



## Higher National Unit specification

### General information

**Unit title:** Plant Biology (SCQF level 8)

**Unit code:** H92H 35

**Superclass:** RH

**Publication date:** May 2015

**Source:** Scottish Qualifications Authority

**Version:** 01

### Unit purpose

This Unit is designed to enable learners to understand key aspects of the plant kingdom, the different habitats they are found in, and their functioning within these environments. Learners will also develop practical skills in techniques relevant to plant biology. The Unit is suitable for learners studying at HND level, and will provide the necessary underpinning knowledge and skills to enable progression to further study of plant biology at degree level or to seek employment in science based industries.

### Outcomes

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

- 1 Describe the organisation, structure and function of plant cell types and tissues.
- 2 Describe how structure is related to function in the major groups of non-flowering plants and how this determines their distribution.
- 3 Describe how structure is related to function in the major groups of flowering plants and how this determines their distribution.
- 4 Perform practical experiments related to plant biology.

### Credit points and level

1 Higher National Unit credit at SCQF level 8: (8 SCQF credit points at SCQF level 8)

### Recommended entry to the Unit

Entry is at the discretion of the centre, however it is recommended that learners should have completed the HN Unit H927 34 *Cell Biology: Theory and Laboratory Skills* or equivalent, or have experience of Biology at Higher level.

## Higher National Unit specification: General information (cont)

**Unit title:** Plant Biology (SCQF level 8)

### 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 Group Award, it is recommended that it should be taught and assessed within the subject area of the Group Award to which it contributes.

The Assessment Support Pack (ASP) for this Unit provides assessment and marking guidelines that exemplify the national standard for achievement. It is a valid, reliable and practicable assessment. 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](http://www.sqa.org.uk/assessmentarrangements).

## Higher National Unit specification: Statement of standards

### Unit title: Plant Biology (SCQF level 8)

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.

Where evidence for Outcomes is assessed on a sample basis, the whole of the content listed in the Knowledge and/or Skills section must be taught and available for assessment. Learners should not know in advance the items on which they will be assessed and different items should be sampled on each assessment occasion.

### Outcome 1

Describe the organisation, structure and function of plant cell types and tissues.

#### Knowledge and/or Skills

- ◆ Organisation, structure and function of roots
- ◆ Organisation, structure and function of stems
- ◆ Organisation, structure and function of leaves
- ◆ Plant tissues: parenchyma, collenchyma, sclerenchyma, xylem, phloem

### Outcome 2

Describe how structure is related to function in the major groups of non-flowering plants and how this determines their distribution.

#### Knowledge and/or Skills

- ◆ Structure of non-flowering plants
- ◆ Reproductive biology of non-flowering plants
- ◆ Vegetative adaptations of non-flowering plants

Non-flowering plants to be covered are: Bryophytes, Clubmosses, Ferns, Horsetails, Gymnosperms.

### Outcome 3

Describe how structure is related to function in the major groups of flowering plants and how this determines their distribution.

#### Knowledge and/or Skills

- ◆ Structure of flowering plants
- ◆ Reproductive and floral biology of flowering plants
- ◆ Vegetative adaptations of flowering plants

Flowering plants to be covered are: Monocotyledons and Dicotyledons.

## Higher National Unit specification: Statement of standards (cont)

**Unit title:** Plant Biology (SCQF level 8)

### Outcome 4

Perform practical experiments related to plant biology.

#### Knowledge and/or Skills

- ◆ Plant biology experiments
- ◆ Working safely, within current health and safety regulations
- ◆ Consistent and accurate results
- ◆ Recording observations and results
- ◆ Evaluation skills
- ◆ Result analysis and conclusions

#### Evidence Requirements for this Unit

Written and/or oral recorded evidence for Outcomes 1–3 should be assessed using a holistic closed-book assessment under supervised conditions. The assessment will use a sampling approach to the Knowledge and/or Skills as detailed below. It is recommended that the assessment be completed within one hour.

Written and/or oral recorded evidence for Outcome 4 should be assessed by production of a full laboratory report, or by completion of an appropriate pro forma. An assessor's observation checklist could be used to record performance evidence of practical experiments.

#### Outcome 1

The assessment will sample 3 of the 4 Knowledge and/or Skills items. However, the item 'describe the organisation, structure and function of three of the five plant tissues' must be assessed on each occasion. Learners will not have prior knowledge of which items are being assessed. Those items which are not sampled must be covered in the alternative (re-sit) assessment.

Where an item is sampled, a learner's response will be judged satisfactory where the evidence shows that the learner can:

- ◆ Describe the organisation, structure and function of roots.
- ◆ Describe the organisation, structure and function of stems.
- ◆ Describe the organisation, structure and function of leaves.
- ◆ Describe the organisation, structure and function of three of the five plant tissues: parenchyma, collenchyma, sclerenchyma, xylem, phloem.

## Higher National Unit specification: Statement of standards (cont)

**Unit title:** Plant Biology (SCQF level 8)

### Outcome 2

The assessment will cover all of the Knowledge and/or Skills items.

A learner's response will be judged satisfactory where the evidence shows that the learner can:

- ◆ Describe the structure of four of the five main groups of non-flowering plants.
- ◆ Describe how the reproductive biology of two non-flowering plants determines their distribution.
- ◆ Describe how the vegetative adaptations of two non-flowering plants determines their distribution.

Non-flowering plants to be covered are: Bryophytes, Clubmosses, Ferns, Horsetails, Gymnosperms.

Learners will not have prior knowledge of which groups of non-flowering plants are being assessed. Those groups which are not assessed must be covered in the alternative (re-sit) assessment.

### Outcome 3

The assessment will cover all of the Knowledge and/or Skill items.

A learner's response will be judged satisfactory where the evidence shows that the learner can:

- ◆ Describe the structure of Monocotyledons and Dicotyledons.
- ◆ Describe how the reproductive and floral biology of one Monocotyledon and one Dicotyledon determines their distribution.
- ◆ Describe how the vegetative adaptations of one Monocotyledon and one Dicotyledon determines their distribution.

### Outcome 4

Learners will perform a minimum of two practical experiments, the content of which will be related to Outcomes 1–3. A learner's response will be judged satisfactory where the evidence shows that the learner can achieve all of the following:

- ◆ Follow instructions to perform experiments related to plant biology.
- ◆ Work in a safe manner regarding current health and safety regulations.
- ◆ Achieve consistent and accurate results.
- ◆ Record experimental observations and results clearly and accurately.
- ◆ Evaluate validity of results in terms of sources of and values of experimental errors.
- ◆ Analyse results correctly and state valid conclusions.

An assessor observation checklist will be used to record the learner's performance of the practical work in line with given instructions and health and safety requirements.

## Higher National Unit specification: Statement of standards (cont)

### Unit title: Plant Biology (SCQF level 8)

Learners must report one of the two practical experiments by production of a full laboratory report. Learners may report the remaining practical experiment by production of a full laboratory report or by completion of an appropriate pro forma. Where a pro forma approach is deployed, the pro forma will not present information or assistance to the learners on how to correctly perform calculations, analyse experimental results or experimental errors. Learners will be expected to perform such activities independently on the basis of the experimental data.

Where a learner does not perform an assessed practical experiment to the required standard, they will be given the chance to either reattempt the same practical experiment, or to undertake a different practical experiment of similar complexity. Where a laboratory report or pro forma does not meet required standard, then the learner will be given a single opportunity to re-draft. If the required standard is still not attained, then an alternative practical experiment will be set.



## Higher National Unit Support Notes

**Unit title:** Plant Biology (SCQF level 8)

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 is intended as part of the framework for HNC/HND Applied Sciences and HND Applied Biological Sciences but may be suitable for inclusion in other HN Science awards. It is designed to develop the theoretical and practical aspects of plant biology introduced in the HN Unit H927 34 *Cell Biology: Theory and Laboratory Skills*. Study of key representatives of the wide diversity of the plant kingdom should ensure that learners are aware of the wide range of categories of plants and how their bodies have evolved in many ways to meet the challenges of exploiting different environments.

#### **Outcome 1 — Describe the organisation, structure and function of plant cell types and tissues**

The study of the major tissue types and their general organisation and functioning within roots, stems and leaves will enable learners to understand how plant size and shape is directly related to the structure and function of plant cells and tissues, and that cellular organisation and tissue structure is directly related to the functioning of plants within the environment.

#### **Outcome 2 — Describe how structure is related to function in the major groups of non-flowering plants and how this determines their distribution**

The study of the characteristics of the reproductive biology and vegetative adaptations of representative non-flowering plants will elucidate ways in which their distribution is determined.

Representatives of non-flowering plants can be taken from the following categories:

- |               |   |
|---------------|---|
| ◆ Bryophytes  | mosses, hornworts, liverworts           |
| ◆ Clubmosses  | whisk ferns, adder's-tongues, moonworts |
| ◆ Ferns       | leptosporangiate ferns                  |
| ◆ Horsetails  | equisetum                               |
| ◆ Gymnosperms | conifers, cycads, ginkgo                |

## Higher National Unit Support Notes (cont)

**Unit title:** Plant Biology (SCQF level 8)

### **Outcome 3 — Describe how structure is related to function in the major groups of flowering plants and how this determines their distribution**

The study of the characteristics of reproductive biology and vegetative adaptations of representative flowering plants will elucidate ways in which their distribution is determined.

Representatives of flowering plants can be taken from the following categories:

- ◆ Monocotyledons: orchids, grasses, palms
- ◆ Dicotyledons: eudicots, magnoliid, nymphaeales

### **Outcome 4 — Perform practical experiments related to plant biology**

Guidance on suitable practical experiments for assessment purposes is given elsewhere in this document. However, it is envisaged that learners will also participate in a range of other practical experiments which will both develop their laboratory skills and support the theory covered in Outcomes 1–3.

In carrying out such activities, learners should follow Good Laboratory Practice (GLP) and carry out or be familiar with the risk and Control of Substances Hazardous to Health (COSHH) assessments on all procedures undertaken. Opportunities should be taken to develop awareness of the sources of experimental error and of the accuracy of measurements, with quantification of errors where possible.

## **Guidance on approaches to delivery of this Unit**

There is no particular order in which Outcomes 1–3 would be best delivered. It is envisaged that laboratory work for Outcome 4 will feature across each of the Outcomes, and that the assessed practical experiments will be undertaken in a similar timeframe to the underpinning theory.

Outcomes 1–3 could be delivered in sequence, with relevant practical experiments being undertaken at appropriate points to achieve Outcome 4.

Outcome 1 is intended to cover the main plant tissues examining how they function within plant roots, stems and leaves.

Outcome 2 is intended to examine representatives of non-flowering plants and how their reproductive biology and vegetative biology determines their distribution.

Outcome 3 is intended to examine representatives of flowering plants and how their reproductive and floral biology as well as their vegetative adaptations can determine their distribution within xeric, mesic and aquatic environments.

Centres may prefer to emphasise the diversity of the plant kingdom by studying evolutionary trends illustrated by important representatives of the major groups of plants and study how organisation of cells and tissues within these representatives of major groups of plants enables them to function with their environment. Practical work could be undertaken at appropriate points during delivery.



## Higher National Unit Support Notes (cont)

**Unit title:** Plant Biology (SCQF level 8)

A learner-centred, participative and practical approach is to be encouraged and field trips, visits and visiting experts could enhance the learner experience.

It is envisaged that Outcome 4 will be delivered alongside the theoretical based Outcomes 1–3. A range of practical experiments could be utilised to both support understanding of the underlying theory and to prepare learners for undertaking the assessed practical experiments.

### 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.

Outcomes 1–3 could be assessed by a single holistic closed-book assessment with an appropriate cut-off score that covers the sampling requirements as detailed in the Evidence Requirements. Assessment should be carried out in supervised conditions, and it is recommended that the assessment be completed within 60 minutes.

Where evidence of Outcome 1 is assessed by sampling, the whole of the content listed in the Knowledge and/or Skills must be taught and available for assessment. Learners should not know in advance the items on which they will be assessed, and different items should be sampled on each assessment occasion. Any items not sampled in the first assessment, must be included in the alternative (re-sit) assessment.

In Outcome 4 learners are required to undertake two assessed practical experiments, the content of which will be related to Outcomes 1–3. Examples of suitable experiments are given below. However, this list is not prescriptive, and other practical experiments of similar complexity may be used by the centre.

Suitable practical experiments for Outcome 1 are:

- ◆ Microscopic examination and comparison of representative plant tissues.
- ◆ Osmolarity of onion cells.
- ◆ Transport of water within plants.
- ◆ Analysis of the differences of tissues in monocotyledons and dicotyledons.

Suitable practical experiments for Outcome 2 are:

- ◆ Photosynthesis of algal gel balls in different environmental conditions.
- ◆ Comparison of Gametophytes and Sporophytes.

Suitable practical experiments for Outcome 3 are:

- ◆ Comparison of the structure and functioning of wind and insect pollinated flowering plants.
- ◆ Photosynthesis in *Elodea* in different environmental conditions.
- ◆ Pollen analysis from peat or air filters.

## Higher National Unit Support Notes (cont)

**Unit title:** Plant Biology (SCQF level 8)

Assessed practical experiments will usually be performed individually. However, there may be some experiments that are suitable to be undertaken in pairs or small groups. If this is the case then the assessor should ensure that all participants are actively involved and are able to adequately demonstrate the required skills.

An exemplar instrument of assessment with marking guidelines has been produced to indicate the national standard of achievement at SCQF level 8.

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.

### 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](http://www.sqa.org.uk/e-assessment).

### Opportunities for developing Core and other essential skills

The delivery and assessment of this Unit will provide learners with the opportunity to develop the Core Skills of *Numeracy* and *Problem Solving* at SCQF level 6, and *Information and Communication Technology (ICT)* at SCQF level 4.

#### Numeracy — Using Number at SCQF level 6

Learners will be required to decide on the steps and operations to solve complex problems, carrying out sustained and complex calculations.

#### Problem Solving — Reviewing and Evaluating at SCQF level 6

Following assessed practical experiments learners will be required to review and evaluate the effectiveness of the exercise with a thorough interpretation of random and systematic sources of error. They will be required to reach sound conclusions on the basis of the data collected and the inherent errors.

## **Higher National Unit Support Notes (cont)**

**Unit title:** Plant Biology (SCQF level 8)

**Information and Communication Technology — Providing/Creating Information (ICT)  
at SCQF level 4**

Learners will make effective and appropriate use of ICT packages to produce laboratory reports or pro formas in an appropriate format. Packages used will likely include word processing and spreadsheets.

### **Sustainability**

Sustainability can be embedded in delivery of the Unit in a variety of ways. For example, by encouraging minimum usage, correct disposal procedures and possibly recycling (eg of solvents) during practical experiments.

## History of changes to Unit

Version	Description of change	Date

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## General information for learners

### Unit title: Plant Biology (SCQF level 8)

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.

This is a 1 credit Unit at SCQF level 8, which you are likely to be studying as part of the second year of an HNC/HND Science programme. Before progressing to this Unit it would be beneficial to have completed the HN Unit H927 34 *Cell Biology: Theory and Laboratory Skills* where you will have learned underpinning aspects of plant biology and developed your practical skills.

On completion of the Unit you should be able to:

- 1 Describe the organisation, structure and function of plant cell types and tissues.
- 2 Describe how structure is related to function in the major groups of non-flowering plants and how this determines their distribution.
- 3 Describe how structure is related to function in the major groups of flowering plants and how this determines their distribution.
- 4 Perform practical experiments related to plant biology.

#### Outcome 1

In this Outcome you will cover the organisation, structure and function of plant cells and tissues.

#### Outcome 2

In this Outcome you will learn how structure is related to function in the major groups of non-flowering plants, and you will learn how this determines their distribution. Non-flowering plants you will study will include Bryophytes, Clubmosses, Ferns, Horsetails, and Gymnosperms.

#### Outcome 3

In this Outcome you will learn how structure is related to function in the major groups of flowering plants, and how this determines their distribution. You will learn how the reproductive and floral biology of Monocotyledons and Dicotyledons, as well as their vegetative structure, allows them to adapt to xeric, mesic and aquatic environments.

#### Outcome 4

In this Outcome you will undertake practical experiments, based on the content of Outcomes 1–3.

During this practical work, you will also be expected to develop good laboratory practices as well as improve your skills of manipulation, observation and measurement. You will be encouraged to develop safe working practices and to strive constantly to improve the accuracy and reliability of your results. The reporting and analysis of experimental data is an important aspect of the practical sessions.

## **General information for learners (cont)**

**Unit title:** Plant Biology (SCQF level 8)

### **Assessment**

For Outcomes 1 to 3 you will take a closed-book, end of Unit assessment.

Outcome 4 will be assessed after you have learned the necessary practical skills, and will take the form of two practical experiments, for which you will report your results either in full laboratory reports, or by completion of pro forma reports.

### **Core Skills**

Although there is no automatic certification of Core Skills in the Unit, you will have opportunities to develop the Core Skills of *Numeracy* and *Problem Solving* at SCQF level 6, and *Information and Communication Technology (ICT)* at SCQF level 4.