



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

Publication date: February 2010

Source: Scottish Qualifications Authority

Version: 01

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National Unit Specification: general information (cont)

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CREDIT VALUE

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

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

CORE SKILLS

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

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Acceptable performance in this Unit will be the satisfactory achievement of the standards set out in this part of the Unit Specification. All sections of the statement of standards are mandatory and cannot be altered without reference to SQA.

OUTCOME 1

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)

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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)

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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

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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

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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)

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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)

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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