RHS Qualifications

RHS Level 2 Certificate in the Principles of Plant Growth and Development

Qualification Specification

September 2024

Qualification number: 6101042X

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1. RHS Qualifications Contact Details

RHS Qualifications is the Awarding Organisation of the Royal Horticultural Society.

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RHS Website: rhs.org.uk/qualifications

2. Equality and Diversity Policy Statement

RHS Qualifications is committed to policies that will promote equal opportunities in all its operations, regardless of age, disability, ethnic origin, gender, marital status, religion, sexual orientation or any other factor.

RHS Qualifications is committed to ensuring that there is no unfair discrimination in any of its operations and will consider all current legislation in relation to the equality of opportunity.

RHS Qualifications will constantly monitor and review its policies and practices pertaining to equal opportunities, to ensure that they remain consistent with its equal opportunities objectives and continue to comply with all relevant legislation. RHS Qualifications will strive to make awareness of and respect for equality and diversity, an integral part of the culture of the organisation. A copy of the RHS Qualifications Equality and Diversity Policy is available on the RHS website.

The privacy, and security of personal data is extremely important to us. Personal information that centres provide is used for the purposes of furthering our legal obligations as an awarding body for creating qualifications and issuing of certificates. For further information and a detailed explanation, please refer to our Privacy Policy on the RHS website (rhs.org.uk/privacy).

3. RHS Level 2 Certificate in the Principles of Plant Growth and Development

3.1. Introduction and context

Horticulturists play a vital role in greening our cities, creating health-giving environments, tending gardens and designed landscapes, growing crops to feed the nation, helping to protect the natural environment and improving the quality of life for all. The love of plants is the simple thing that unites all horticulturists along with the understanding that plants are the foundation that underpins all other layers of life.

All life on earth is directly or indirectly reliant on plants either from a nutritional perspective or increasingly as the World Health Organisation report *Urban Green Spaces and Health* suggests, through a deeper connection linked to mental health and wellbeing. Put simply, people need plants. Plants need Horticulturists.

3.2. Audience

This qualification allows learners to develop a level of plant knowledge deemed essential by the horticultural industries. It equips learners with the knowledge and understanding to progress to employment within the horticultural sector. It assesses the knowledge of the scientific principles underpinning horticultural practices and supports career development for those already working in the profession.

It also provides learners the opportunity of personal development, including the changing of careers and engagement in their learning and offers an opportunity to develop transferable skills such as problem solving, implementing management plans / programmes, and communication as part of their applied learning.

It allows learners the opportunity to progress to further learning opportunities at Level 3, and then to higher education, career advancement or entry in the horticultural industries at a more advanced, technical level. There are no pre-requisites for entry to this qualification.

3.3. Guided Learning Hours (GLH) and Total Qualification Time (TQT)

The Guided Learning Hours (GLH) represent the time that the learner spends learning under the immediate guidance and supervision of a tutor and includes assessment by the tutor, as well as invigilated exams. Guided Learning Hours are always less than total qualification time, as learners are expected to complete a certain amount of study in their own time. The Guided Learning Hours for this qualification is 120.

Total Qualification Time (TQT) includes the Guided Learning Hours and represents the notional time that an average learner could reasonably expect to take to complete the learning outcomes of the units to the standard determined by the assessment criteria, and gain the qualification. It includes all face-to-face contact with tutors as well as assessment time and unsupervised directed study, coursework and practice. The Total Qualification Time for this qualification is 180.

3.4. Teaching Pattern

The qualification is designed to be studied on a part-time basis. No particular teaching pattern is specified, and centres offering courses leading to the qualification are free to define their own teaching structure and teaching hours.

3.5. Qualification Structure

This qualification certificate is divided into two units, each containing four topics made up of elements. The content is identified through the use of Unit / Topic / Element codes, as follows:

RHS Level 2 Certificate in the Principles of Plant Growth and Development

UNIT 1		
Topic		**Elements**
1	**Plant Science 1:** provides underpinning knowledge of the plant, its structure and function.	1. Scientific and common plant names 2. Lifecycle adaptations 3. External parts of the plant 4. Internal plant structures 5. Pollination and fertilisation 6. Photosynthesis and respiration 7. Movement of water through the plant
2	**Plant Health:** provides underpinning knowledge and understanding of the effect of a range of factors on plant health.	1. Environmental conditions 2. Plant nutrition and plant health 3. Impact of competition on plant health 4. Pests and pathogens 5. Biosecurity and plant passports 6. Maintaining plant health
3	**Plant Nutrition**: provides horticultural knowledge of plant nutrition and growing media.	1. Soil types and profiles 2. Role of nutrients 3. Soil-based nutrition 4. pH and nutrient availability 5. Bulk constituents for growing media
4	**Plant Specification:** provides horticultural knowledge to make recommendations for planting based on matching plant need and site requirements.	1. Site-based criteria 2. Plant-based criteria 3. Plant specifications 4. Receiving plant material on site 5. Planting and post-planting care 6. Maintaining new plantings

UNIT 2		
Topic		**Elements**
1	**Plant Science II:** provides an understanding of the range and role of plant adaptations.	1. Leaf adaptations 2. Stem adaptations 3. Root adaptations 4. Flower adaptations 5. Seed adaptations 6. Growth habit adaptations
2	**Planting Styles:** provides horticultural knowledge of the factors involved in creating a wide range of different horticultural plantings**.**	1. Historical contexts 2. Formal planting 3. Informal planting 4. Plant associations 5. Plant uses 6. Edible landscapes 7. Short-term plantings
3	**Horticulture and Society:** allows learners to develop their knowledge and understanding of horticulture's contribution to society, including social, environmental and economic.	1. Wellbeing 2. Environment 3. Economy 4. Community
4	**Biodiversity:** provides an applied knowledge of the roles of plants in creating habitats to encourage biodiversity.	1. Plants and biodiversity 2. Impact of climate change 3. Creating habitats 4. Citizen science and species surveys 5. Biodiversity Action Plans

4. Assessment

4.1. Assessment Outcomes

The content covered in each topic of this syllabus specification is expressed in terms of 'Assessment Outcomes' (AOs).

Assessment Outcomes define the way in which learners demonstrate their abilities under test conditions. The AOs use a 'progressive mastery' model for each topic area. This qualification has three broad categories of assessment outcomes, which are:

AO1 – knowledge recall of scientific ideas, processes, techniques, procedures, and making correct use of terms, symbols and units of measurement

AO2 – application of knowledge and understanding of concepts, theories, facts to different situations and contexts through presentation of reasoned explanations and analysis and interpretation of information and ideas

AO3 – application of knowledge and understanding in an integrated and holistic way in order to reach conclusions and make judgements and recommendations.

The relevant content (elements) for each of these AOs is included against each topic area in the specifications below. It is therefore clear what is to be covered and the nature of how it will be assessed. Each topic will start with knowledge recall (AO1), progress to application of knowledge to situations (AO2), and ultimately to making connections with other relevant topic areas i.e. holistic (AO3). The aim is that those learners who successfully meet all these progressive demands will be able to demonstrate a wide range of skills and especially the ability to apply what they have learned in practical contexts.

4.2. Assessment methods

This qualification will be entirely assessed by a summative, unseen written examination for each unit. Therefore examination 1 will cover Unit 1 (topics 1.1-1.4) and examination 2 will cover Unit 2 (topics 2.1-2.4).

In each examination, all assessment outcomes specified in the unit will be covered. Examinations must be taken with a provider approved by RHS Qualifications, or under arrangements for exceptional supervision agreed by RHS Qualifications.

Examinations must be conducted in accordance with the RHS requirements for the Conduct of Examinations (see rhs.org.uk/qualifications for more details).

4.3. Grading

Both unit examinations carry equal marks. Learners have to achieve at least 50% in each unit and must pass both unit 1 and 2 in order to be awarded the qualification.

A final grade for the overall qualification will be calculated by amalgamating the marks for each unit and expressed as a percentage. Learners will be awarded the following grades for the complete qualification:

50-64% Pass
65-79% Merit
80%+ Distinction

5. Learning Resources

There is a wide range of books, online material and other learning resources published which support the studies of those learning horticulture. RHS Qualifications does not recommend or endorse any specific learning resources as meeting the needs of learners studying for RHS qualifications. Learners are encouraged to seek guidance from their tutors on which learning resources will best support their studies, or to choose the most appropriate resources to support the qualification requirements and their needs from the wealth of material available.

6. Approved Centres

RHS Qualifications can only be delivered by approved centres. Further information regarding the approval process can be found at: rhs.org.uk/qualifications.

7. Learner Registration

All learners must be registered with RHS Qualifications at the commencement of this qualification through the RHS Qualifications Web Portal. More information about the registration process is available from RHS Qualifications.

8. Reasonable Adjustments and Special Consideration

RHS Qualifications is committed to ensuring fair assessment for all learners, and will facilitate access to its qualifications through reasonable adjustments to assessment arrangements for learners with an identified specific need. An example of a reasonable adjustment which could be made is the provision of extra time in an examination, or the production of a modified examination paper for a learner with a visual impairment.

Special consideration is given following the examination to learners who are present for the examination but may have been disadvantaged by temporary illness, injury or adverse circumstances which arose at, or near, the time of examination**.**

Full guidance is provided in the document 'Guidance to Centres for Reasonable Adjustments and Special Consideration'. The document is available on the RHS website (rhs.org.uk/qualifications), the RHS Qualifications Approved Centre web portal, or can be obtained from RHS Qualifications.

Applications for reasonable adjustments or special consideration must be made by the Approved Centre on behalf of the learner. Application must be made within specified timescales.

9. Fees

For a full list of fees please see the RHS Qualifications Fees Notice. This document is available on the Qualifications page on the RHS website and on the RHS web portal. All fees are payable prior to confirmation of entry for any examination.

10. Late Entries

RHS Qualifications publishes annually, and distributes to Approved Providers, the closing dates of entry for each examination for the following year. Entries submitted after the published closing date will be subject to a late entry fee.

11. Enquiry about Results service

An enquiry about results service is available from RHS Qualifications. Applications must be submitted within the specified number of working days of the results release date. Applications received after this date will not be processed. Detailed regulations about this service are available from RHS Qualifications.

12. Re-mark & Feedback

The fee for a remark and feedback can be found on the RHS Qualifications Fees Notice. If a re-mark results in an upgrade of the result, the fee paid will be refunded.

13. Appeals Procedure

An appeals procedure exists to conduct appeals lodged by learners against decisions made by RHS Qualifications, concerning their examination performance, the granting of an award and/or the closure of their entry to an award on academic grounds.

The procedure is also followed in instances where RHS Qualifications has imposed a penalty on a learner, tutor or invigilator, and where the Centre wishes to appeal against this decision after results are published.

A copy of the procedure is available on the RHS Qualifications web portal and on the RHS website.

14. Replacement Certificate (if lost, damaged or destroyed)

The fee for a replacement certificate can be found on the RHS Qualifications Fees Notice. Requests for a replacement certificate must be sent to the Qualifications Department.

15. Policy on Malpractice and Maladministration

Malpractice consists of those acts which undermine the integrity and validity of any assessment or examination, the certification of qualifications and/or damage the authority of those responsible for conducting the assessment, examination and certification.

RHS Qualifications does not tolerate actions or attempted actions of malpractice by learners or centres in connection with RHS qualifications. RHS Qualifications may impose penalties and/or sanctions on learners or centres where incidents, or attempted incidents, of malpractice have been proven.

A copy of the full policy is available on the RHS Qualifications web portal and on the RHS website.

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Syllabus Specification

The Qualification-wide outcomes shown below are integral parts of the syllabus – they are assessed in the same manner as all other assessment outcomes within the two units that make up the qualification.

These can be assessed at AO1, AO2 and AO3.

Qualification-wide outcomes
Health and Safety • Knowledge of, and compliance with, current legislation as it relates to horticulture • The management of risk within horticulture • The storage, care and maintenance of PPE, tools and equipment in horticultural settings. **Sustainability** The impact of horticulture on the wider environment, with specific reference to: • Reduction of the negative impacts of horticultural practices • The contribution of horticulture to the three pillars of sustainability (economic viability, social equity and environmental protection) • The concept that horticulture should be net-positive, benefitting the wider environment • The impact of horticulture on climate change • The impact of climate change on horticulture. **Best Practice** • Professional approaches and techniques • Professional use of named plant species in a wide range of horticultural settings • Horticultural practices which are professional, current, effective and sustainable • The adoption of trials results, research and development findings. **Equality and diversity** • Knowledge and compliance with all current legislation as it relates to horticulture • The concepts of respect, fairness and dignity • Negative impacts of poor practice to include: discrimination, victimisation and harassment • The advantages of inclusive cultures.

RHS Level 2 Certificate in the Principles of Plant Growth and Development

UNIT 1

UNIT 1		
Topic		**Elements**
1	**Plant Science 1:** provides underpinning knowledge of the plant, its structure and function.	1. Scientific and common plant names 2. Lifecycle adaptations 3. External parts of the plant 4. Internal plant structures 5. Pollination and fertilisation 6. Photosynthesis and respiration 7. Movement of water through the plant
2	**Plant Health:** provides underpinning knowledge and understanding of the effect of a range of factors on plant health.	1. Environmental conditions 2. Plant nutrition and plant health 3. Impact of competition on plant health 4. Pests and pathogens 5. Biosecurity and plant passports 6. Maintaining plant health
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Qualification-wide outcomes

Health and Safety

- Knowledge of, and compliance with, current legislation as it relates to horticulture
- The management of risk within horticulture
- The storage, care and maintenance of PPE, tools and equipment in horticultural settings.

Sustainability

The impact of horticulture on the wider environment, with specific reference to:

- Reduction of the negative impacts of horticultural practices
- The contribution of horticulture to the three pillars of sustainability (economic viability, social equity and environmental protection)
- The concept that horticulture should be net-positive, benefitting the wider environment
- The impact of horticulture on climate change
- The impact of climate change on horticulture.

Best Practice

- Professional approaches and techniques
- Professional use of named plant species in a wide range of horticultural settings
- Horticultural practices which are professional, current, effective and sustainable
- The adoption of trials results, research and development findings.

Equality and diversity

- Knowledge and compliance with all current legislation as it relates to horticulture
- The concepts of respect, fairness and dignity
- Negative impacts of poor practice to include: discrimination, victimisation and harassment
- The advantages of inclusive cultures.

Unit:	**1**
Topic:	**1**
Title:	**Plant Science 1**

Topic overview

The understanding of plant naming, along with a formal study of form and function provides a knowledge base that is fundamental to all horticulturists.

The knowledge gained within this topic can be applied by learners to the selection of plant material, to identify and describe plants, to ensure optimum plant growth and meet the plants' requirements for sunlight and water.

This topic introduces the learner to plant growth and development, starting with investigating how plants are named, before moving on to consider the technical language used by horticulturists to describe, classify and identify plant species. Learners explore the different structures and tissues found within the plant, developing a knowledge of their functions and distinguishing characteristics.

Plant growth processes are explored, the impacts of the environment on the function of the plants understood and the increasing impacts of climate change on the plant appreciated.

Consequently, this topic provides essential underpinning scientific knowledge, which integrates into all other topic areas.

Element 1	Scientific and common plant names	
AO1: **Knowledge**	AO2: **Application**	AO3: **Integration**
The importance of scientific names and their use, including formatting conventions. The meaning and application of the following terms within a horticultural context, to include: • plant taxonomy • family • genus • species • cultivar • variety • hybrid. The concept of major plant groups, to include: • angiosperms • gymnosperms • pteridophytes • bryophytes • monocotyledonous plants • eudicotyledonous plants. How external characteristics (e.g. flower, leaf) can be used to group plants into family, genus, species, cultivar and variety. How growth stage impacts on external characteristics e.g. juvenile growth. The concepts of Plant Breeders' Rights (PBRs) and restrictions on propagation when applied to a named variety.	Group plants according to their external characteristics e.g. flower, leaf. Implications of PBRs on plant propagation and penalties for non-compliance.	Apply taxonomic principles to horticultural practices e.g. cultivation requirements and pest/pathogen susceptibilities.
Commentary		
In AO1, learners take their initial steps into understanding plant naming, first by learning the basic principles and terminology before moving on in AO2 to apply this knowledge to group plants based on their external features and characteristics. This knowledge of taxonomy and nomenclature, as it relates in applied horticultural settings, is then integrated with other topics in AO3. This includes the impact of taxonomy on horticultural practices such as cultural practices, and in the susceptibility of plant species to pests and pathogens, for example the susceptibility of members of Rosaceae to Fireblight. Another key concept is that plant taxonomy is a fluid concept as new thinking is applied within the world of horticulture. This topic also introduces learners to the concept of Plant Breeders Rights at AO1 and then develops this concept at AO2 considering the obligations Plant Breeders' Rights place on professional horticulturists.		

Element 2	Lifecycle adaptations	
AO1: **Knowledge**	AO2: **Application**	AO3: **Integration**
Life cycle adaptations, to include: • ephemeral • annual • biennial • perennial (herbaceous) • perennial (woody).	Advantages of life cycle adaptations, to include: • exploitation of short growing season • avoidance of extreme weather conditions • ecological niches • growth in less favourable conditions.	The impact of plant lifecycles on biodiversity, plant selection and design. The impact of climate change on plant lifecycles, biodiversity, plant selection and design.
Commentary		
Plant lifecycles have significant horticultural impacts in particular when considering plant selection decisions, or the establishment of wildflower communities. AO1 introduces the concept and related terminology, with AO2 exploring the advantages of different life cycle adaptations from an ecological perspective. AO3 considers the broader impact of life cycles with a particular emphasis on biodiversity.		

Element 3	External parts of the plant	
AO1: **Knowledge**	AO2: **Application**	AO3: **Integration**
Characteristics of external plant structures. Function of external plant structures and horticultural importance. Use of external plant structures for identification of plant taxa. Structures include roots, stems, leaves and flowers: • Roots: fibrous, tap, root cap, hair • Stems: nodes and internodes, bud types, arrangement, lenticels, bark • Leaves: margin, shape, venation, arrangement and function • Flowers: floral parts of typical eudicotyledonous and monocotyledonous flowers. Inflorescence structures, seed heads.	How characteristics of external plant structures are used to identify and describe plant species. How the characteristics of external plant structures support their function e.g. leaf arrangement enables efficient light capture for photosynthesis.	Impact of external plant structure on horticultural performance, plant care and husbandry e.g. defence against pest and disease attack, or the establishment, spread and colonisation of new areas in weed biology e.g. impact of lifecycle, rhizomes.
Commentary		
AO1 introduces the learner to the external parts of the plant. The characteristics, the function, and the arrangement of the parts of the plant are established, along with the professional terminology which is commonly used in horticultural settings, for example, alternate and opposite leaves. These concepts are applied at AO2 where the characteristics and the arrangements of the external parts of the plant are used in the identification of plant species. The links between the characteristics and arrangement of the external parts of the plant to their function are considered, thus allowing learners to build up a holistic knowledge of how plants work. In AO3 these concepts are considered in wider horticultural contexts, for example in the way they can be interpreted to predict the cultural needs of a plant, the role of external features in plant defence against pests and pathogens, or the way they can aid in out-competing other species. Please note: The scope within this element is limited to the terminology that is commonly used within seed catalogues and common terms used when horticulturists are describing plants in a professional setting.		

Element 4	Internal plant structures	
AO1: **Knowledge**	AO2: **Application**	AO3: **Integration**
Characteristics, arrangement, function and horticultural importance of internal structures, to include: • Root: xylem, phloem, cambium, epidermis, endodermis • Stem: xylem, phloem, cambium, epidermis • Leaf: xylem, phloem, epidermis, lamina, stomata, palisade & spongy mesophyll.	The importance of internal structures for growth and transportation of carbohydrates, nutrients, and water around and out of the plant.	Apply knowledge of internal structures to horticultural practice e.g. modes of action of plant pests, the impact of plant diseases on internal structures of the plant.
Commentary		
The characteristics, and function of internal stem, root and leaf structures are introduced to learners in AO1 with an emphasis on the horticultural importance of these tissues including the way they are arranged within the plant. This knowledge is then applied in AO2 to develop understanding of the role of plant tissues in essential functions such as the transport of carbohydrate, the uptake of water and nutrients and their movement through the plant. AO3 then applies this knowledge to horticultural situations, for example with regard to plant health.		

Element 5	Pollination and fertilisation

AO1: **Knowledge**	AO2: **Application**	AO3: **Integration**
The importance of pollination and fertilisation. The processes of pollination and fertilisation including key terminology. Functions of plant parts involved in pollination and fertilisation: • peduncle • receptacle • sepals • petals • stamen • anther • filament • pollen grain • stigma • style • ovary • ovule. The agents of natural pollination: • pollinating animals (bees, moths, flies, birds) • wind • water.	The impact of temperature conditions, light levels, humidity and nutrition on pollination and fertilisation in different plant species. Cross-pollination and processes to ensure this occurs. Methods to promote pollination and therefore seed and fruit production e.g. encouraging pollinating insects.	Apply knowledge of the process of pollination and fertilisation to increase fruit/seed production, to include: • selecting sites for plantings • creating microclimates • selecting suitable pollination partners. Changes in invertebrate populations, impacts on pollination, the role of gardens in population restoration.

Commentary

In AO1 the learners develop an understanding of the key terminologies, structures and processes involved in pollination and fertilisation.

Pollination and fertilisation are considered in a horticultural context at AO2, with the impacts of biotic and abiotic factors being identified, along with the advantages derived by the plant from cross-pollination. Learners also develop a knowledge of the role of the horticulturist in ensuring pollination and fertilisation through, for example, the encouragement of pollinating insects.

The role of the horticulturist in ensuring pollination and fertilisation is further considered at AO3 where this concept is applied in areas such as the selection of appropriate species for sites, the creation of microclimates and in ensuring effective pollination partners in productive growing.

AO3 also integrates with sustainability to consider the changes in invertebrate populations (for example the decline in bee populations) on pollination. AO3 also investigates the ways that a horticulturist can develop garden habitats to counteract population decline.

Element 6	Photosynthesis and respiration	
AO1: **Knowledge**	AO2: **Application**	AO3: **Integration**
The concept and importance of photosynthesis and respiration for plant growth. The processes of photosynthesis and respiration in plants.	The law of limiting factors and its horticultural implications applied to specific contexts e.g. growing in a conservatory or greenhouse.	The impact of the presence of abiotic factors within horticultural sites on photosynthesis and respiration, to include: • the role of specific plant nutrients in chlorophyll production • the effects of wind and pest attack on photosynthetic area • the implications of climate change on the relationship between photosynthesis and respiration.
Commentary		
AO1 introduces the concept of photosynthesis and respiration, before moving on to establish their importance. The basic process of photosynthesis is considered. AO2 builds on the concepts established in AO1 by adding horticultural contexts, for example with regards to the law of limiting factors, which can be applied in a number of horticultural settings. At AO3 learners consider the ways that photosynthesis and respiration are affected by external factors. Key concepts could include: • the role of photosynthesis in carbon sequestration • the impact of changing temperatures on increasing respiration rates • the balance of photosynthetic input, against respiration demand, with the threat of increased night temperatures leading to respiration outstripping photosynthesis, and plant death • concepts such as higher carbon dioxide leading to increased photosynthesis and so increased carbon sequestration and water uptake.		

Element 7	Movement of water through the plant	
AO1: **Knowledge**	AO2: **Application**	AO3: **Integration**
The role of water in plants. The process of water uptake and movement through the plant. The transpiration stream and water loss from the leaf.	The impact of environmental factors on water uptake and movement, to include: • soil moisture • temperature • relative humidity • wind • sunlight. Plant-based strategies for drought management, to include: • wilting • hirsute leaves • early senescence.	The impact of horticultural practices on water availability, to include: • planting densities • relative humidity • shading • nutrient uptake. The impact of soil structure and growing media formulation on water uptake.
Commentary		
AO1 introduces the learner to the process of water uptake and movement through the plant. This knowledge is then applied in a horticultural context in AO2, where the impact of environmental factors on water availability and uptake are considered. AO2 also introduces the concept of plant adaptations, and their role in plant survival, which is picked up in Unit 2. These concepts are then applied to a wider horticultural context in AO3 including the impact of plant densities, relative humidity and shade on water uptake, along with the role of water in the uptake of plant nutrients and the role that soils and growing media have on root development, and consequently water availability and uptake.		

Unit:	**1**
Topic:	**2**
Title:	**Plant Health**

Topic overview

This topic provides learners with an essential understanding of the factors that may influence plant health and integrates with the Plant Science, Plant Nutrition and Plant Specification topics.

Horticulturists manage and mitigate the different factors that can impact on plant health.

Plants are subject to a wide range of abiotic factors some of which favour plant growth, while others are detrimental, for example, wind and frost can have significant negative impact on plant growth, as can extremes in relative humidity, an over or undersupply of plant nutrients, or the presence of weeds.

Plant health also involves the systematic study of pests, diseases and pathogens to develop strategies that allow the horticulturist to prevent or mitigate problems as they arise.

This is a dynamic area of study, with climate change playing an increasing role in the introduction of new plant health risks.

Element 1	Environmental conditions	
AO1: **Knowledge**	AO2: **Application**	AO3: **Integration**
Abiotic conditions that can adversely affect plant health, to include: • temperature • wind • water • relative humidity • light levels • oxygen.	The impact of environmental conditions on the growth of named plant species, to include: • temperature • wind • water • relative humidity • light levels. • oxygen.	The impact of environmental conditions and a changing climate on horticultural practices e.g. • selection of plants that are less affected by identified abiotic factors • mitigation of site limitations to create growing conditions suitable for a wider range of plants • impacts on long lived species.
Commentary		
AO1 introduces learners to a range of abiotic conditions that can have a negative impact on plant growth, considering the many factors that can together or individually impact on plant health. These conditions are considered from a range of contexts, including soils and the root environment as well as the aerial environment. AO2 considers a range of environmental conditions by considering their impacts on a range of named plant species, thus adding context to the concepts considered at AO1. The knowledge gained in AO1 and AO2 is then integrated with other topics within the unit in AO3, for example the importance of selecting species suited to the specific conditions on planting sites.		

Element 2	Plant nutrition and plant health	
AO1: **Knowledge**	AO2: **Application**	AO3: **Integration**
The role of nutrition in ensuring plant health. Symptoms of nutritional deficiencies, to include: • effect of nutrient mobility • macronutrients and elements required for plant growth: nitrogen, phosphorus, potassium, calcium, sulphur, magnesium, carbon, oxygen, hydrogen • micronutrients: iron, boron, manganese, and molybdenum.	The impact of poor plant nutrition on plant health, to include: • growth • vigour • yield • cold resistance • disease susceptibility • flowering potential.	The impact of plant nutrition on the growth characteristics of plants.
Commentary		
AO1 introduces the role of nutrients in ensuring plant health, before moving on to consider the symptoms of nutrient deficiencies in the plant. The role of nutrient mobility is introduced to inform the location of the deficiency symptom within the plant. AO2 applies this knowledge in the cultivation of plants, considering the impact of poor plant nutrition on plant health. AO3 integrates with the wider role of plant nutrition, along with the impact plant nutrition plays with regard to the growth characteristics of plants, for example the promotion of vegetative growth or flowering growth.		

Element 3	Impact of competition on plant health	
AO1: **Knowledge**	AO2: **Application**	AO3: **Integration**
The benefits of weeds as cover crops, nutrient recyclers, habitats and food sources. The disadvantages of weeds e,g. competition with plants for water, nutrients, physical space, and sunlight. The role of weeds as hosts for plant pests and pathogens. Legal control measures for weeds e.g. the Weeds Act, antisocial behaviour orders (Japanese knotweed). Cultural, physical, mechanical and chemical weed control principles. Negative environmental impacts of weed control methods e.g. cultivation of soil, chemical control.	The efficacy of control measures (where this is necessary) for weeds / invasive species and other unwanted vegetation, to include: • cultural • physical • chemical.	The impact of planting sites, weed biology, availability of plant nutrients and pH on the successful control of weeds and invasive species.
Commentary		
AO1 introduces learners to the positive impacts of weeds as cover crops, nutrient recyclers, habitats and food sources balanced carefully with the negative impacts of weeds and invasive species on the availability of light, space nutrients and water. The role of weeds as hosts for pests and pathogens is established and the legal implications of weed infestations are considered. AO2 applies a horticultural perspective, considering the efficacy of the different methods of weed control. AO3 allows the learner to integrate knowledge from other topic areas by investigating the role of weed biology and site-specific factors to ascertain the most appropriate control measures.		

Element 4	Pests and pathogens	
AO1: **Knowledge**	AO2: **Application**	AO3: **Integration**
How pests and pathogens are introduced to a site. The impact of pests and pathogen presence on plant health. The control measures to prevent and manage outbreaks of pests and pathogens, to include: • physical • cultural • chemical • biological. Legalities of pest control.	The impact of economic threshold, resistant cultivars, humidity on plant health decisions. The influence of temperature on fecundity. The restrictions and opportunities offered by different growing systems e.g. organic cultivation practices. The concept of notifiable pests and diseases including actions required when identified.	The benefits of Integrated Pest Management (IPM) including prioritising non-chemical control measures. The benefits of garden health plans as holistic tools to manage plant health. The intended and unintended impacts of control measures on biodiversity.
Commentary		
AO1 investigates how pests and pathogens are introduced onto horticultural sites, their impacts on plant health and the key control measures open to horticulturists in controlling infestations. AO2 applies a horticultural perspective by considering factors that can influence plant health decisions, along with the restrictions and opportunities organic growing systems offer. Learners are also introduced to the concept of notifiable pests and diseases, along with the actions that are required when identified. AO3 introduces the learner to the benefits of IPM, and garden health plans. Please note: garden health plans consider the entire range of potential impacts on plant health, while considering the mitigations that can be carried out to manage these threats. Integrated Pest Management is a component part of garden health plans, along with the management of other abiotic factors.		

Element 5	Biosecurity and plant passports	
AO1: **Knowledge**	AO2: **Application**	AO3: **Integration**
Principles and purpose of biosecurity. The purpose and use of biosecurity policies.	The role of biosecurity in ensuring plant health on a garden, regional and national basis. The application of plant health legislation e.g. UK plant passports, their role and purpose.	The impact of site-specific factors on biosecurity. The impact of a changing climate on pests and pathogens.
Commentary		
AO1 introduces the concept of biosecurity, as defined by current legislation and practice. AO2 considers how the principles of biosecurity are used by horticulturists to ensure longer term plant survival. AO3 considers the impact of site-specific factors on biosecurity, for example local plant health risks, and the potential effects of a changing climate on these risks.		

Element 6	Maintaining plant health	
AO1: **Knowledge**	AO2: **Application**	AO3: **Integration**
The relationship between plant health status and resilience to pests and pathogens.	Techniques that can be applied to keep plants healthy e.g. plant spacings, planting depth.	The role of garden health plans to strategically mitigate and manage plant health risks. The role of resistant cultivars / species.
Commentary		
AO1 introduces the concept that healthy plants are more resilient. AO2 identifies cultural practices that can promote plant health, such as ensuring plants are grown at optimum spacings. AO3 considers the importance of garden health plans in mitigating health risks.		

Unit:	**1**
Topic:	**3**
Title:	**Plant Nutrition**

Topic overview

There are few areas of horticulture that are faster moving, or that have such profound impacts on sustainability and climate change than plant nutrition. The carbon released from manufacture, such as the Haber Bosch process, is a key and significant driver of climate change.

Horticultural science, and associated best practice, highlights the significant damage that fertilisers cause in their application.

The horticulturist applies scientific principles and best practice to minimise environmental damage, while enhancing biodiversity and wellness when creating gardens and designed landscapes.

This process includes the specification of plants for places, the formulation of growing media, the sustainable management of soils as a precious resource.

Element 1	Soil types and profiles	
AO1: **Knowledge**	AO2: **Application**	AO3: **Integration**
The impact of soil on plant growth, to include: • texture • structure • topsoil • subsoil • organic matter. Horticultural significance of soil loss and degradation on plant growth. Impact of climate change. Concept of soil structure.	Identify soil texture. Techniques to ameliorate soils including aeration, compaction and drainage. Positive and negative impacts on soil structure	The concept and purpose of soil management plans. The impact of poor soil structure on plant health and plant selection.
Commentary		
AO1 introduces soil as an area of study, considering the positive and negative impacts that different soil types can have on plant growth. The impacts of soil degradation and soil loss on plant growth are considered, along with the impacts of climate change, for example, increased temperature benefits bacterial action, which increases the rate of breakdown of organic matter and results in the loss of humus from the soil profile. AO2 introduces the learner to the principles and practices of soil textural analysis and identifies where soils are likely to negatively impact on plant growth. It explores where the horticulturist has to take action to ameliorate such soils by identifying the techniques that can be used to remedy a number of different structural issues. AO3 introduces the use of soil management plans to identify the actions that are required to develop the structure of their soils, to enhance plant growth and ensure plant health.		

Element 2	Role of nutrients	
AO1: **Knowledge**	AO2: **Application**	AO3: **Integration**
The function of nutrients within plants, to include: • macronutrients and elements required for plant growth: nitrogen, phosphorus, potassium, calcium, sulphur, magnesium, carbon, oxygen, hydrogen • micronutrients: iron, boron, manganese, and molybdenum.	The impact of nutrient regimes on the growth of plants e.g. promotion of vegetative growth, promotion of flowering and fruiting. The impact of soil and growing media on nutrition e.g. root penetration in compacted soil, inappropriate pH.	The impact of nutrient deficiencies on plant growth and development. The impact of nutrient deficiencies on plant health. The importance of plant selection strategies to minimise inputs.
Commentary		
AO1 introduces the learner to the specific functions plant nutrients play within the plant. AO2 considers the impact that differing nutrient regimes can have on the growth of plants, from the promotion of vegetative growth, through to the promotion of flowering. AO2 also considers the impact of soil and growing media on root growth and nutrient uptake. AO3 integrates this topic with plant health by considering the impact of nutrient deficiencies on plant growth and development.		

Element 3	Soil-based nutrition	
AO1: **Knowledge**	AO2: **Application**	AO3: **Integration**
Natural nutrient cycles, the fixation of atmospheric nitrogen, the role of microbial activity in the release of nutrition. The role of soil micro-organisms on making plant nutrients available. The importance of the rhizosphere in nutrient uptake. The role of fertilisers in growing media. The role of natural fertiliser teas. The use of green manures.	The advantages and limitations of organic and synthetic fertilisers and manures as sources of plant nutrition. The advantages and limitations of biochar.	The importance of plant selection to reduce or eliminate the need for the addition of plant nutrients. The contribution of fertiliser manufacture to climate change. The eutrophication of water bodies through leachate. The review and removal of fertilisers in sustainable horticulture.
Commentary		
AO1 Introduces learners to soil-based nutrition, through concepts such as nutrient cycles, the role of soil micro-organisms on nutrient availability to plants, the role of the rhizosphere and the use of natural fertiliser teas. The role of fertilisers in the formulation of growing media is also considered. AO2 develops learners' knowledge through introducing the concept of fertilisers and manures as sources of plant nutrition, through considering their positive effects on plant growth along with their negative impact on climate change and the unseen ecology of the soil. This includes carbon emissions from the manufacture of synthetic fertilisers and the negative impacts of fertiliser salts on microorganisms in the soil. The role of biochar as a sustainable soil improver is introduced. AO3 considers fertilisers through integration with sustainability and best practice. This includes the importance of plant selection to limit the need for additional plant nutrients, the environmental impacts of fertiliser manufacture, with specific reference to carbon emissions, the impact of leachate on water quality and the reasons why fertilisers are being phased out in sustainable horticultural settings.		

Element 4	pH and nutrient availability	
AO1: **Knowledge**	AO2: **Application**	AO3: **Integration**
Impact of pH on nutrient uptake.	Protocols used when collecting and testing soil to determine pH. Mitigating actions to adjust pH levels in soil and growing media. Impact of mitigation on soil ecology.	The role of good plant selection to reduce corrective actions. The impact of incorrect pH on the health of existing plant species. The role of Garden Health Plans including species selection, mitigations.
Commentary		
AO1 introduces learners to the impact of pH on the uptake of plant nutrients. AO2 explains the processes involved in the collection and testing of soils to determine pH, and actions that can be taken by horticulturists to adjust the pH of soils, along with the impacts of these measures on soil ecology. AO3 integrates with sustainability and best practice as qualification-wide outcomes to inform plant selection to reduce the need for amelioration, the impacts of incorrect pH on plant health for existing species and the role of garden health plans. The key concept is that soil amelioration to meet plant needs is not appropriate from a sustainable perspective.		

Element 5	Bulk constituents for growing media	
AO1: **Knowledge**	AO2: **Application**	AO3: **Integration**
Bulk constituents, their characteristics, and environmental footprints to include: • coir • composted organic matter • sheep's wool • bracken • leaf litter • loam • perlite • sand • vermiculite • rockwool • forest residue • grit. Historic use of peat. The removal of peat in growing media.	The advantages and limitations of bulk constituents for plant growth. The formulation of the following composts: • seed • multi-purpose • potting • soil-based • ericaceous • aquatic • orchid • cactus.	The impact on plant health of growing plants in an inappropriate growing media. Environmental implications of different bulk constituents to include: • carbon footprint • habitat loss from extraction • contamination.
Commentary		
The range of bulk constituents used in growing media are considered in AO1, with their advantages and limitations evaluated in AO2. The wider environmental impacts are considered at AO3. The negative impacts of peat extraction and the requirement to eliminate peat use in growing media is explored in AO1. The attention of centres is drawn to the RHS strategic plans for sustainability and environmental horticulture.		

Unit:	**1**
Topic:	**4**
Title:	**Plant Specification**

Topic overview

Horticulturists develop sites into gardens and designed landscapes through reference to scientific findings, best practice and models of sustainable thinking.

Plant specification is a critical component of this process, both from the selection of plant species, but also through sustainable procurement.

The basic principles of ‘right plant right place’ are applied within this topic.

This topic integrates closely with Plant Science, Plant Nutrition and Plant Health and the qualification-wide outcomes to consider the factors that influence and determine the specification of plants for specific locations and purposes.

Element 1	Site-based criteria	
AO1: **Knowledge**	AO2: **Application**	AO3: **Integration**
Site factors that impact plant establishment and growth, to include: • aspect • topography • exposure • light/shade • soil type • drainage/water management • microclimates • size of planting site. The potential impact of climate change on the above factors.	The impact of site factors on planting decisions, to include: • aspect • topography • exposure • light/shade • soil type • drainage/water management • microclimates • size of planting site.	Techniques of working with the sites natural aspects to minimise the need for mitigation interventions. Impact of inappropriate plant selection on plant health. How natural habitat determines plant requirements e.g. an alpine plant may require cool, dry, well drained conditions. Impact of site issues on plant selection e.g. pest and pathogens.
Commentary		
AO1 introduces the concept of site assessment with the identification of critical factors. The impacts of climate change on these factors are also considered. At AO2 these factors are considered to inform planting decisions. AO3 integrates this element with other topics within the unit to consider actions that can be taken to mitigate negative site aspects, the impacts of poor species selection on plant health, the impact of provenance on species requirements along with the effect that the presence of pests and pathogens can have on plant selection. Centres are reminded that they can add their own horticultural contexts to topics, planting sites can therefore include productive growing areas, or decorative areas.		

Element 2	Plant-based criteria	
AO1: **Knowledge**	AO2: **Application**	AO3: **Integration**
Impact of plant requirements on selection, to include: • hardiness • exposure • soil type/drainage • temperature • water • light/shade. Application of plant science to inform plant selection, to include: • hardiness • aspect • water needs • environmental tolerances • soil types. The value of: • Award of Garden Merit (AGM), • hybrids, F_1 hybrids, F_2 hybrids • clones and clonal selection. • resistant hybrids/varieties /cultivars.	Importance of using scientific information when matching plant requirements to site characteristics. Impact of provenance on resilience to changing climatic conditions.	Sustainable practices to ensure appropriate plant selection and establishment. Best practice with regard to sustainable planting techniques. Impact of inappropriate plant selection on plant health. Presence of known site issues on plant selection e.g. pest, diseases.
Commentary		
To apply best practice and sustainable horticultural concepts in the selection of the right plant for the right place requires the horticulturist to both evaluate the site, but also to consider the requirements of different plant species. For example, how natural habitat determines plant requirements e.g. an alpine plant may require cool, dry, well-drained conditions. These concepts are introduced to learners in AO1 which also introduces the candidate to the value of RHS Award of Garden Merit, F_1 and F_2 hybrids, clones and clonal selection when considering plants for specific sites. AO2 applies the concepts introduced in AO1 to consider the importance of matching plant requirements to the characteristics of the planting site. AO3 investigates, with qualification-wide outcomes of sustainability and best practice to consider plant selection and establishment.		

Element 3	Plant specifications	
AO1: **Knowledge**	AO2: **Application**	AO3: **Integration**
Factors when ordering plant material, to include: • plant types: evergreen, semi-evergreen, deciduous, ephemeral, annual, biennial, perennial (herbaceous & woody), shrub, tree • material type: pot-grown, bare root, rootballed / burlap • production method • biosecurity • environmental considerations.	Advantages and limitations of plant material for different horticultural situations, to include: • plant types: evergreen, semi-evergreen, deciduous, ephemeral, annual, biennial, perennial (herbaceous & woody), shrub, tree • Material type: pot-grown, bare root, rootballed / burlap • production method • biosecurity • environmental considerations.	The impact of plant specification on biosecurity e.g. material source. The environmental impacts of plant specification e.g. the concept of carbon and water footprints.
Commentary		
AO1 identifies key criteria to be considered when specifying plants for planting. AO2 considers the advantages and limitations of those different criteria when applied to different horticultural situations. AO3 develops this concept further by considering wider ethical and biosecurity contexts.		

Element 4	Receiving plant material on site	
AO1: **Knowledge**	AO2: **Application**	AO3: **Integration**
Processes for receiving plant material on site, to include: • receipt and quality checks • plant passporting information • heeling in/storage of plant material. Indicators of plant quality issues, to include: • presence of pest or disease • poor growth • old stock • weed infestations • pot-bound.	Process of reporting problems e.g. Defra. Implications of accepting poor quality plant material and actions to prevent this.	The biosecurity risks of poor-quality plant material. The efficacy of quarantining new plant material to prevent plant health problems.
Commentary		
Receiving plants on site is a critical part of developing new plantings. In AO1 the process of receiving plant material is established, with AO2 identifying the implications of accepting plant material out of specification. The biosecurity risks of poor-quality plant material are covered in AO3 along with the need to quarantine new material as part of a biosecurity policy.		

Element 5	Planting and post-planting care	
AO1: **Knowledge**	AO2: **Application**	AO3: **Integration**
The process of planting, to include: • soil amelioration • position • spacing • plant density • depth of planting • firming • staking • irrigation/water management • fertiliser requirements • mulching.	The implications of planting practices and post-planting care for plant establishment and growth. The impacts of poor practice e.g. incorrect addition of organic matter.	The advantages and limitations of different staking and support systems on both plant establishment and development of resilience. The impact of weed management on plant establishment and biodiversity. The impact of cultural factors on establishment and plant health e.g. timing of planting and post planting care.
Commentary		
The process of planting is vital for good plant establishment, this includes applying best practice and professional techniques to planting practices, which are identified as part of AO1. AO2 considers the implications of poor practice such as use of outdated techniques. AO3 identifies wider considerations from the evaluation of staking systems to weed management, water management and fertiliser applications.		

Element 6	Maintaining new plantings	
AO1: **Knowledge**	AO2: **Application**	AO3: **Integration**
Purpose, timing and components of maintenance tasks for the first 12 months after planting, to include: • weed control • irrigation/water management • removal of dead plant material • checking/replacing stakes and guards. The reasons for recording failure rates.	The relationship between maintenance tasks and plant establishment and growth.	The use of garden health plans to ensure successful establishment of new plantings, to include: • irrigation/water management • nutrition • identification and mitigation of stress • timings of maintenance operations • impact of operations on soil and plant health • investigation into causes of failure.
Commentary		
The maintenance of new plantings is often critical to their establishment. AO1 considers the key criteria, while in AO2 these criteria are related to their benefit to the plant. In AO3 the wider factors that can impact on plant establishment are considered.		

RHS Level 2 Certificate in the Principles of Plant Growth and Development

UNIT 2

	Topic	Elements
1	**Plant Science II:** provides an understanding of the range and role of plant adaptations.	1. Leaf adaptations 2. Stem adaptations 3. Root adaptations 4. Flower adaptations 5. Seed adaptations 6. Growth habit adaptations
2	**Planting Styles:** provides horticultural knowledge of the factors involved in creating a wide range of different horticultural plantings**.**	1. Historical contexts 2. Formal planting 3. Informal planting 4. Plant associations 5. Plant uses 6. Edible landscapes 7. Short-term plantings
3	**Horticulture and Society:** allows learners to develop their knowledge and understanding of horticulture's contribution to society, including social, environmental and economic.	1. Wellbeing 2. Environment 3. Economy 4. Community
4	**Biodiversity:** provides an applied knowledge of the roles of plants in creating habitats to encourage biodiversity.	1. Plants and biodiversity 2. Impact of climate change 3. Creating habitats 4. Citizen science and species surveys 5. Biodiversity Action Plans

Qualification-wide outcomes

Health and Safety

- Knowledge of, and compliance with, current legislation as it relates to horticulture
- The management of risk within horticulture
- The storage, care and maintenance of PPE, tools and equipment in horticultural settings.

Sustainability

The impact of horticulture on the wider environment, with specific reference to:

- Reduction of the negative impacts of horticultural practices
- The contribution of horticulture to the three pillars of sustainability (economic viability, social equity and environmental protection)
- The concept that horticulture should be net-positive, benefitting the wider environment
- The impact of horticulture on climate change
- The impact of climate change on horticulture.

Best Practice

- Professional approaches and techniques
- Professional use of named plant species in a wide range of horticultural settings
- Horticultural practices which are professional, current, effective and sustainable
- The adoption of trials results, research and development findings.

Equality and diversity

- Knowledge and compliance with all current legislation as it relates to horticulture
- The concepts of respect, fairness and dignity
- Negative impacts of poor practice to include: discrimination, victimisation and harassment
- The advantages of inclusive cultures.

Unit:	**2**
Topic:	**1**
Title:	**Plant Science II**

Topic overview

This topic builds on the plant science topic in Unit 1, to consider the incredible range of plant material that horticulturists work with.

Plants are adapted to survive in a diverse range of environments. Plants exhibit a wide range of leaf types, stems that climb or can support large networks of branches, roots that can both absorb water, but which can store carbohydrates and flowers that can ensure cross-pollination. Seeds can survive for thousands of years, along with a wide range of growth habits and lifecycles that range from weeks to hundreds of years.

Plant breeders through the years have enhanced these adaptations, which are often part of the garden merit of a particular species making the study of this area fascinating and rewarding to the horticulturist.

Element 1	Leaf adaptations	
AO1: **Knowledge**	AO2: **Application**	AO3: **Integration**
Leaf adaptations, to include: • hairy • waxy • coloured • rolled • variegated • reduced • succulent • oils • aerenchyma cells • bulbs. The potential of leaves for propagation (totipotency).	Advantages of leaf adaptations for the plant, to include: • reduced transpiration • increased humidity • reflection of light • cooling of leaf • storage of water • protection from herbivory • buoyancy in aquatics.	Horticultural uses of leaf adaptations, to include: • implication of leaf adaptation on plant selection • prediction of plant cultural and environmental preferences • function to include air quality, shade, water absorption • resilience • benefits for biodiversity.
Commentary		
The leaves of plants are adapted in a number of ways to allow plants to survive and thrive in a diverse range of environments. This concept is introduced in AO1 which investigates a range of leaf adaptations. The concept of totipotency is also introduced to learners. AO2 considers the advantages of these adaptations from an ecological perspective. AO3 applies the concept of leaf adaptations within horticultural settings. The relationship between adaptations and plant selection strategies could involve the specification of smaller leaved species as a more appropriate choice for formal hedging. The role of leaf adaptations in plant selection to include hirsute leaves filtering particulates out of air, the use of trees to provide shade within urban car parks, the role of leaves and canopies in slowing water flow into drainage systems. The impact of leaf adaptation on resilience, for example pest defence, and xerophytic adaptations.		

Element 2	Stem adaptations	
AO1: **Knowledge**	AO2: **Application**	AO3: **Integration**
Stem adaptations, to include: • secondary thickening / wood • physical defence, including thorns • tendrils • twining stems • stolons • tubers • runners • glandular hairs or ducts containing essential oils • corms • rhizomes. The potential of stems for propagation (totipotency).	Advantages of stem adaptations for the plant, to include: • defence from herbivory • support • enhanced light • water storage • carbohydrate storage • resilience to weather conditions.	Horticultural uses of stem adaptations, to include: • climbing plants • decorative stem/trunk adaptations • colonisation of areas • creation of habitats for wildlife • impact on suitability for different design styles.
Commentary		
Stem adaptations offer plants a number of competitive advantages, they also offer horticulturists, amongst other benefits, a range of decorative features. AO1 investigates a range of stem adaptations and the concept of totipotency is expanded to include plant stems. AO2 considers the advantages of these adaptations from an ecological perspective. AO3 explores the wider horticultural application of stem adaptations in: • selecting the right plant for the right place • the creation of habitats for wildlife • planting styles.		

Element 3	Root adaptations	
AO1: **Knowledge**	AO2: **Application**	AO3: **Integration**
Root adaptations, to include: • fibrous • tap • foraging • tropisms • adventitious buds • tubers • pneumatophores • root nodules in legumes • adventitious roots/prop roots. The potential of roots for propagation (totipotency).	Advantages of root adaptations for the plant, to include: • anchorage / support • water / nutrient uptake • orientation • search for nutrition and water • reproduction • carbohydrate storage • water storage • gaseous exchange.	The maintenance implications of root adaptations to include: • colonisation • impact of oxygen levels in soil on roots • impact to hard landscaping / grassed areas • weed control • transplanting.

Commentary

Root adaptations often go unnoticed but are fundamentally important for plant survival and to inform horticultural practices.

AO1 investigates a range of root adaptations and the concept of totipotency is expanded to include plant roots.

AO2 considers the advantages of those adaptations to plant survival, especially within a changing climate.

AO3 explores the wider horticultural application of root adaptations. Examples could include:

- the selection of suitable plant species based on rooting characteristics
- current best practice with regard to mowing and soil management under tree canopies
- the impact of surface rooting on the maintenance of paths and grassed areas
- the implication of root structures in weed control
- the impacts of root types on transplanting and success rates.

Element 4	Flower adaptations	
AO1: **Knowledge**	AO2: **Application**	AO3: **Integration**
Flower adaptations, to include: • flower arrangements • timing of flowering • petals (bright / reduced) • scent • nectar • hermaphrodite • monoecious • dioecious • quantity and characteristics of pollen.	Advantages and functions of flower adaptations for the plant, to include: • enhancing pollination • linking pollen characteristics to vectors of pollination • favouring cross-pollination.	Horticultural uses of flower adaptations to include: • planting / design styles • supporting pollinators • biodiversity.
Commentary		
Flowers are adapted in a number of ways to offer the plant advantage with regard to pollination and fertilisation. The adaptations are identified in AO1, their advantages to the horticulturist are considered at AO2, their wider implications are considered within AO3.		

Element 5	Seed adaptations	
AO1: **Knowledge**	AO2: **Application**	AO3: **Integration**
Seed adaptations, to include: • quantity of seed produced • dispersal mechanism • dormancy mechanisms • seed coats • storage of fats and oils • orthodox • recalcitrant.	Advantages of seed adaptations for plant dispersal (geographic and in time). The benefits of seed adaptations for germination, to include: • light • moisture • temperature. Techniques to overcome dormancy in horticultural situations, to include: • washing • scarification • stratification.	Impact of seed adaptations on biodiversity and garden design. Impact of dispersal mechanisms and soil seed bank on horticultural maintenance.
Commentary		
Seed adaptations have impacts on horticultural techniques, for example the treatments to break dormancy. AO1 introduces the concept and considers the characteristics of seed adaptations. AO2 considers the horticultural implications and plant-based advantages of these adaptations. AO3 considers the wider horticultural implications in a number of contexts.		

Element 6	Growth habit adaptations	
AO1: **Knowledge**	AO2: **Application**	AO3: **Integration**
Growth habit adaptations including low to ground (alpines), perennial, woody, evergreen, deciduous.	Advantage of growth habit adaptations to the plant including optimising microclimates, surviving adverse winter conditions, and ecological services.	Suitability of growth habit adaptations for different garden situations and planting styles. The implications of plant growth habit for biodiversity.
Commentary		
The growth habits of plants are key considerations when specifying plants for planting. AO1 introduces the concept with examples of growth habits. AO2 investigates the survival advantages of such growth habits. AO3 considers the wider horticultural implications of growth habit adaptations.		

Unit:	**2**
Topic:	**2**
Title:	**Planting styles**

Topic overview

Horticulturists apply their knowledge of plants, biodiversity, and the way people interact with plants to develop the gardens and landscapes in their care. Unit 2 brings these aspects of horticulture together.

Learners are introduced to the concept of planting styles, investigating formality and informality within gardens, the design characteristics of historical landscapes and gardens to allow them to appreciate the way that horticulture is used in preserving and interpreting heritage.

This topic also covers the use of plants in gardens, from screens and boundaries, through to the provision of shade, and the art of combining plants to create gardens.

Horticulturists do not just create beautiful spaces; they also grow the fruit and vegetables that we eat. Horticulturists are increasingly engaging with communities in the growing of vegetables to impact on wider societal issues, this aspect is also considered within this topic.

This topic also allows learners to explore productive growing in the context of edible landscapes.

Element 1	Historical contexts	
AO1: **Knowledge**	AO2: **Application**	AO3: **Integration**
Key design characteristics of historical landscapes and gardens most relevant to the heritage sector, to include: • Renaissance gardens • Landscape style • Picturesque style • Gardenesque style • Arts and Crafts gardens • The wild garden • Modern garden styles.	Indicative features of historic landscapes. The importance of features and plantings being appropriate to period and style and recognition of those which are not. Actions that might be taken to rectify features or plantings that do not conform to period or style. How historical styles influence garden design today. The role of horticulture in preserving and interpreting representative histories and heritage.	Changing attitudes to nature over time and their influence on garden styles and biodiversity. Impact of heritage on garden establishment and maintenance.
Commentary		
AO1 establishes the importance of heritage horticulture by investigating the design characteristics of key historical styles. AO2 uses this knowledge to allow learners to review and identify the style of the garden and to suggest actions that could be taken to rectify features that do not conform to the period or style. It also considers the importance of acknowledging and communicating decolonised and inclusive histories, which involves telling stories from multiple perspectives. AO3 considers the way that attitudes towards nature have changed over time, how these attitudes have influenced the development of garden styles, and the impact these styles have on biodiversity.		

Element 2	Formal planting	
AO1: **Knowledge**	AO2: **Application**	AO3: **Integration**
Features of formal planting styles, to include: • straight lines, geometric shapes • symmetry • formal hedges • hedges to restrict planted areas • monochromatic or dichromatic planting schemes • planting in even numbers • formal ponds.	The importance of formal elements and plantings being appropriate to the planting style. Actions that might be taken to rectify features or plantings that do not conform to planting style. The use of formal planting styles to present living histories and to explore issues e.g. public displays of power and dominance over nature.	The impact of formal plantings on biodiversity. Plant adaptations suitable for use in formal plantings e.g. leaf, stem and habit. Sustainability impacts of formal lawns to include: • monocultures • water management • nutrition • weed control.
Commentary		
Plant selection and location are crucial in determining the look and feel of a garden. AO1 considers the characteristics of formal planting styles within a garden, while AO2 offers learners the opportunity to apply this knowledge as they consider a range of plantings and state whether these form part of formal or informal gardens. AO3 considers the broader considerations of formal planting styles with regard to their impact on biodiversity. AO3 also integrates with Plant Science II by considering plant adaptations that make species appropriate to this planting style.		

Element 3	Informal planting	
AO1: **Knowledge**	AO2: **Application**	AO3: **Integration**
The features of informal plantings and their design function, to include: • irregular shapes within design • plantings less restricted by shape and free flowing • full-colour palette • planting in odd numbers • planted water features • structure and shape as well as flowering for woody perennials.	The importance of features and plantings being appropriate to the planting style. Actions that might be taken to rectify features or plantings that do not conform to planting style. The use of informal planting styles to present living histories e.g. the role of Robinson in championing naturalistic planting styles.	The impact of informal plantings on biodiversity. Plant adaptations suitable for use in informal plantings e.g. leaf, stem and habit.
Commentary		
The way in which selected plants are grouped and planted makes a huge impact on the look, feel and character of planted areas. AO1 considers the characteristics of an informal garden, while AO2 offers learners the opportunity to consider a range of plantings and state whether these form part of a formal or informal garden. AO3 considers the broader considerations of informal planting styles with regard to their impact on biodiversity. AO3 also integrates with Plant Science II by considering plant adaptations that make species appropriate to this planting style.		

Element 4	Plant associations	
AO1: **Knowledge**	AO2: **Application**	AO3: **Integration**
The principles of plant associations, to include: • colour • height • form • seasonal interest. The importance of interrelationships between plant species including appropriateness of colour, height, form and flowering times. The importance of selecting plant material that reflects both the design ethos and the heritage of the site.	Use garden situations to inform the groupings of plants to include: • colour • height • form • seasonal interest.	The role of plant adaptations when considering plant associations, e.g. leaf size and shape, growth habit. The wider environmental and biodiversity impact of plant choices. Select plant species appropriate to the historical and cultural aspects of the garden.
Commentary		
The creation of beautiful plantings involves the selection of plants that enhance each other. This is fundamental to developing an effective and beautiful planting design. This process should be balanced and include the selection of plants based on foliage, texture, habit and flower. AO1 identifies the basic considerations when selecting plants that associate well, such as appropriateness, colour, height and form. This concept is applied at AO2 to suggest plants that will create effective plantings that balance colour, height, form and flowering time, to create effective plantings for given garden situations. AO3 considers the broader impact of the selection of plant species, considering plant adaptations, the impacts of the planting on biodiversity and the appropriateness of the plant species to the historical and cultural aspects of the garden.		

Element 5	Plant uses	
AO1: **Knowledge**	AO2: **Application**	AO3: **Integration**
Uses of plants within a garden, to include: • height • structure • shade • wildlife • horizontal planes • vertical lines • screens • boundaries • ecosystem services • climate mitigation. Implications of poor plant selection for purpose and function in design.	Select plants for purpose, to include: • height • structure • shade • wildlife • horizontal planes • vertical lines • screens • boundaries • ecosystem services • climate mitigation.	The role of plant adaptations when considering plant uses. The wider environmental and biodiversity impact of plant choices.
Commentary		
Plants are used in a number of different contexts within a garden, for example as hedges, climbers, wall shrubs and trees, which give structure to gardens. AO1 introduces the learner to these uses of plants, while at AO2 learners specify plant species for the purposes identified in AO1. AO3 considers the role of plant adaptations along with the impact of species selection on biodiversity. Please note: Climate mitigation can include provision of shade, increase of relative humidity, flood prevention and alleviation, and other related principles.		

Element 6	Edible landscapes	
AO1: **Knowledge**	AO2: **Application**	AO3: **Integration**
Planting styles suitable for edible landscapes including herbs, fruit and vegetables. The principles of growing systems including traditional, organic, biodynamic. Potagers, containers and accessible edibles.	Select herbs, fruit and vegetables to meet design characteristics of the wider garden / landscape. Specify appropriate plant support structures to meet design characteristics of the wider garden/landscape (e.g. bamboo canes, oak obelisks). Sustainability impact of plant supports e.g. bamboo canes.	The social impact of edible landscapes including social inclusion and green prescribing. The role of community orchards, allotments, the incredible edible movement, community gardens and guerrilla gardening for health, wellbeing and biodiversity.
Commentary		
Edible landscapes and productive growing are hugely popular areas of horticulture. The concept of edible landscapes is introduced in AO1 with different styles of planting being considered. Edible landscapes are often cultivated to traditional, organic or biodynamic principles and so the principles of these systems are introduced within AO1. AO2 considers the selection of edible plants to meet the design characteristic of a garden or designed landscape. AO2 also allows the learner to investigate the range of support structures available within edible landscapes and to select the most appropriate system for the characteristics of the garden. AO3 integrates this topic area with others considering the wider personal and societal benefits of edible landscapes.		

Element 7	Short-term plantings	
AO1: **Knowledge**	AO2: **Application**	AO3: **Integration**
Characteristics of plant species suitable for short-term plant displays e.g. traditional bedding, mazes, annual meadows. Plants suitable for seasonal display: • annuals • half-hardy annuals • bulbs • shrubs • short-lived perennials. The positive and negative environmental impact of seasonal plant displays.	Evaluation of plant species for use in short-term plantings.	The environmental and biodiversity impacts of the production of bedding plants for short-term seasonal display. The carbon and water footprint of short-term plant displays.
Commentary		
Horticulture can be good for the environment, but it is not always. In this topic area AO1 considers the characteristics of plant species suitable for short-term displays, with AO2 evaluating suitable plant species for such displays, while AO3 considers the wider environmental and biodiversity impact of such displays.		

Unit:	**2**
Topic:	**3**
Title:	**Horticulture and Society**

Topic overview

The role that horticulture plays in enhancing health and wellbeing is receiving increasing recognition. Horticulture, at its best, connects people, builds communities, creates beauty and improves the lives of all.

The green spaces horticulturists create positively impact on peoples' lives. These spaces change behaviours, they improve both physical and mental health, they support environmental resilience, they build stronger communities and can reinforce cultural identity.

The importance of horticulture in wellness, therapy, social inclusion and community cohesion is one of the most exciting horticultural developments in recent years.

Element 1	Wellbeing	
AO1: **Knowledge**	AO2: **Application**	AO3: **Integration**
The social benefits of gardening, to include: • physical health • mental health • social inclusion • antisocial behaviour. The social benefits of: • urban greening • allotments • domestic gardens, parks, botanical and heritage gardens.	The design of gardens to include: • health • mindfulness • wellbeing.	The historic role of horticulture in improving the lives of people. Historical contexts e.g. the development of movements such as the Arts and Crafts movement, the development of parks. Links between horticulture and nature. The development of nature therapy.
Commentary		
Published work from a variety of organisations (including the RHS) highlight the significant benefit green spaces have on people, their behaviour and their health and wellbeing. AO1 investigates the measurable impact plants and gardens have on health and wellbeing. AO2 applies this knowledge by investigating the impact of horticulture on health, wellbeing and the design of gardens. AO3 links to topics such as planting styles to take a historical perspective on horticulture, health and wellbeing.		

Element 2	Environment

AO1: **Knowledge**	AO2: **Application**	AO3: **Integration**
Positive impacts of horticulture on the environment, to include: • carbon storage in soils and plant tissue • plant ecosystem services including air quality improvement, temperature regulation, noise reduction, flood mitigation and water management • biodiversity. Negative impacts of horticulture, to include: • carbon footprint • machinery emissions • peat extraction • single use plastic • water management • heating of glasshouses and structures • waste and end of life impacts. The principles and implications of climate change. Environmental benefits of: • urban greening • allotments • domestic gardens • parks • botanical and heritage gardens.	Sustainable horticultural practices, to include: • the carbon footprint of plants • water management • composting of green waste • soil carbon management with no dig systems • alternatives to plastics.	How horticultural practices can support the environment and ecosystems. The impact of climate change on planting styles and biodiversity.

Commentary

Although horticulture can be hugely beneficial to the environment, it can also be damaging. The positive and negative impacts are considered in AO1 along with the principles and the implications of climate change, with AO2 including horticultural practices, and suggesting new approaches which minimise the risk of negative environmental impacts. Negative aspects could include the heating of glasshouses, the transport of plants, or the recycling of tools at end of life.

AO3 broadens the topic to review the environmental impacts of climate change on planting styles and biodiversity.

Element 3	Economy	
AO1: **Knowledge**	AO2: **Application**	AO3: **Integration**
UK horticultural sectors, to include: • garden tourism • garden maintenance and landscaping • plant production • retail • food production • arboriculture.	The scale and value of ornamental horticulture to the UK economy, to include: • garden tourism • garden maintenance and landscaping • retail • ornamental plant production.	The additional value of horticulture, to include: • social inclusion • increased biodiversity • reduced crime • improved health and wellbeing.
Commentary		
Lead organisations and government departments publish figures on the economic impact of horticulture on the UK economy. AO1 allows learners to identify the key sectors that make up the horticultural industries within the UK, this knowledge is developed at AO2 by considering the scale and value of the ornamental horticulture industry. AO3 adds to this figure by considering the social value that is derived from improved health and wellbeing, reduced crime and the positive impacts on biodiversity to paint a holistic picture of the value of horticulture in the UK.		

Element 4	Community	
AO1: **Knowledge**	AO2: **Application**	AO3: **Integration**
Types of community horticultural projects and their impact, to include: • community and school growing projects • Britain in Bloom • therapeutic horticulture • social enterprises • parks and public green spaces • community kitchens in gardens.	The benefits of community projects, to include: • helping to reduce social isolation • contributing to positive physical mental health and wellbeing • bringing communities together • making people proud of where they live • the supply of fresh food • engagement in and ownership of food production.	The benefits that community projects and volunteering bring to the preservation of heritage gardens and the development of biodiverse plantings.
Commentary		
Community horticulture is a relatively new and growing area of the horticultural industries. Community projects engage communities in horticulture. The projects are varied, from the greening of urban areas to the use of horticulture within therapeutic settings. AO1 introduces a range of community horticulture projects, with AO2 investigating the benefits of such projects and AO3 considering the wider role of volunteering.		

Unit:	**2**
Topic:	**4**
Title:	**Biodiversity**

Topic overview

Green spaces, especially within urban communities, can have huge implications on biodiversity. Horticulturists apply their knowledge of plants, planting styles and community to enhance biodiversity.

Therefore, as they create and maintain gardens and designed landscapes, horticulturists can have a profound impact on biodiversity.

Within this topic learners are introduced to the concept of biodiversity, considering the principles of food chains, the relationships between primary and secondary consumers, the impacts of climate change on plants, the importance of habitats within horticultural sites, the role of citizen science projects to monitor biodiversity and the concept and impacts of biodiversity action plans.

Element 1	Plants and biodiversity	
AO1: **Knowledge**	AO2: **Application**	AO3: **Integration**
The basic principles of a food chain/web including producers plus primary, secondary and tertiary consumers. The relationship between plant diversity and associated primary and secondary consumers in a habitat e.g. ragwort and cinnabar moth. The importance of re-evaluating concepts e.g. considering pests / weeds from a biodiversity perspective. The role of botanical gardens in conservation and education.	The potential of plant species in the provision of food for pollinating insects, and habitats for plants, animals and fungi. The positive impact on biodiversity of wildflower plantings e.g. food for pollinators.	The impact of plant selection on biodiversity. The benefits of natural plantings for local communities. The importance of engaging with community organisations to champion natural plantings. The value of developing private gardens as biodiverse spaces.
Commentary		
All life on earth is directly or indirectly reliant on plants. Plant selection by horticulturists has a huge impact on biodiversity. This role is introduced in AO1 by identifying the basic principles of a food chain. AO2 adds a horticultural context, assessing the biodiversity potential of different plant species. AO3 broadens the topic out to consider the impact of plant selection on biodiversity, the benefits of natural plantings on local communities, the importance of community engagement, and the value that can be derived from developing the UK's gardens as biodiverse spaces. This area integrates closely with Element 4 & 5 of Topic 3 (Unit 2). This area also integrates with Equality and Diversity and Sustainability as qualification-wide outcomes.		

Element 2	Impact of climate change	
AO1: **Knowledge**	AO2: **Application**	AO3: **Integration**
The impact of climate change on plants, to include: • temperature • humidity • water management • emerging new pests and pathogens.	Criteria to consider when selecting plant material, to include: • water management • provenance • hardiness • heat tolerance • susceptibility to spreading and emerging pests and diseases • weather extremes, changes in phenology. The impact of using non-native plant species including resilience and biodiversity.	The impact of climate change on existing plantings. Plant selection for climate change resilience and biodiversity.
Commentary		
Horticulturists increasingly have to factor in a changing climate when selecting plants. AO1 introduces this topic by identifying the impacts of climate change on plants. AO2 considers a range of criteria that should be considered when selecting plant material for new plantings, along with the impacts of using non-native species from the perspective of increasing the resilience of plantings and the consequences of such plant selections in a changing climate. AO3 applies a more holistic overview of the topic, considering the impact of climate change on both existing plantings and the selection of plants for future plantings.		

Element 3	Creating habitats	
AO1: **Knowledge**	AO2: **Application**	AO3: **Integration**
Importance of habitats in horticultural sites, to include: • layering of plantings • diversity of habitat e.g. groundcover, trees • nesting sites • shelter • food • overwintering / hibernation sites • access for foraging animals • habitat corridors • soil.	How gardens can be maintained and designed to create habitats and encourage wildlife.	Plant associations / planting styles suitable for creating habitats. Selection of plant species with adaptations that favour wildlife. The benefits of wildlife for local communities.
Commentary		
Horticulturists can make a huge difference for wildlife by creating habitats. AO1 identifies the types of habitat wildlife requires, while AO2 takes this concept further by considering how gardens can be managed to create such habitats. AO3 considers the use of plant associations and selecting plants with adaptations that favour wildlife.		

Element 4	Citizen science and species surveys	
AO1: **Knowledge**	AO2: **Application**	AO3: **Integration**
Wildlife present in gardens and its requirements, to include: • wildflowers • small mammals • birds • invertebrates. The role of citizen science projects to identify species' population trends e.g. RSPB Big Garden Bird Watch, Butterfly Conservation.	How to identify and record wildlife in a horticultural situation and use data to inform habitat creation.	Plant associations/planting styles suitable for creating habitats. Selection of plant species with adaptations that favour wildlife. The benefits of wildlife for local communities.
Commentary		
The RSPB Big Garden Bird Watch, or the work of Butterfly Conservation is an example of how citizen science can be used to track and monitor wild populations of bird species, or butterflies. AO1 introduces the concept by identifying the species that might share an average urban garden, with AO2 involving learners in collating data to build up an indication of biodiversity. AO3 considers the role of planting styles and plant associations in increasing the range of species within the gardens along with the way that wildlife can enhance local communities.		

Element 5	Biodiversity Action Plans	
AO1: **Knowledge**	AO2: **Application**	AO3: **Integration**
Biodiversity Action Plans (BAPs), to include: • purpose • importance • legislation.	The impact of BAPs on garden maintenance decisions.	The impact of BAPs within community horticulture, heritage horticulture and the creation of garden styles e.g. incorporation of standing deadwood into a formal or historic garden.
Commentary		
Biodiversity Action Plans are vital management tools, which can have significant impact on gardens, and their maintenance. AO1 introduces the concept of BAPs and AO2 analyses impact of BAPs on garden maintenance decisions. AO3 considers the broader impacts of BAPs on community horticulture, on heritage horticulture and on planting styles.		