

Unit Specification



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

Unit code: HP00 75

Superclass: RA

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Unit purpose

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

In this unit learners will work with others to produce a plan to investigate a scientific topic using practical procedures. Learners 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. Learners will be assessed on their ability to carry out an allocated task competently and in a safe manner. Learners 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. Learners will then review and evaluate their own and group contributions to the investigation.

Outcomes

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

- 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.

Credit points and level

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

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Recommended entry to the unit

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

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

together with

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

Core Skills

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

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

Context for delivery

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

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

Equality and inclusion

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

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

National unit specification: statement of standards

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

Outcome 1

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

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

Outcome 1 — Performance evidence and written and/or oral evidence

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

Learners 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 of 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.

Learners 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 performance criteria (a) and (e) in order to confirm that each learner has contributed constructively to the group planning discussions throughout and that all performance criteria have been achieved.

National unit specification: Statement of standards (cont)

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

Learners 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 learner 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.

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

Written and/or oral evidence is required for Outcome 2 performance criteria (d). Learners 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

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

Learners 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.

Learners 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 performance criteria (a). Learners will be given a suitable template to help them produce their report.

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

National unit specification: statement of standards (cont)

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Outcome 4 — Learner review sheet

Learners 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 learners will need support and guidance in completing their review and a template will be provided. However learners will take responsibility for completing their own review.

The assessment support pack (ASP) for this unit provides an investigation brief for Outcome 1, assessor observation checklists and templates for the team plan, the scientific report and a learner review sheet. Centres wishing to develop their own assessments must refer to the ASP to ensure that they are of a comparable standard.

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

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

1 Literacy

- 1.1 Reading
- 1.2 Writing
- 1.3 Listening and talking

3 Health and wellbeing

- 3.1 Personal learning
- 3.2 Emotional wellbeing
- 3.5 Relationships

4 Employability, enterprise and citizenship

- 4.3 Working with others

5 Thinking Skills

- 5.1 Remembering
- 5.2 Understanding
- 5.3 Applying
- 5.4 Analysing and evaluating

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

National unit support notes

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

Unit support notes are offered as guidance and are not mandatory.

While the exact time allocated to this unit is at the discretion of the centre, the notional design length is 40 hours.

Guidance on the content and context for this unit

This unit has been designed as a mandatory unit of the National 5 Laboratory Science Skills for Work Course and has been designed to be taken as part of that course. It can also be taken as a free-standing unit. It is suitable for learners who wish to gain experience in carrying out a practical science investigation. It is suited to learners who have an interest in, and may be considering a career in laboratory science, as well as those whose interest is more general.

In this unit learners will work with others to produce a plan to investigate a scientific topic using practical procedures. Learners 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. Learners will be assessed on their ability to carry out an allocated task competently and in a safe manner. Learners 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. Learners 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 learners and to the resources available.

During this unit, in addition to the specific vocational skills developed and assessed, learners 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 support notes (cont)

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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 approaches to delivery of 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 learner experience of the process of scientific method, of planning and of basic practical procedures before they proceed to the investigation.

Learners 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.

The group should also take decisions on the allocation of the tasks between the group members.

It is recommended that teachers/lecturers check that the learners have developed a plan which is practicable before the learner's progress to the planned practical tasks. The investigation selected by each group of learners 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 learners to achieve Outcomes 2, 3 and 4. Care should be taken to check that the learners 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 are an important aspect of the unit. Prior to carrying out the investigation, learners 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 *Laboratory Science: Working in a Laboratory* (National 5) unit. Learners should be encouraged to perform tasks safely and conduct themselves in a manner appropriate to a workplace.

National unit support notes (cont)

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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. A template to aid learners is provided in the ASP.

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

Guidance on approaches to assessment of this unit

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

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

The evidence requirements are fully expressed in the mandatory section of this unit specification.

Learners 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 learner's progress to Outcomes 2, 3 and 4. This will ensure that learners have developed a plan which is practicable. Learners 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 learner 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).

National unit support notes (cont)

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

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

Written/oral evidence is required for Outcome 2 PC (d). Learners 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 learner 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.

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

Outcome 4

A learner review sheet will be used to assess the performance criteria for Outcome 4. It is recommended that the teacher/lecturer assesses the learner 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 Assessment Support Pack (ASP) for this unit provides an investigation brief for Outcome 1, assessor observation checklists and templates for the group plan, scientific report and a learner review sheet. Centres wishing to develop their own assessments must refer to the ASP to ensure that they are of a comparable standard.

National unit support notes (cont)

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

Opportunities for e-assessment

E-assessment may be appropriate for some assessments in this unit. By e-assessment we mean assessment which is supported by Information and Communication Technology (ICT), such as e-testing or the use of e-portfolios or social software. Centres which wish to use e-assessment must ensure that the national standard is applied to all learner evidence and that conditions of assessment as specified in the evidence requirements are met, regardless of the mode of gathering evidence. The most up-to-date guidance on the use of e-assessment to support SQA's qualifications is available at www.sqa.org.uk/e-assessment.

Opportunities for developing Core Skills

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.

General information for learners

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

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

In this unit you will work with others to produce a plan to investigate a scientific topic using practical procedures. You will identify a hypothesis to investigate and then devise procedures and tasks to test the hypothesis. Each member of the group will carry out their allotted task in a safe manner and then present their findings to the rest of the group. You will produce a scientific report with your own individual analysis and evaluation of the information gathered. At the end you will have the opportunity to review and evaluate your own and group contribution to the investigation.

The assessments will be either written, oral or of a practical nature. You will gather evidence of your skills in a folio as you work through the unit. You will produce a scientific report and an evaluation of your own and the group's contribution.

Administrative information

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History of changes to National unit Specification

Version	Description of change	Date

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