills.

Performance Criteria

- (a) Identify own strengths and weaknesses in specified employability skills
- (b) Seek feedback from others when reviewing own employability skills.
- (c) Identify areas for improvement in specific skills and qualifications and set relevant goals.
- (d) Evaluate progress in achieving these goals over a set period of time.

National Unit Specification: statement of standards (cont)

UNIT Laboratory Science: Careers using Laboratory Science (SCQF level 5)

EVIDENCE REQUIREMENTS FOR THIS UNIT

Written and/or oral evidence which covers all Outcomes and Performance criteria is required for this Unit. All evidence is gathered in open-book conditions.

Outcomes 1 and 2: Written and/or oral evidence

Evidence for Outcomes 1 and 2 will be gathered in open-book conditions at appropriate points throughout the Unit and presented in a candidate folio. Progress will be discussed with the teacher/lecturer at appropriate points during the investigations to ensure that the folio is the candidate's own work. A record of each discussion must be retained.

Candidates will investigate a range of industries and/or services which use laboratory science.

Candidates will be given a clear brief for the investigation.

Candidates are required to:

- ◆ identify **three** industries and/or services which use laboratory science. One must be a local industry and/or service, one must be a national industry and/or service, and one must be a global industry and/or service. The three industries and/or services chosen must include at least **two** from the range:
 - agriculture, horticulture, forestry and fisheries
 - biotechnology/bio-industries
 - chemical industry
 - construction
 - education
 - energy provision
 - engineering
 - food and drink industries
 - health sector
 - pharmaceutical industries
 - sport and recreation
 - transport
- ◆ explain why laboratory science is relevant to each of the identified industries and/or services
- ◆ explain how laboratory science is used within each of the identified industries and/or services
- ◆ identify a current career opportunity in laboratory science in each of the identified industries and/or services
- ◆ describe a job role and responsibilities in laboratory science for each identified industry and/or service
- ◆ describe the skills, qualifications and experience required for **one** identified job role which is of personal interest from **one** of the identified industries and/or services

Candidates must present their findings in an organised and appropriate format.

National Unit Specification: statement of standards (cont)

UNIT Laboratory Science: Careers using Laboratory Science (SCQF level 5)

Outcome 3 Candidate reviews

Evidence requirements for Outcome 3 will take the form of **three** completed candidate reviews which will give candidates the opportunity to record their progress in developing employability skills. Candidates will be provided with a review template.

Each review will include the following:

- ◆ A record of the candidate's analysis of own strengths and weaknesses in relation to 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

- ◆ A record of feedback gathered from others in relation to employability skills.

Candidates will gather feedback from the teacher/lecturer on **two** occasions and another person on **one** occasion. The other person can be, for example, another candidate or placement supervisor who has observed the candidate.

- ◆ A record of identified areas for improvement and goals set in relation to these employability skills.

- ◆ An evaluation of progress towards achievement of these goals over a set period of time.

The first review will take place at an early stage of the Unit, one will be completed at an appropriate point during the Unit and the third will be carried out towards the end of the Unit. Candidates will complete the reviews based on their experiences and learning to date. The reviews will be completed in supervised open-book conditions.

On each occasion the candidate must sign and date each review sheet. The review sheets will be countersigned by the assessor.

When delivering this Unit as part of the SCQF level 5 Laboratory Science Course opportunities will occur throughout the Course to identify, develop and practise the relevant skills, which are the basis of the reviews. Further guidance is given in the support notes under content and context.

National Unit Specification: statement of standards (cont)

UNIT Laboratory Science: Careers using Laboratory Science (SCQF level 5)

It is expected that, at this level, most candidates will need support and guidance in completing their reviews. Templates and other support must be provided. However candidates must take responsibility for completing their own reviews.

The National Assessment Bank (NAB) pack provided for this Unit illustrates the standard that should be applied. It contains an investigation template, candidate brief and candidate review sheets. If a centre wishes to design its own assessments for this Unit, they must be of a comparable standard.

National Unit Specification: support notes

UNIT Laboratory Science: Careers using Laboratory Science (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

This Unit has been designed as a mandatory Unit Skills for Work Laboratory Science Course at SCQF level 5 and has been designed to be taken as part of that Course. It can also be taken as a freestanding 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 introduces candidates to the wide range of industries and services which use scientific knowledge and laboratory skills. Candidates will learn about the variety of ways in which science and laboratory skills are used in different industries and services and about the job roles which use these skills. Candidates will investigate a range of career opportunities within industries and services which use laboratory science and investigate the skills, qualifications and experience required for a job role of personal interest within the field of laboratory science.

Candidates will have the opportunity to reflect on and evaluate their own employability skills and attributes.

Outcome 1

Outcome 1 introduces candidates to the wide range of industries and/or services that laboratory science contributes to, including many in which the science element may not be immediately apparent to the client or service user.

Candidates will investigate the role that laboratory science plays in three different industries and/or services. At least two will be chosen from different areas among those specified in the Evidence Requirements. If there is a specific locally-based industry or service which employs staff using laboratory skills or if the candidate has a particular interest in a specific industry or service which does not fall among those listed, then the candidate should be encouraged to include this among their three choices. It is important that candidates learn that there is a wide range of industries and services which make use of science knowledge and skills and that they do so in a variety of different ways.

Candidates are asked to explain both why laboratory science is relevant and how laboratory science is used in each example. For example, in many sport and recreation fields, candidates may comment that laboratory science is relevant because it enables quantifiable checks on athletes' physiological performance during training. Alternatively they may comment that it provides an objective test for the use of banned substances during competition. They would then comment on how it is used in these instances by explaining for example that there would be chemical analysis made of blood and urine samples.

National Unit Specification: support notes

UNIT Laboratory Science: Careers using Laboratory Science (SCQF level 5)

Outcome 2

Candidates will identify career opportunities available using laboratory science and related skills. They should be encouraged to investigate a wide range of such opportunities and to become aware of the use of laboratory work in widely varying industries and services.

Candidates will investigate job roles and responsibilities for each of the three industries and/or services identified in Outcome 1. For some industries and services these may be roles in significantly different areas. For others it is likely that the roles will simply reflect different levels of seniority and, therefore, of experience and responsibility. In this case the employability requirements of checking the precision, accuracy and safety of one's own work and, for more senior staff, taking responsibility for that of others may be discussed.

Candidates will explore and discuss current career opportunities in laboratory science in each of the identified industries and/or services, and will investigate job roles and responsibilities within each industry and/or service. Candidates will investigate the skills, qualifications and experience required for one job role of personal interest from one of the identified industries/services and should be encouraged to explore the variety of possible pathways available for achieving these skills and attributes. There is also the opportunity to consider more generally the range of practical skills needed in laboratory work.

The results of the candidate's investigations for both Outcomes 1 and 2 should be recorded in a suitably organised manner in an appropriate form of folio, eg a presentation, display, poster or set of leaflets. It is important that candidates have the opportunity to develop their skills in organising and presenting their findings clearly, an important skill in science careers.

Outcome 3

This Outcome is intended to give candidates the opportunity to evaluate and to review their performance in employability skills. They will be expected to seek and accept comment from others on those employability skills. They will then be expected to take responsibility for improving their performance by identifying areas for improvement both by self-evaluation and by taking feedback from others. This should include setting goals and evaluation of progress towards these goals over a set period of time. It should also include recording these reviews and progress in a suitable manner.

Employability skills

Candidates will be required to review and evaluate 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

National Unit Specification: support notes

UNIT Laboratory Science: Careers using Laboratory Science (SCQF level 5)

- ◆ 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

These skills can be practised, reviewed and evaluated in real or simulated workplace environments, individual or group laboratory activities. When this Unit is being taken as part of the SCQF level 5 Laboratory Science Course, opportunities will arise to practise, review and evaluate employability skills, for example by carrying out the following activities:

- ◆ Carry out an investigation and contribute to group working in the Unit *Laboratory Science: Practical Investigation Skills* (SCQF level 5)
- ◆ Participate in practical activities in the Units *Laboratory Science: Working in a Laboratory* (SCQF level 5) and *Laboratory Science: Practical Skills* (SCQF level 5)

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

Outcomes 1 and 2

Candidates must identify and describe a number of industries and/or services which use science and laboratory skills and obtain information about some specific job roles within these industries and/or services. This will be in the form of an investigation. The investigation will require candidates to gather information from a variety of sources. These could include:

- ◆ workplace visits
- ◆ work experience
- ◆ visiting speakers
- ◆ interviews with workers in relevant job roles
- ◆ scientific societies
- ◆ internet
- ◆ libraries
- ◆ handouts

It may be beneficial for candidates to work in groups and share information although the final investigation and folio must be the candidate's own work. Candidates should discuss with the group and with the teacher/lecturer a suitable format for presenting the information. Care should be taken that the language and materials used throughout promote equality and diversity and avoid gender or cultural stereotypes. In most cases, styles of presentation will form a natural and appropriate way to allow all candidates to learn of a wider range of industries and services from the work of other candidates in the group.

National Unit Specification: support notes

UNIT Laboratory Science: Careers using Laboratory Science (SCQF level 5)

Outcome 3

Candidates should be encouraged to use the SMART model when setting personal goals, ie they should be specific, measurable, attainable, realistic, time-bound. They should also be encouraged to realise that such targets are personal and so will vary from those of others. Where this Unit is being taken as part of the SCQF level 5 Laboratory Science Course, opportunities to practise employability skills should occur naturally throughout the Course.

OPPORTUNITIES FOR CORE SKILL DEVELOPMENT

In this Unit candidates will be involved in an investigation and in self-evaluation and review of employability skills. They should have the opportunity to practise and develop both oral and written communication skills and their inter-personal skills in working with others as they research the information needed for Outcomes 1 and 2. They will also develop their communication skills in their presentation of their findings for these Outcomes. In Outcome 3 candidates must seek the opinion of others on their performance in specified employability skills which gives further opportunities for them to develop both their communication skills and their ability to work with others. It is likely that most candidates will chose to use computers either as part of their research methods or whilst preparing their presentation or both. Candidates choosing to do this will have the opportunity to develop their ICT skills. Candidates have to take responsibility for their own performance in the investigation and in the review and evaluation of their employability skills. This may allow them to develop the three components of *Problem Solving*: Critical Thinking, Planning and Organising; Reviewing and Evaluating.

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

If candidates are taking this Unit as a free-standing Unit, centres must ensure that they are given the opportunity to develop the specified employability skills over a period of time in relevant activities.

When this Unit is being delivered as part of the SCQF level 5 Laboratory Science Course, it would be appropriate for Outcomes 1 and 2 to be completed and assessed at the beginning of the course and for Outcome 3 to be assessed throughout the course so that candidates have opportunities to practise and develop the specified employability skills and set and evaluate their goals.

Outcomes 1 and 2

The folio should be the discussed by the candidate and the teacher/lecturer at an appropriate point to authenticate that it is the candidate's own work. A record of this discussion should be kept.

Outcome 3

Feedback from others will be in the form of feedback from a teacher/lecturer on two occasions and feedback from another person on one occasion. The other person could be another candidate, a placement supervisor or anyone else who has observed the candidate and is able to make appropriate comment. The reviews will be completed in supervised open-book conditions. On each occasion the candidate will sign and date each review sheet. The review sheets will be countersigned by the assessor.

National Unit Specification: support notes

UNIT Laboratory Science: Careers using Laboratory Science
(SCQF level 5)

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



National Unit Specification: general information

UNIT Laboratory Science: Working in a Laboratory (SCQF level 5)

CODE F86L 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.

This Unit provides an opportunity to gain practical experience in measuring and weighing quantities, basic laboratory skills such as handling chemicals and preparing solutions and in calculating and presenting results of practical work. Safety and security procedures are addressed to enable candidates to maintain health and safety while working in a laboratory environment and a risk assessment is carried out. Opportunities arise for the development of numeracy and communication skills when recording and reporting practical work.

OUTCOMES

- 1 Carry out a risk assessment for a specified procedure in a scientific laboratory.
- 2 Perform chemical handling procedures in a scientific laboratory.
- 3 Use scientific instruments to measure, record and calculate in specified tasks.

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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National Unit Specification: general information (cont)

UNIT Laboratory Science: Working in a Laboratory (SCQF level 5)

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

Achievement of this Unit gives automatic certification of the following:

Complete Core Skills	None
Core Skill components	Using Number at SCQF level 4 Critical Thinking at SCQF level 4

There are also opportunities to develop aspects of Core Skills which are highlighted in the *Support Notes* of this Unit Specification.

National Unit Specification: statement of standards

UNIT Laboratory Science: Working in a Laboratory (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

Carry out a risk assessment for a specified procedure in a scientific laboratory.

Performance Criteria

- (a) Identify the main hazards present.
- (b) Identify the associated significant risks to health and safety.
- (c) Suggest appropriate ways to minimise risks.

OUTCOME 2

Perform chemical handling procedures in a scientific laboratory.

Performance Criteria

- (a) Identify the requirements for specific forms of chemical storage.
- (b) Carry out appropriate steps to prepare a chemical solution.
- (c) Demonstrate safe working practices in preparing a chemical solution.
- (d) Select and use appropriate personal protective equipment and materials required when dealing with a chemical spill.
- (e) Comply with relevant current health and safety requirements throughout practical activities.

OUTCOME 3

Use scientific instruments to measure, record and calculate in specified tasks.

Performance Criteria

- (a) Select and set up an appropriate measuring instrument for a specified task.
- (b) Use the instrument correctly to take accurate measurements.
- (c) Record measurements from the instrument using correct notation.
- (d) Perform calculations correctly for a specified task.

National Unit Specification: statement of standards (cont)

UNIT Laboratory Science: Working in a Laboratory (SCQF level 5)

EVIDENCE REQUIREMENTS FOR THIS UNIT

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

Outcome 1: Written and/or oral evidence

Evidence for Outcome 1 will be gathered in open-book conditions at an appropriate point in the Unit.

Candidates will be provided with a case study specifying a procedure in a given area of a scientific laboratory for which the risk assessment will be carried out.

Candidates are required to:

- ◆ identify the main hazards present in the specified procedure. The main hazards **must** include:
 - use of electrical equipment
 - use of flammable materials
 - use of chemicals
- ◆ identify **one** significant risk associated with **each** identified hazard.
- ◆ identify **one** way to minimise **each** identified risk.

The evidence for Outcome 1 will be presented in the form of a completed risk assessment. The risk assessment will be carried out in a real or simulated setting under supervision at an appropriate point in the Unit. Candidates must organise and present their findings in an appropriate format. A template for the risk assessment will be provided.

It is the centre's responsibility to ensure that the evidence collected is the candidate's own work.

Outcome 2 — Written and/or oral and performance evidence

Written and/or oral evidence is required for Outcome 2 Performance Criteria (a) and will be gathered under supervised open-book conditions.

Candidates are required to:

- ◆ identify **five** categories of chemicals from their hazard symbols.
- ◆ state where and how a chemical from each identified category should be stored. This must include the appropriate location, type of container/label/position.

Performance evidence is required for Performance Criteria (b), (c), (d), and (e).

Candidates will be required to undertake **two** practical activities. One practical activity must relate to the chemical preparation. The other practical activity must relate to the simulated chemical spill.

For the chemical preparation activity, candidates will be required to demonstrate that they are able to:

- ◆ prepare a chemical solution according to a standard protocol.
- ◆ demonstrate safe working practices in preparing a chemical solution.

National Unit Specification: statement of standards (cont)

UNIT Laboratory Science: Working in a Laboratory (SCQF level 5)

For the simulated chemical spill activity, candidates will be required to demonstrate that they are able to:

- ◆ select appropriate personal protective equipment and materials required to deal with a chemical spill.
- ◆ participate in a practical activity which involves a simulated chemical spill.

Throughout each practical activity candidates must comply with relevant current health and safety requirements. This must include safe disposal of chemicals as appropriate.

Further guidance on appropriate practical activities can be found in the support notes.

Assessor observation checklists must be used to provide evidence of candidate performance.

Outcome 3 Written and/or oral evidence and performance evidence

Performance evidence is required for Outcome 3 Performance Criteria (a) and (b).

Candidates are required to demonstrate by **two** practical activities that they are able to:

- ◆ select, set up and accurately use an appropriate instrument to measure volume
- ◆ select, set up and accurately use an appropriate instrument to measure mass

An assessor observation checklist must be used to support the performance evidence for Performance Criteria (a) and (b) for each practical activity.

Further guidance on appropriate practical activities can be found in the support notes.

Written and/or oral evidence is required for Outcome 3 Performance Criteria (c) and (d) and will be gathered during the practical activities under supervised open book conditions

Candidates are required to:

- ◆ record measurements taken during the practical activities in an appropriate format.
- ◆ use correct notation for recorded measurements: appropriate SI units of volume and mass and multiples/fractions thereof
- ◆ perform **one** correct calculation of **each** of the following four types:
 - Percentages (eg percentage solution)
 - Ratios (eg serial dilutions)
 - Averages (eg from replicate measurements)
 - Rearranging formula to solve for any variable (eg Concentration = Moles/Volume)

The National Assessment Bank (NAB) pack for this Unit illustrates the standard that should be applied. It provides an exemplar case study and a risk assessment template for the assessment of Outcome 1. An assessor observation checklist and a specified tasks exemplar is provided for Outcomes 2 and 3. 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: Working in a Laboratory (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

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.

This Unit provides an opportunity to gain practical experience in measuring and weighing quantities, basic laboratory skills such as handling chemicals and preparing solutions and in calculating and presenting results of practical work. Safety and security procedures are addressed to enable candidates to maintain health and safety while working in a laboratory environment and a risk assessment is carried out. Opportunities arise for the development of numeracy and communication skills when recording and reporting practical work.

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 & safety in the 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 in 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: statement of standards (cont)

UNIT Laboratory Science: Working in a Laboratory (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. It is suggested that the content for Outcome 1 is taught at the start of the delivery of this Unit to enable candidates to be made fully aware of the hazards and risks present in a science laboratory. 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 the Unit is delivered in conjunction with *Laboratory Science: Practical Skills* (SCQF level 5). This would also optimise the number of practical activities required to generate sufficient evidence.

Outcome 1

In this Outcome candidates will learn how to carry out a basic risk assessment for a specified procedure in a laboratory setting. Candidates will be provided with a case study specifying a procedure in a given area of a scientific laboratory for which the risk assessment will be carried out. The risk assessment could be in relation to the practical activities undertaken in Outcomes 2 and 3. Candidates will be taught about risk assessments and why and how these are carried out. Candidates should be made aware of the difference between a hazard and a risk. The nature of the work carried out in a scientific laboratory, often involves hazardous chemicals, pathogens, sharps etc, which leaves employees exposed to potential harm, therefore there is a need for candidates to be able to demonstrate in practise their ability to work safely in a laboratory.

Candidates should be encouraged to explore and develop an understanding of the relevant health and safety requirements in a science laboratory. An example of this includes the basic requirements of the Health and Safety at Work Act in relation to the candidates' role in a laboratory, and why HASAW, COSHH etc are important.

Outcome 2

In this Outcome candidates will be required to demonstrate competence in their ability to handle chemicals. This will include chemical storage, chemical disposal, working with chemicals and dealing with chemical spills. Candidates will be required to identify where chemicals should be stored (eg a chemical store) and how chemicals should be stored in terms of type of container/label/position. A candidate-centred practical approach to teaching and learning should be employed. Candidates should have the opportunity to learn, develop and implement chemical handling skills in a laboratory environment where they will experience workplace conditions and will learn how to work with others in a team.

Examples of relevant practical activities for preparing a chemical solution could include:

- ◆ preparing a chemical solution of 0.1 mol l^{-1}
- ◆ preparing 5% w/v sodium chloride

Examples of relevant practical activities for a simulated chemical spill could include:

- ◆ using vinegar solution in place of concentrated sulphuric acid
- ◆ using sea salt in place of solid sodium hydroxide

National Unit Specification: statement of standards (cont)

UNIT Laboratory Science: Working in a Laboratory (SCQF level 5)

Outcome 3

In this Outcome candidates are required to select and operate appropriate measuring instruments for two specified tasks: one to measure volume and one to measure mass. Candidates must also record results from the scientific instruments accurately and using appropriate scientific notation thus developing skills of oral and/or written communication.

Candidates are required to perform one calculation correctly for percentages, ratios, averages and also to rearrange formulae to solve for any variable. Outcome 3 should be delivered in a manner which enables candidates to learn and practise a range of calculations (in a scientific context). Centres are strongly advised to allow candidates opportunities to become competent in carrying out such calculations before they undertake specific tasks. The learning and teaching should arise naturally throughout the selected practical activities.

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 and interpreting data as well as performing calculations based on this data; this offers scope to develop aspects of additional components of the Core Skill of *Numeracy*. If the candidate uses a computer while undertaking any part of this Unit (eg in researching relevant health and safety legislation) they will have the opportunity to develop aspects of the Core Skill of *Information and Communication Technology*. In Outcome 2 candidates are required to select appropriate materials and equipment to deal with a simulated chemical spillage. This provides an opportunity to develop aspects of additional components of the Core Skill of *Problem Solving*, and there may be opportunities 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 a holistic approach to generating evidence is recommended. By selecting appropriate practical activities it should be possible to provide candidates with an opportunity to perform risk assessments, carry out calculations and demonstrate awareness of relevant health and safety procedures, as well as demonstrate competence in the practical task itself. Evidence for all Outcomes should be gathered over a realistic timeframe, which gives candidates the opportunity to practise and develop their practical skills. It is therefore recommended that multiple opportunities for formative assessment exist throughout the Unit before candidates are assessed as competent in the relevant practical skills.

National Unit Specification: statement of standards (cont)

UNIT Laboratory Science: Working in a Laboratory (SCQF level 5)

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



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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National Unit Specification: general information (cont)

UNIT Laboratory Science: Practical Skills (SCQF level 5)

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)

UNIT Laboratory Science: Practical Skills (SCQF level 5)

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 aseptic technique to a satisfactory standard
- ◆ subculture microorganisms (bacteria, yeast **and** mould) using aseptic 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



National Unit Specification: general information

UNIT Laboratory Science: Practical Investigation (SCQF level 5)

CODE F86N 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.

In this Unit candidates will work with others to produce a plan to investigate a scientific topic using practical procedures. Candidates working as part of a group will identify a hypothesis to investigate. Methods for testing the hypothesis using practical procedures are devised and tasks are allocated to each member of the group. Candidates will be assessed on their ability to carry out an allocated task competently and in a safe manner. Candidates will present their findings to members of the group and will produce a scientific report with their individual analysis and evaluation of the information gathered. Candidates will then review and evaluate their own and group contributions to the investigation.

OUTCOMES

- 1 Produce an investigation plan with others to explore a scientific topic to a given brief.
- 2 Carry out the allocated role in accordance with the investigation plan.
- 3 Analyse and evaluate all information gathered from the investigation.
- 4 Review and evaluate own and group contribution to the investigation.

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

Administrative Information

Superclass: RA

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National Unit Specification: general information (cont)

UNIT Laboratory Science: Practical Investigation (SCQF level 5)

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

Achievement of this Unit gives automatic certification of the following:

Complete Core Skills	<i>Problem Solving</i> at SCQF level 4 <i>Working with Others</i> at SCQF level 4
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Core Skill components	None
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There are also opportunities to develop aspects of Core Skills which are highlighted in the *Support Notes* of this Unit Specification.

National Unit Specification: statement of standards

UNIT Laboratory Science: Practical Investigation (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

Produce an investigation plan with others to explore a scientific topic to a given brief.

Performance criteria

- (a) Contribute constructively to group discussions to identify an appropriate scientific topic and hypothesis to investigate.
- (b) Identify with reasons the relevant factors which must be taken into account during the investigation.
- (c) Identify with reasons the choice of practical methods to test the scientific hypothesis.
- (d) Identify the equipment and tasks needed to test the scientific hypothesis.
- (e) Agree the allocation of roles and responsibilities for each member of the group.

OUTCOME 2

Carry out the allocated role in accordance with the investigation plan.

Performance criteria

- (a) Use the practical methods identified in the investigation plan to carry out the allocated role.
- (b) Use the equipment identified within the investigation plan appropriately throughout.
- (c) Follow safe and hygienic practices throughout the investigation.
- (d) Record results and observations in an appropriate format.

OUTCOME 3

Analyse and evaluate all information gathered from the investigation.

Performance criteria

- (a) Organise and present findings from the allocated role to others.
- (b) Analyse information gathered from the investigation.
- (c) State valid conclusions based on the analysis of the information gathered.
- (d) Evaluate the scientific hypothesis tested and experimental procedures used in accordance with the investigation plan.

National Unit Specification: statement of standards (cont)

UNIT Laboratory Science: Practical Investigation (SCQF level 5)

OUTCOME 4

Review and evaluate own and group contribution to the investigation.

Performance Criteria

- (a) Identify strengths and areas for improvement of own and group contribution to the planning and implementation of the investigation.
- (b) Take account of feedback from others as part of the review.
- (c) Identify action points in own and group contribution to planning and implementing an investigation.

EVIDENCE REQUIREMENTS FOR THIS UNIT

Written and/or oral evidence and performance evidence which covers all Outcomes and Performance Criteria is required for this Unit.

Outcome 1 Written and/or oral evidence and performance evidence

Evidence for Outcome 1 will be gathered at an appropriate point during the Unit.

Candidates working in groups will produce a plan to carry out an investigation to explore a scientific topic. They will be provided with a clear brief which states that the plan must include:

- ◆ an outline of the scientific hypothesis to be investigated
- ◆ the relevant factors which must be taken into account during the investigation and reasons for each. The factors must include time, resources, equipment, variables, and factors to be kept constant.
- ◆ the choice practical methods to be used to test the scientific hypothesis and the reasons for this choice
- ◆ the equipment and tasks needed to test the scientific hypothesis
- ◆ a statement of the roles and responsibilities allocated to each member of the group.

Candidates will be given a template for the group plan. The evidence must be produced in supervised conditions. An assessor observation checklist must be used for PCs (a) and (e) in order to confirm that each candidate has contributed constructively to the group planning discussions throughout and that all Performance Criteria have been achieved.

Outcome 2 Performance evidence and written and/or oral evidence

Candidates will demonstrate the achievement of all Performance Criteria during a practical activity. Performance evidence supported by an assessor's observation checklist is required for Outcome 2 Performance Criteria (a), (b) and (c). Each individual candidate will be required to demonstrate by practical activity that they are able to:

- ◆ carry out the allocated role in accordance with the investigation plan using the identified practical methods
- ◆ use the identified equipment appropriately throughout the investigation
- ◆ follow safe and hygienic practices throughout the investigation.

National Unit Specification: statement of standards (cont)

UNIT Laboratory Science: Practical Investigation (SCQF level 5)

This evidence will be produced under controlled supervised conditions when the candidate is carrying out the allocated role(s) for the investigation.

Written and/or oral evidence is required for Outcome 2 pc (d). Candidates will record results and observations in an appropriate format which will include the correct use of SI units.

Outcome 3 Performance evidence and written and/or oral evidence

Candidates must analyse and draw conclusions using all the information gathered by the group.

Candidates must organise and present their findings to others. The findings can be presented in a form of written statements or in the form of a short oral presentation.

Candidates will produce an individual written and/or oral scientific report which must include:

- ◆ an analysis of all of the results and observations from the investigation
- ◆ conclusion(s) from the investigation based on the experimental information
- ◆ an evaluation of the hypothesis based on these conclusions
- ◆ an evaluation of the experimental procedures used based on the information gathered by the group.

An assessor observation checklist must be used to provide evidence of PC (a). Candidates will be given a suitable template to help them produce their report.

This evidence will be produced by candidates on their own under supervised conditions at appropriate points throughout the Unit.

Outcome 4 Candidate review sheet

Candidates will be required to produce evidence that they have:

- ◆ identified strengths and areas for improvement of own and group contribution to the planning and implementation of the investigation
- ◆ taken account of feedback from others as part of this review
- ◆ identify action points in own and group contribution to planning and implementing of the investigation

Evidence must be gathered in supervised conditions.

It is expected that, at this level, most candidates will need support and guidance in completing their review and a template will be provided. However candidates will take responsibility for completing their own review.

The National Assessment Bank (NAB) pack for this Unit provides an investigation brief for Outcome 1, assessor observation checklists and templates for the team plan, the scientific report and a candidate review sheet. 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 Investigation (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

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 suitable for candidates who wish to gain experience in carrying out a practical science investigation. 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.

In this Unit candidates will work with others to produce a plan to investigate a scientific topic using practical procedures. Candidates working as part of a team will identify a hypothesis to investigate. Methods for testing the hypothesis using practical procedures are devised and tasks are allocated to each member of the group. Candidates will be assessed on their ability to carry out an allocated task competently and in a safe manner. Candidates will present their findings to members of the group and will produce a scientific report with their individual analysis and evaluation of the information gathered. Candidates will then review and evaluate their own contribution to the investigation.

The Unit can be offered in the context of biology, chemistry, physics, environmental or general science and could be integrated with the teaching of the sciences which involve practical work in the laboratory or in the field. Teachers/ lecturers are encouraged to suggest and negotiate contexts appropriate to the needs/interests of the candidates and to the resources available.

During this Unit, in addition to the specific vocational skills developed and assessed, candidates will have an 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*

National Unit Specification: support notes

UNIT Laboratory Science: Practical Investigation (SCQF level 5)

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

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

It is important that there is an induction to this Unit which will include practical skills and health and safety awareness. Consideration should be given to safety at all times during the Unit. The concept of scientific experimental method should be introduced. A series of tasks should be planned to give the candidate experience of the process of scientific method, of planning and of basic practical procedures before they are proceed to the investigation.

Candidates will produce a plan for an investigation in small groups to ensure that all members of the group can participate in the planning process and in the practical work. The group should initially decide the topic for scientific investigation in discussion with the teacher/lecturer. The scientific hypothesis to be tested is then identified by the group. Discussion should take place to enable decisions on the relevant factors which must be taken into account, which methods should be used in the investigation, what equipment and tasks need to be carried out to test the scientific hypothesis. Decisions on the allocation of the tasks between the group members should also be taken by the group.

It is recommended that teachers/lecturers check that the candidates have developed a plan which is practicable before the candidates progress to the planned practical tasks. The investigation selected by each group of candidates must enable them to fulfil the requirements of the performance criteria. Following the planning sessions, the teacher/lecturer should check that the investigation plan enables candidates to achieve Outcomes 2, 3 and 4. Care should be taken to check that the candidates are aware of the health and safety issues associated with any tasks that they plan to carry out.

The measurements and observations, the recording and analysis is an important aspect of the Unit. Prior to carrying out the investigation, candidates should be able to select appropriate forms of communicating information, be able to interpret basic graphical information and carry out simple calculations as indicated in the Unit *Laboratory Science: Working in a Laboratory* (SCQF level 5). Candidates should be encouraged to perform tasks safely and conduct themselves in a manner appropriate to a workplace.

Following the completion of the practical task(s), the members of the group should share all the information gathered to enable analysis to take place. This sharing of information could take place in a discussion and/or presentation between members of the group or by a written statement of the recorded results and observations to each member of the group. The individual report of the analysis and evaluation of information from the investigation should take the form of a scientific report using a template to aid candidates will be provided in the NAB.

Candidates are to review and evaluate their own and group contribution to the investigation by considering their own and the groups strengths and areas for improvement in the planning, in the practical work and in the analysis and evaluation. Feedback from others by discussion in the group and with the teacher/lecturer should be sought. Action points for future development should be identified by the candidate. It is expected that, at this level, most candidates will need support and guidance in completing their review and a template sheet will be provided. However candidates will take responsibility for completing their own review.

National Unit Specification: support notes (cont)

UNIT Laboratory Science: Practical Investigation (SCQF level 5)

OPPORTUNITIES FOR CORE SKILL DEVELOPMENT

In addition to the embedded Core Skills of *Problem Solving* and *Working with Others*, the production of the planning document and the report of the investigation enable the Core Skill of *Communication* to be developed.

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

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

Candidates will be provided with a brief which states the requirements of the assessment for this Unit.

Outcome 1

It is recommended that the assessor checks the achievement of Outcome 1 before the candidate's progress to Outcomes 2, 3 and 4. This will ensure that candidates have developed a plan which is practicable. Candidates will be given a suitable template to help them produce their evidence in supervised conditions. The assessor must use an observation checklist to confirm that the candidate has contributed constructively to the group planning discussions throughout and that all performance criteria have been achieved.

Outcome 2

Performance evidence supported by an assessor observation checklist is required for Outcome 2 PC (a) (b) and (c).

This evidence will be produced under controlled supervised conditions when the candidate is carrying out the allocated task(s) for the investigation.

Written/oral evidence is required for Outcome 2 PC (d). Candidates will record results and observations in an appropriate format which will include the correct use of SI units.

Outcome 3

Performance evidence supported by an assessor observation checklist is required for Outcome 3 PC (a). Written and/or oral evidence is required for PC (b) (c) and (d).

Teachers/lecturers should check that each candidate has obtained a full set of data and observations for the investigation before progressing to the analysis and evaluation. The evidence for the Outcome will be an individual written and/or oral scientific report which must include:

- ◆ an analysis of all of the results and observations from the investigation
- ◆ conclusion(s) from the investigation based on the experimental information
- ◆ an evaluation of the hypothesis based on these conclusions
- ◆ an evaluation of the experimental procedures used based on the information gathered by the group.

Candidates will be given a suitable template to help them produce their evidence.

National Unit Specification: support notes (cont)

UNIT Laboratory Science: Practical Investigation (SCQF level 5)

Outcome 4

A candidate review sheet will be used to assess the performance criteria for Outcome 4. It is recommended that the teacher/lecturer assesses the candidate at the stage when they are showing consistent competence in a given task.

All assessor observation checklists of performance evidence and written and/or oral evidence must be retained.

The National Assessment Bank (NAB) pack for this Unit provides an investigation brief for Outcome 1, assessor observation checklists and templates for the group plan, scientific report and a candidate review sheet. 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