

Next Generation Higher National Unit Specification

Plant Biology (SCQF level 7)

Unit code: J6F4 47
SCQF level: 7 (16 SCQF credit points)
Valid from: session 2024–25

Prototype unit specification for use in pilot delivery only (version 3.0) August 2024

This unit specification provides detailed information about the unit to ensure consistent and transparent assessment year on year.

This unit specification is for teachers and lecturers and contains all the mandatory information required to deliver and assess the unit.

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Unit purpose

This SCQF level 7 unit gives learners an understanding of the main structures that develop in the plant life cycle, and of the physiological processes behind them. It is suitable for learners studying Higher National Certificate (HNC) Horticulture, and provides a foundation in the principles and theory for more advanced study in plant science, biotechnology and plant husbandry.

Learners would benefit from previous experience in Biology at SCQF level 6, or a National Certificate (NC) in an appropriate discipline. On completion of this unit, learners can progress to study at Higher National Diploma (HND) level or at SCQF level 8 in a related subject.

Unit outcomes

Learners who complete this unit can:

- 1 describe plant structure, growth and life cycles
- 2 explain plant physiological processes
- 3 describe the factors that affect plant growth

Evidence requirements

Outcome 1

Learners must gather evidence that demonstrates that they can:

- ◆ describe key aspects of plant taxonomy and nomenclature of:
 - the main plant divisions: bryophyta, pteridophyta, pinophyta, magnoliophyta
 - monocotyledons, basal angiosperms, eudicots (core and basal)
 - hybrids, cultivated plants
- ◆ describe the structure and function of plants, including:
 - cellular structures: cell membrane, cell wall, main organelles
 - plant organs and their growth and development
 - vascular and non-vascular transport systems
- ◆ describe the plant growth cycle of a range of plant divisions, including:
 - alternation of generations, and sporulation
 - sexual reproduction and methods of seed dispersal
 - asexual reproduction
 - effects of plant hormones

Learners can provide evidence by a project-based assessment that demonstrates their knowledge and understanding of plant development.

Outcome 2

Learners must gather evidence that demonstrates that they can:

- ◆ explain the major physiological processes in plants, including:
 - photosynthetic pathways (C3, C4 and CAM)
 - respiration
 - osmosis
 - transpiration and evapotranspiration
 - translocation and partitioning of assimilates
- ◆ explain the physiology of major plant growth stages, including:
 - germination
 - bud formation
 - secondary growth
 - senescence

- dormancy

Learners can provide evidence, in the form of a portfolio, to demonstrate their knowledge and understanding of plant processes.

Outcome 3

Learners must gather evidence that demonstrates that they can:

- ◆ describe major limiting factors that affect plant growth, including:
 - abiotic: light, temperature, carbon dioxide (CO₂), water, nutrients,
 - biotic: pests, diseases, intra- and interspecific competition
- ◆ explain how soil properties have an impact on plant growth and development, including:
 - physical: texture, structure, water-holding capacity
 - chemical: pH, nutrient availability, deficiency and toxicity, organic matter
 - biological: soil macrofauna, soil mesofauna, and soil microfauna

Learners can provide evidence in the form of a case study of a specific plant or plant group that can be integrated with other activities in the course.

Knowledge and skills

The following table shows the knowledge and skills covered by the unit outcomes:

Knowledge	Skills
<p>Outcome 1 Learners should understand the:</p> <ul style="list-style-type: none"> ◆ principles of plant taxonomy ◆ structure and function of plants ◆ stages of plant growth cycles in relation to structure and function 	<p>Outcome 1 Learners can:</p> <ul style="list-style-type: none"> ◆ apply taxonomic principles to plant nomenclature ◆ identify and name plant parts ◆ identify the stages of plant growth
<p>Outcome 2 Learners should understand the:</p> <ul style="list-style-type: none"> ◆ mechanism of major plant processes ◆ importance of plant nutrients and the effect of deficiencies 	<p>Outcome 2 Learners can:</p> <ul style="list-style-type: none"> ◆ explain the importance of major plant processes ◆ identify the essential elements for plant growth and the symptoms of some deficiencies in major elements
<p>Outcome 3 Learners should understand:</p> <ul style="list-style-type: none"> ◆ how biotic and abiotic factors can affect plant growth ◆ how soil properties have an impact on plant growth and development 	<p>Outcome 3 Learners can:</p> <ul style="list-style-type: none"> ◆ identify effects on plants, owing to abiotic and biotic factors ◆ apply knowledge of plant growth development in horticultural practice ◆ grow plants and monitor plant growth giving consideration to biotic and abiotic factors ◆ differentiate between physical, chemical and biological properties of soil and explain how they have an impact on plant growth

Meta-skills

Throughout the unit, learners develop meta-skills to enhance their employability in the horticulture sector.

Self-management

This meta-skill includes:

- ◆ sorting
- ◆ attention
- ◆ filtering
- ◆ critical reflection
- ◆ decision making
- ◆ independent thinking

Social intelligence

This meta-skill includes:

- ◆ receiving information
- ◆ giving information

Innovation

This meta-skill includes:

- ◆ information sourcing
- ◆ problem recognition

Literacies

Learners develop core skills in the following literacies:

Numeracy

Learners develop numeracy skills as they carry out a variety of scientific calculations throughout their studies.

Communication

Learners develop communication skills in their research work to produce their portfolio.

Digital

Learners develop digital skills and computer literacy in their research to produce their e-portfolio.

Delivery of unit

The unit is designed to provide learners with important underpinning knowledge and understanding of plant classification, morphology, structure and function. They can then apply this knowledge in a range of activities in HNC Horticulture.

You should teach this unit alongside other units in the course. You can integrate it with units such as Production Horticulture at SCQF level 7 or Creating Gardens and Greenspace at SCQF level 7.

Your initial focus of delivery should be on developing the learner's underpinning knowledge, which becomes more relevant and applicable as the learner studies other units. You can spread delivery of this double-credit unit over the year.

Additional guidance

The guidance in this section is not mandatory.

Content and context for this unit

Describe plant structure, growth and life cycles (outcome 1)

This outcome looks at taxonomy and the nomenclature of plants according to current practices.

Of the more than 10 plant divisions, you should cover at least bryophyta, pteridophyta, pinophyta and magnoliophyta. Take the levels of classification down to genus, species and cultivar, and instruct learners on the correct method of nomenclature.

You should highlight the distinguishing features of monocotyledons, basal angiosperms and eudicots (core and basal), including pollen, leaf vein and flower structure.

Learners should be able to identify the major external and internal anatomy of external and internal in the divisions listed, including:

- ◆ root
- ◆ rhizome
- ◆ shoot
- ◆ leaf
- ◆ bud
- ◆ storage organs
- ◆ xylem
- ◆ phloem
- ◆ cambium
- ◆ casparian band
- ◆ meristems

You should explore plant reproduction, covering:

- ◆ sexual and asexual reproduction, and vegetative propagation, and the impact of these different processes on species and survival
- ◆ sporulation in mosses and ferns, and the distinction between the naked seed of gymnosperms and coated seed of angiosperms
- ◆ sexual reproduction in angiosperms, from the formation of gametes to pollination fertilisation, and seed formation and dispersal
- ◆ the influence on plant health, and plant growth and development, of substances like auxins, gibberellins, cytokinins, abscisic acid and ethylene, including on:
 - root initiation and growth
 - apical dominance
 - leaf formation and abscission
 - fruit set

- ripening
- senescence
- ◆ the effects of practices such as disbudding, pruning and pinching out

Explain plant physiological processes (outcome 2)

This outcome covers the main plant physiological processes, including:

- ◆ germination: required events and sequence
- ◆ photosynthesis: site of the light reaction, evolution of O₂, fixation of CO₂, a simple representation of the events and end products of the dark reaction
- ◆ respiration: raw products, energy production, the by-products of water and CO₂
- ◆ net photosynthesis: explained in terms of the gross, photosynthesis, respiration and photorespiration; also partitioning of assimilates, source–sinks in plants
- ◆ transpiration: soil–plant atmosphere continuum, movement of water by osmosis, adhesion theory, stomatal function
- ◆ translocation: movement of products around the plant, source–sink movement of resources
- ◆ secondary growth and wood formation

You should also explain:

- ◆ dormancy
- ◆ bud formation
- ◆ breaking dormancy
- ◆ transition from heterotrophic to autotrophic growth

You should help learners to identify essential nutrients for growth, and understand the function of major nutrients, minor nutrients and trace nutrients. They should also understand the importance of NPK (nitrogen–phosphorus–potassium) ratios, and investigate their effect on growth. Conversely, they should explore the effects major nutrient deficiencies on plant physiology and physical symptoms. You can also cover examples of toxicity.

Describe the factors that affect plant growth (outcome 3)

This outcome looks at the factors affecting plant growth and the concept of limiting factors. You should cover:

- ◆ abiotic factors:
 - Examine the effect of light quality, humidity, CO₂ supplementation and temperature range on the rate of photosynthesis.
 - Explore the influence of soil type and pH on water and nutrient availability, and subsequent plant function.
 - Detail the importance of water in plant processes, and the influence of balance on growth and morphology that affect root–shoot ratios and relative growth increment.

- Explain stomatal conductance and the factors affecting transpiration, along with nutritional regimes and effects on plant growth and morphology, including leaf form and flowering.
- ◆ biotic factors:
 - Explore the effect of competition on growth, either between species or within, and explain the influence of planting density or in limiting resources including light, water and nutrients.
 - Consider the effect of pests and diseases on the physiology of plant processes, such as the loss of cell tissue, production of toxins and disruption of normal growth and development.
- ◆ adaptations to pest and disease
 - Outline physical characteristics and the production of chemicals.

Equality and inclusion

This unit is designed to be as fair and as accessible as possible with no unnecessary barriers to learning or assessment.

You should take into account the needs of individual learners when planning learning experiences, selecting assessment methods or considering alternative evidence.

Guidance on assessment arrangements for disabled learners and/or those with additional support needs is available on the assessment arrangements web page:

www.sqa.org.uk/assessmentarrangements.

Information for learners

Plant Biology (SCQF level 7)

This information explains:

- ◆ what the unit is about
- ◆ what you should know or be able to do before you start
- ◆ what you need to do during the unit
- ◆ opportunities for further learning and employment

Unit information

This SCQF level 7 unit provides you with knowledge of the main structures that develop in the plant life cycle and gives you an understanding of the physiological processes that take place. It is suitable for those studying Higher National Certificate (HNC) Horticulture and you can apply the knowledge and understanding you gain to horticultural practice. Studying this unit provides you with a foundation in the principles and theory for more advanced study in plant science, biotechnology and plant husbandry.

On completion of this unit, you can:

- ◆ describe plant structure, growth and life cycles
- ◆ explain plant physiological processes
- ◆ describe the factors that affect plant growth

You would benefit from previous experience in Biology at SCQF level 6 or a National Certificate (NC) in a related discipline. On completion of this unit, you can progress to study at Higher National Diploma (HND) level or SCQF level 8 in a related subject.

Administrative information

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Superclass: SA

History of changes

Version	Description of change	Date
2.0	Amended evidence requirements for outcomes 2 and 3.	August 2023
3.0	Amended wording of and evidence requirements for outcomes 1, 2, and 3.	August 2024

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