



Higher National Unit specification

General information for centres

Unit title: Plant Growth and Development

Unit code: F21T 34

Unit purpose: This Unit is designed to enable candidates to explain the biological processes underlying development, growth and reproduction in higher plants. It underpins the scientific basis for the propagation, cultivation and production of plants and prepares candidates for more advanced studies in plant science and production technology.

On completion of the Unit the candidate should be able to:

- 1 Describe the process of germination in seeds.
- 2 Describe the development and growth of roots and shoots.
- 3 Describe the reproductive processes in higher plants.

Credit points and level: 1 HN credit at SCQF level 7: (8 SCQF credit points at SCQF level 7*)

**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.*

Recommended prior knowledge and skills: It would be beneficial for candidates to have studied biology or other relevant science subject preferably at Standard Grade/SCQF level 5 or equivalent. National Units that are relevant to this Unit include D883 11 *Plant Structure and Function*, D13P 12 *Plant Physiological Processes* and D0JW 12 *Environmental Physiology of Plants*.

Core Skills: There are opportunities to develop the Core Skills of *Communication* and *Numeracy* at SCQF level 6 in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

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.

Assessment: All three Outcomes could be assessed by a series of structured questions. The assessments for each Outcome may be combined into a single holistic assessment. Alternatively Outcome 3 may be assessed by written or recorded oral report or assignment

Higher National Unit specification: statement of standards

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The sections of the Unit stating the Outcomes, Knowledge and/or Skills, and Evidence Requirements are mandatory.

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. Candidates 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 process of germination in seeds

Knowledge and/or Skills

- ◆ Structure of seeds
- ◆ Seed dormancy and stimuli that break dormancy
- ◆ Seed imbibition
- ◆ Process of substrate breakdown of storage tissues
- ◆ Seed germination
- ◆ Influence of environmental factors on germination
- ◆ Practical applications of seed technology

Evidence Requirements

Candidates will need to provide evidence to demonstrate their Knowledge and/or Skills by showing that they can:

- ◆ describe the structure of seeds in higher plants
- ◆ list the types of seed dormancy and stimuli that break dormancy
- ◆ describe the process of imbibition in terms of passive and active water uptake and the factors that limit imbibition
- ◆ describe the process of substrate breakdown in storage tissues of seeds
- ◆ describe the process of germination in terms of emergence of the radicle and shoot, and the transition from the heterotrophic to the autotrophic state
- ◆ describe the influence of environmental factors on germination
- ◆ suggest appropriate applications of seed technology

Where the knowledge is sampled, the sample should comprise a minimum of three of the bullet points listed under Knowledge and/or Skills. The whole of the content listed should be taught and available for assessment. A different sample is required each time the Outcome is assessed. Candidates must give satisfactory responses to all questions in the assessment.

Higher National Unit specification: statement of standards (cont)

Unit title: Plant Growth and Development

Assessment Guidelines

This Outcome can be assessed by structured questions, which could include short answer, restricted response or multiple choice questions, conducted under supervised conditions. It may be possible to combine the assessment for this Outcome with Outcomes 2 and 3 in a holistic assessment for the Unit.

Outcome 2

Describe the development and growth of roots and shoots

Knowledge and/or Skills

- ◆ Structure of shoots
- ◆ The organisation of the shoot apical meristem and the production of primordia
- ◆ Secondary thickening in woody perennials
- ◆ Development, dormancy and growth of lateral buds
- ◆ Structure, development and growth in leaves of higher plants
- ◆ Structure, development and growth of roots
- ◆ The major classes of endogenous plant growth regulators and their effects on growth and development
- ◆ The use of exogenous plant growth regulators to control growth and development in cultivated higher plants

Evidence Requirements

Candidates will need to provide evidence to demonstrate their Knowledge and/or Skills by showing that they can describe the:

- ◆ structure of shoots
- ◆ organisation of the shoot apical meristem and the production of primordia
- ◆ process of secondary thickening in woody perennials
- ◆ development, dormancy and growth of lateral buds
- ◆ structure, development and growth of leaves of higher plants
- ◆ structure, development and growth of roots
- ◆ roles of the major classes of endogenous plant growth regulators on growth and development
- ◆ use of exogenous plant growth regulators to control growth and development in cultivated higher plants

Where the knowledge is sampled, the sample should comprise a minimum of four of the bullet points listed under Knowledge and/or Skills. The whole of the content listed should be taught and available for assessment. A different sample is required each time the Outcome is assessed. Candidates must give satisfactory responses to all questions in the assessment.

Higher National Unit specification: statement of standards (cont)

Unit title: Plant Growth and Development

Assessment Guidelines

This Outcome can be assessed by structured questions, which could include short answer, restricted response or multiple choice questions, conducted under supervised conditions. It may be possible to combine the assessment for this Outcome with Outcomes 1 and 3 in a holistic assessment for the Unit.

Outcome 3

Describe the reproductive processes in higher plants

Knowledge and/or Skills

- ◆ The initiation and development of flowers in higher plants
- ◆ Structure of flowers
- ◆ Sexual reproduction in higher plants
- ◆ Development and growth of seed and fruit
- ◆ Asexual reproduction in higher plants

Evidence Requirements

Candidates will need to provide evidence to demonstrate their Knowledge and/or Skills by showing that they can describe:

- ◆ the process of flower initiation in terms of maturation, induction and the formation of the flower bud
- ◆ the structure of flowers in relation to reproductive function and method of pollination in a named higher plant
- ◆ the process of sexual reproduction in higher plants in terms of the generation of male and female gametes, pollination and fertilisation
- ◆ the development and growth of seed and fruit in a named higher plant
- ◆ asexual reproduction in a named higher plant

Assessment Guidelines

This Outcome can be assessed by structured questions, which could include short answer, restricted response or multiple choice questions, conducted under supervised conditions. It may be possible to combine the assessment for this Outcome with Outcomes 1 and 2 in a holistic assessment for the Unit.

Alternatively this Outcome could be assessed by a written or recorded oral report or assignment on the reproductive process in a named cultivated species, covering all the bullet points in Knowledge and/or Skills.

Administrative Information

Unit code: F21T 34
Unit title: Plant Growth and Development
Superclass category: SB
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Version	Description of change	Date

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Higher National Unit specification: support notes

Unit title: Plant Growth and Development

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

The Unit aims to enable the candidate to use scientific and botanical terminology to describe the growth and development of higher plants. It is intended to provide foundation science for candidates intending to take up careers involving the propagation, cultivation and production of plants. It also provides underpinning knowledge for candidates intending to study at advanced levels in plant science and production technology.

The content of the Unit can be delivered flexibly to reflect the interests and teaching/learning approaches of centres and candidates.

Outcome 1

Outcome 1 examines the biology of seed germination. Candidates should be introduced to the structures of different seed types including monocotyledons and dicotyledons, epigeal and hypogeal. The differences in storage tissues in monocots and dicots and the physiology of germination should be explored. Seed dormancy and the stimuli that break dormancy should be discussed along with the ecological and practical significance of the dormancy mechanisms for plants in the wild and in cultivation. Imbibition should be described and methods of inducing imbibition in impermeable seeds mentioned. Candidates should be introduced to the biochemistry and the sequence of events in substrate breakdown in storage tissues of seeds and the regulation of induction of amylase by gibberellins. The germination process is explained in terms of increase in metabolic activity, respiration and meristematic activity; active uptake of water and cell expansion leading to the emergence of the radicle and shoot and the transition from heterotrophic to autotrophic state. The influence on germination of environmental factors including temperature, water and nutrient supply, and soil physical factors are explained and the practical implications for the production of plants from seed are illustrated using examples appropriate to the Group Award to which the Unit contributes.

Outcome 2

Outcome 2 examines development and growth in roots and shoots, including leaves. The primary structure of shoots is described distinguishing major differences between monocotyledons and dicotyledons before progressing to an examination of the organisation of the shoot apical meristem. The development and growth of shoots in monocotyledons and dicotyledons is described. The biology of woody perennials including secondary thickening and the development of woody tissues, juvenility and transition to maturity in woody perennials and its significance for fruit crop production and plant propagation are also studied.

The anatomy, development and growth of roots are described. Candidates are introduced to the variability in the architecture of root systems and that root systems are neither static nor homogenous. The physiological and ecological significance of differences in root architecture should be discussed.

Higher National Unit specification: support notes (cont)

Unit title: Plant Growth and Development

Candidates are introduced to the role of endogenous plant growth regulators in the co-ordination of development and growth in plants. The major classes of endogenous plant growth regulators, the sites of synthesis, and the effects of plant growth regulators on development and growth including initiation and growth of roots; apical dominance and internode growth in stems; leaf formation and abscission; bud and seed dormancy; fruit set and fruit development can be explored. The use of exogenous plant growth regulators to control growth and development of cultivated plants is illustrated using examples that are appropriate to the Group Award.

Outcome 3

Reproduction in higher plants to include the initiation and development of flowers, maturation, induction of the flowering stimulus, initiation of the floral apex, and the development of flowers is described. The structure of flowers in monocotyledons and dicotyledons should be described in relation to reproductive function and method of pollination. Processes of sexual reproduction in the production of male and female gametes, pollination, fertilisation and development of the embryo and endosperm are described. Development and growth of seed and fruit is described using examples that are appropriate to the Group Award to which the Unit contributes. Physiological changes during fruit growth and maturation and the role of endogenous plant growth regulators in controlling fruit set and maturation is introduced.

The various forms of asexual reproduction in higher plants eg division of bulbs and corms, tillering in grasses, production of stolons or rhizomes and vivipary are illustrated using examples appropriate to the Group Award.

Guidance on the delivery and assessment of this Unit

The Unit may be taught through a series of lectures complemented by support notes and published materials. Practical classes that examine topics such as plant structure and the effects of plant growth regulators on plant growth would enhance the learning experience.

Workbooks covering all topics may be completed by candidates using published materials and Course teaching materials to demonstrate correct use and application of terminology and principles of plant science.

Candidates are encouraged to research particular topics such as the use of modified environmental conditions or plant growth regulators to alter and control the growth and development of cultivated plants.

Closed-book, short answer tests on individual topics or groups of topics can serve to reinforce the teaching/learning and prepare candidates for final assessment.

Higher National Unit specification: support notes (cont)

Unit title: Plant Growth and Development

The following texts or current equivalents are appropriate for the Unit.

- ◆ Forbes J.C. Watson R.D. (1992), '*Plants in Agriculture*' Cambridge University Press
- ◆ Moore R. Clark w.d. Vodopich D.S. (1998), '*Botany*' WCB/McGraw-Hill

Opportunities for developing Core Skills

There are opportunities to develop the Core Skills of *Communication* and *Numeracy* at SCQF level 6 in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

Open learning

Elements of this Unit could be delivered by distance or flexible learning. It is probable that candidates would need to attend the centre for tutorial sessions and assessments.

Candidates with disabilities and/or additional support needs

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments, or considering alternative Outcomes for Units. Further advice can be found in the SQA document *Guidance on Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs* (www.sqa.org.uk).

General information for candidates

Unit title: Plant Growth and Development

The Unit aims to provide you with an understanding of the biology underlying the growth of plants. It is intended to provide foundation science knowledge required to take up employment in the propagation, cultivation and production of plants. It also provides the underpinning knowledge you require if you intend to pursue more advanced studies in plant science and production technology.

During the course of the Unit you will study the biology underlying seed germination, development and growth of shoots, leaves, flowers, seed and fruit. You will be introduced to various physiological processes underlying plant development and growth. You will also consider the roles of endogenous plant growth regulators (plant hormones) in controlling growth and development. You will be encouraged to identify and learn about examples in which industry either modifies the growing environment or applies plant growth regulators to modify development and growth to achieve particular objectives. You will also consider sexual and vegetative reproduction in plants and the role of plant breeding in crop improvement.