

National Unit Specification: General Information

UNIT Experimental Procedures - Science (Higher)

NUMBER D937 12

COURSE

SUMMARY

This unit is suitable for candidates who have some practical experience of experimental work. It gives candidates an opportunity to extend their practical abilities for vocational purposes or to prepare for entry to Higher Education. Candidates who complete this unit will be able to perform a variety of experimental procedures and process the results obtained. The laboratory based project in this unit is designed to let candidates develop skills in numeracy, working with others and problem solving.

OUTCOMES

- 1 Perform experimental procedures.
- 2 Record and process experimental results.
- 3 Plan, organise and complete a laboratory based project.

RECOMMENDED ENTRY

While entry is at the discretion of the centre, candidates would normally be expected to have attained one of the following:

- D942 10 Science Practical Skills (Intermediate 1)
- Intermediate 1 Biology, Chemistry or Physics
- Standard Grade Biology, Chemistry, Physics or Science at grade 3.

CREDIT VALUE

1 credit at Higher.

Administrative Information

Superclass: RA

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CORE SKILLS

Information on the automatic certification of any core skills in this unit is published in *Automatic Certification of Core Skills in National Qualifications* (SQA, 1999).

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 the Scottish Qualifications Authority.

Note on range for the unit

The experimental procedures to be carried out in this unit must be related to: biology, chemistry and physics.

OUTCOME 1

Perform experimental procedures.

Performance Criteria

- a) Equipment for an experimental procedure is set up correctly.
- b) The procedure carried out is correct and safe.

Evidence Requirements

The candidate should carry out a minimum of six experimental procedures which must cover the areas of biology, chemistry and physics. A checklist should be used to ensure that the candidate has correctly set up the equipment and carried out the procedures.

OUTCOME 2

Record and process experimental results.

Performance Criteria

- a) The recorded measurements and observations are structured in a format appropriate to the procedure.
- b) The assessment of the reliability of results is correct with respect to the degree of accuracy of the procedure.
- c) The graphical presentation of measurements or observations is appropriate to the results.
- d) Analysis and interpretation of results from graphical information are correct.
- e) Calculations from measurements are correct.

Evidence Requirements

Evidence of achievement of this outcome can be provided in written format to ensure that all the performance criteria are covered.

National unit specification: statement of standards (cont)

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The written evidence must show that the candidate can record measurements and observations on four occasions and that PCs (b), (c), (d) and (e) have been performed at least once. For PC (c) the candidate must select the most appropriate way of presenting information which may be in the form of a graph, bar chart or histogram. For PC (d) the candidate must be able to interpret when presented with information in a number of related but straightforward forms. For PC (e) candidates are required to perform calculations which involve at least three stages and the use of mathematical equations or the handling of statistical data. Checklists should be used to ensure that each of the relevant performance criteria are achieved in a satisfactory manner.

OUTCOME 3

Plan, organise and complete a laboratory based project.

Performance Criteria

- a) A clear plan is devised with others to carry out the laboratory project.
- b) The resources required are identified and obtained.
- c) The laboratory based project is carried out in collaboration with others.
- d) The plan is reviewed and evaluated to assess its effectiveness.
- e) The results obtained are reviewed and evaluated and appropriate conclusions are drawn.
- f) The candidate evaluates and draws conclusions about own contribution to team work.

Evidence Requirements

Evidence of achievement in this outcome can be provided in written and/or oral format to ensure that all performance criteria are covered.

The evidence must show that the candidate can work with others, can draw up plans, can devise an effective strategy to carry out the project and can carry out that project.

The candidate should justify the choice of strategy in terms of accounting for factors involved, resources and time available. Candidates are expected to pool together their results and draw conclusions from these results and to evaluate their own performance within the team.

For PC (a) the candidate must show evidence that the components of the task have been identified and the component tasks allocated. For PC (c) the candidate must show evidence that he/she has supported others in the team, kept others informed of progress and contributed to group discussions.

National unit specification: support notes

UNIT Experimental Procedures: Science (Higher)

This part of the unit specification is offered as guidance. None of the sections of the support notes is mandatory.

GUIDANCE ON CONTENT AND CONTEXT

Teachers/lecturers are encouraged to select and negotiate contexts appropriate to the needs of candidates and to the resources available.

A list of possible procedures is given below:

Chemistry

- 1 Preparation of standard solution to a calculated molarity in the order of 0.1M (0.1 mol l^{-1}) or 0.05M (0.05 mol l^{-1}).
- 2 Titration (concordant to 0.1 cm^3).
- 3 Measurement of pH of a series of solutions using a pH meter.
- 4 Identification of an unknown substance using simple melting point measurement.
- 5 Chromatography to identify an unknown substance.
- 6 Refluxing and distillation.
- 7 Experimental determination of the percentage yield of a product.
- 8 Solvent extraction.
- 9 Recrystallisation.
- 10 Quantitative analysis using a spectrometer.

Physics

- 1 Use of multimeter or ammeter/voltmeter (analogue or digital scales) in ac/dc circuits with only resistive components.
- 2 Use of a cathode ray oscilloscope for measurement of time intervals and voltage.
- 3 Use of spectrometer with prisms/diffraction gratings.
- 4 Op-amp applications.
- 5 Use of transistor as a switch and/or measuring device.
- 6 Use of thermistors/thermocouples to measure temperature.
- 7 Null deflection methods in electrical circuits.

National unit specification: support notes (cont)

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Biology

- 1 Setting up a microscope to view a prepared slide.
- 2 Side preparation of living/biological material.
- 3 Separating biological material by centrifuging.
- 4 Preparation of sterile equipment and media.
- 5 Transferring living material from different containers without contamination or loss of material.
- 6 Chromatography to identify an unknown substance.
- 7 Use of dissection instruments with plants.
- 8 Use of probes and/or meters to monitor one or more of the following variables: pH, temperature, oxygen concentration, light.

GUIDANCE ON TEACHING AND LEARNING APPROACHES

Laboratory practical work is one of the essential features of this unit. A series of exercises should be planned to give the candidate experience of the basic procedures before they are assessed.

Practical procedures must be approved by the teacher/lecturer and due consideration should be given to safety at all times.

An important aspect of this unit is the calculation of results and the drawing up of suitable conclusions. Experiments must be chosen so that all the performance criteria can be assessed. Either the project or the experiments must include calculations which involve at least three steps. A candidate must be able to select appropriate forms to communicate information, and also to interpret graphical information. Experiments must be chosen so that both of these skills are assessed. The list of experiments given is for guidance, other experiments can be substituted.

GUIDANCE ON APPROACHES TO ASSESSMENT

It is recommended that the teacher/lecturer assesses the candidate at the stage at which he/she is showing consistent competence in a given task. Where the candidate is unsuccessful in achieving an outcome, provision should be made for remediation and reassessment.

SPECIAL NEEDS

This unit specification is intended to ensure that there are no artificial barriers to learning or assessment. Special needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments or considering alternative outcomes for units. For information on these, please refer to the SQA document *Guidance on Special Assessment and Certification Arrangements* (SQA, 1998).