



RHS Qualifications

RHS Level 2 Certificate in the Principles of Horticulture

Qualification Specification September 2018

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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 take into account 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.

3. Level 2 Certificate in the Principles of Horticulture

3.1 Introduction

This qualification provides a route to employment in professional horticulture by assessing knowledge of the principles underpinning horticultural practices, and supports career development for those already working in the profession. It also provides a foundation for further learning or training in the field of horticulture.

There are no pre-requisites for entry to the qualification.

The qualification is on the Register of Regulated Qualifications.

Qualification Number: 601/0355/3

3.2 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 are 196.

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 315.

3.3 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.

3.4 Qualification Structure

The qualification will be awarded to those who successfully complete the following eight mandatory units:

RHS Ref	Unit	Level
R2101	Plant classification, structure, and function Unit reference number K/505/2967	2
R2102	Plant nutrition and the root environment Unit reference number R/505/2834	2
R2103	Maintaining plant health Unit reference number Y/505/2835	2
R2104	Understanding plant propagation Unit reference number D/505/2965	2
R2111	Understanding garden features, plant selection and planning Unit reference number F/601/0251	2
R2112	Understanding the choice, establishment and maintenance of garden plants and lawns Unit reference number T/601/0263	2
R2113	Understanding the production of outdoor vegetables and fruit Unit reference number A/601/0264	2
R2114	Understanding protected environments and their use in plant cultivation Unit reference number L/601/0267	2

3.5 Assessment

Each unit will be assessed by a separate written examination covering all learning outcomes specified in the unit.

Examinations must be taken in a centre approved by RHS Qualifications, or under arrangements for exceptional supervision agreed by RHS Qualifications.

Examinations must be conducted in accordance with the RHS Regulations for the Conduct of Examinations. Examinations will be offered twice a year in February and June.

Past examination papers including the examiner's comments are published for the past four examination sessions. These are available for download under the appropriate qualification section of the RHS website.

3.6 Language

Examinations will be offered in English.

3.7 Learning Resources

There is a wide range of books 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 resources best support their studies, or to choose the most appropriate resources for their needs from the wealth of material available.

3.8 Grading

A unit will be awarded to a candidate who achieves a mark of 50% or more in the written examination for that unit.

Where a candidate achieves a mark of 70% or more in the examination for the unit, the unit will be awarded with commendation.

RHS Ref	Unit	Mark	Pass with Commendation	Pass
R2101	Plant classification, structure, and function	100	70	50
R2102	Plant nutrition and the root environment	60	42	30
R2103	Maintaining plant health	60	42	30
R2104	Understanding plant propagation	60	42	30
R2111	Understanding garden features, plant selection and planning	100	70	50
R2112	Understanding the choice, establishment and maintenance of garden plants and lawns	60	42	30
R2113	Understanding the production of outdoor vegetables and fruit	60	42	30
R2114	Understanding protected environments and their use in plant cultivation	60	42	30

Where a candidate receives commendation in all eight theory mandatory units, the qualification will be awarded with commendation.

4. Approved Centres

Centres wishing to offer examinations leading to RHS qualifications must be approved by RHS Qualifications.

Applications for approval should be sent to the Quality Assurance and Relationships Officer at the contact details in section 1.

5. Candidate Registration

RHS Approved centres should register candidates for examinations in the units of the qualification through the RHS Qualifications web portal.

Approved Centres undertake to obtain on behalf of their learners a Unique Learner Number (ULN), unless the learner chooses not to have one.

If centres supply an email address for candidates at the time of registration, candidates will be invited to open an account on the RHS Qualifications web portal, and will be able to view their examination history, their current registrations, and their results when available.

6 Reasonable Adjustments and Special Consideration

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

Special consideration is given following the examination to candidates 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 webpPortal, 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 candidate. Application must be made within specified timescales.

7. Enquiry about Results service

The following service is available to candidates who have a query regarding their examination result:

Re-mark and Feedback

Re-marking of the examination paper by an independent examiner.

Feedback will be provided identifying areas of strength and weakness with constructive suggestions for improvement.

Candidates requesting a re-mark need to be aware that grades may go down as a result of the re-marking.

Applications for the 'Enquiry about Results Service' must be made through the Approved Centre where the candidate registered for the examination. This service will be available for 28 days from the date of release of the results to Approved Centres on the RHS web portal.

8. Examination Dates

For a full list of examination dates please see the RHS Qualifications Examination Dates, this document is available on the Qualifications page on the RHS website, and on the RHS web portal

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 service or entry for the examination.

Late Entries

RHS Qualifications publishes annually, and distributes to Approved Centres, 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. The total fee charged for late entries is twice the standard examination fee for each unit

Replacement Certificate (if lost, damaged or destroyed)

The fee for a replacement certificate can be found on the RHS Qualifications Fees Notice. Please send your request to the Qualifications Department.

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.

10 Unit Equivalents

Below is a table listing unit equivalences that have been granted for this qualification. Candidates who have been awarded a unit credit certificate for the previous unit number will not receive a unit certificate for the equivalent unit number.

Current Equivalent Unit Number	Previous Unit Number
K/505/2967	H/601/0307
R/505/2834	A/601/0314
Y/505/2835	K/601/0342
D/505/2965	M/601/0343

11. Appeals Procedure

An Appeals procedure exists to conduct appeals lodged by candidates 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 cases where there is irregularity or malpractice in the conduct of examinations and where RHS Qualifications has imposed a penalty on a candidate, tutor or invigilator, and 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.

12. Policy on Malpractice and Maladministration

Malpractice consists of those acts which undermine the integrity and validity of the 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 candidates 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.

Plant classification, structure and function

RHS reference number: R2101

Unit reference number: K/505/2967

Unit equivalent to: H/601/0307

Unit guided learning: 31

Level: Level 2

Unit purpose and aim(s): This unit will enable candidates to develop an understanding of the basis on which higher plants are classified and named, and to appreciate the role and function of morphological and anatomical features in higher plants. The unit will ensure that the fundamental physiological processes within the plant are understood including photosynthesis, respiration and water movement. Additionally students will understand the mechanisms of pollination, fertilisation, seed formation and subsequent germination.

Learning outcome The Learner will	Assessment criteria The learner can	Indicative column The learner should be able to
1. Know the characteristics and the naming of the main groups of plants and their life cycles.	1.1 Describe plant groups of significance to horticulture.	Identify the differences between conifers and flowering plants; conifers - mostly evergreen, woody, cones, and naked seeds, perennials. Flowering plants - evergreen and deciduous, herbaceous and woody, flowers and enclosed seeds, all life cycles. Describe the differences between monocotyledons and dicotyledons: features of root, stem, leaf, flower and seed including internal arrangements of vascular bundles in stems and roots.
	1.2 Understand botanical and horticultural plant names.	State the reasons why botanical plant names are important. Stability, uniqueness, internationally understood, confusion over common names allows plant identification and communication. Describe the binomial system of naming plants. State the meaning of the terms 'genus' and 'species' and state how they are written, with reference to THREE plant examples. Describe the naming of cultivated plants. State the meaning of the term cultivar and state how it is written with reference to three plant examples.
	1.3 Describe the stages in plant growth.	Describe the stages of the life-cycle of a plant: seed, juvenile (vegetative), adult (reproductive), senescence, death and their significance for horticulture.

	<p>1.4 Define a range of botanical and horticultural terms relating to plant growth.</p>	<p>Define the botanical terms: 'annual', 'ephemeral', 'biennial' and 'perennial' and the horticultural meanings of 'annual', 'biennial' and 'perennial'. (An example of different meanings is that <i>Dipsacus fullonum</i> (teasel) is a true biennial, <i>Erysimum cheirii</i> (wallflower) is used as a biennial in horticulture but is a perennial).</p> <p>Define the botanical terms: 'herbaceous', 'woody', 'evergreen', 'semi-evergreen'.</p> <p>Define the horticultural terms: 'tender perennial', 'half hardy annual', and 'hardy annual'. (A 'tender perennial' cannot survive frost; a 'half hardy annual' is sown under protection early in the season then planted out; a 'hardy annual' is sown in situ).</p> <p>Define the terms 'shrub' and 'tree'.</p> <p>TWO plant examples should be known for EACH term.</p>
<p>2. Know the structure and function of plant cells, tissues and vegetative organs.</p>	<p>2.1 Describe the structure of plant cells and state the functions of plant cell components and tissues.</p>	<p>Draw a typical plant cell.</p> <p>State the function of: cell wall, cell membrane, nucleus, vacuole, cytoplasm, chloroplast & mitochondrion.</p> <p>Describe where cell division is located within the plant - apical and lateral meristems.</p> <p>Describe how plants increase in size – cell division and enlargement (NO DETAILS OF MITOSIS ARE REQUIRED).</p>
	<p>2.2 Describe the characteristics and state the function of plant tissues.</p>	<p>State what is meant by the term 'plant tissue'.</p> <p>Describe the characteristics and function of: protective (epidermis), meristematic (cambium), transport (phloem, xylem) and packing (parenchyma) plant tissues.</p>
	<p>2.3 Describe the structure and state the functions of roots.</p>	<p>State the primary functions of the root - anchorage, water and mineral uptake.</p> <p>Describe root types - 'tap', 'lateral', 'fibrous' and 'adventitious', to include the origin of each type e.g. tap root from radicle, adventitious roots from stem.</p>

		<p>Describe the difference between monocotyledon and dicotyledon roots.</p> <p>Describe the structure of the root and state the function of its components - internal and external structures to include drawings of transverse and longitudinal sections through a young dicotyledon root to show the following components: root cap, apical meristem, zone of elongation, zone of differentiation, root hairs, epidermis, cortex, endodermis, pericycle, phloem, xylem and cambium.</p> <p>Describe how the root is adapted to perform other functions - storage/perennation, tap root (<i>Daucus</i>) and root tuber (<i>Dahlia</i>), climbing (<i>Hedera</i>) and support/prop (<i>Zea</i>).</p>
	<p>2.4 Describe the structure and state the functions of stems.</p>	<p>State the primary functions of the stem - holding leaves and flowers in optimum positions and transport between roots and leaves.</p> <p>Describe the structure of the stem and state the functions of its components - internal structures to include drawing of a transverse section through a young dicotyledon stem to show the following components: epidermis, cortex, cambium, phloem, xylem, pith, vascular bundle and external structures to include lenticels, nodes, axillary and apical buds, scars (scale and leaf).</p> <p>Describe how the stem is adapted to perform other functions - protection: stem spines (thorns of <i>Crataegus</i>) and prickles of <i>Rosa</i>; storage/perennation: corms (<i>Crocus</i>) stem tubers (<i>Begonia</i>) and rhizomes (<i>Iris germanica</i>), climbing: (<i>Wisteria passiflora</i>); natural vegetative reproduction: stolons/runners (<i>Fragaria</i>), rhizomes (<i>Festuca rubra</i>), stem tubers (<i>Solanum tuberosum</i>).</p>
	<p>2.5 Describe the structure and state the functions of leaves.</p>	<p>State the primary function of leaves – photosynthesis.</p> <p>Describe: petiole, lamina, veins, and midrib. Leaf shape, colour and leaf arrangement on the stem – simple, compound (palmate, pinnate).</p> <p>Draw a dicotyledon leaf section to show the following components epidermis, xylem, phloem, veins, palisade & spongy mesophyll, cuticle, guard cells and stomata.</p>

		Describe how leaves are adapted to perform other functions - storage/perennation by bulbs, (<i>Narcissus</i> and <i>Lilium</i>) and water storage (<i>Sedum</i>), protection by leaf spine (<i>Berberis</i>), climbing by tendrils (<i>Lathyrus</i>) and twining <i>petioles</i> (<i>Clematis</i>) and attraction of pollinators by bracts (<i>Hydrangea</i>).
3. Understand the structure and function of flowers fruits and seeds.	3.1 Describe the structure and state the functions of flowers.	<p>State the functions of flowers: to aid pollination, give rise to seeds and fruits.</p> <p>Draw a vertical section of a monocotyledon flower (not grass) and a dicotyledon flower to show where appropriate: receptacle, tepal, sepal, petal, calyx, corolla, nectary, anther, filament, stamen, stigma, style, ovary and ovule.</p> <p>State the meaning of 'monoecious' and 'dioecious' in relation to plants. Know TWO examples of each.</p> <p>State the meaning of the term 'pollination'.</p> <p>Describe the characteristics of wind and bee pollinated plants - variations in flower structure and pollen.</p>
	3.2 Describe the structure and functions of fruits and seeds.	<p>State the meaning of the term 'fertilisation' - fusion of a male gamete from pollen with a female gamete in the ovule to produce the embryo.</p> <p>State the meaning of the terms 'fruit' and 'seed' - a fruit is formed from the ovary after fertilisation. A seed is formed from the ovule after fertilisation.</p> <p>State the function of fruits and seeds - Fruit: distribution and protection of the seed and may impose dormancy. Seed: distribution and protection of the embryo, may impose dormancy, gives rise to new plants.</p> <p>Describe the means by which seeds are dispersed - wind: (wing, parachute and censer (papaver)); water*; explosive; animals: (attachment, scatter hoarding and frugivory). TWO plant examples for EACH of the above except where indicated * where only ONE is required.</p> <p>Describe the internal and external structure of the seed and state the function of the various parts: testa, cotyledon, embryo, radicle, plumule, hypocotyl, epicotyl, endosperm, hilum, micropyle.</p>

		<p>Examples to be studied to include French bean (<i>Phaseolus vulgaris</i>) and broad bean (<i>Vicia faba</i>).</p> <p>Describe ONE example of epigeal germination and ONE example of hypogeal germination, germination of French bean (<i>Phaseolus vulgaris</i>), and broad bean (<i>Vicia faba</i>).</p>
<p>4. Understand the importance of photosynthesis, respiration, and the movement of water and minerals through the plant.</p>	<p>4.1 Describe photosynthesis and the factors that affect it.</p>	<p>State the equation for photosynthesis in words (carbon dioxide, water, sugars, oxygen) and state the necessity for chlorophyll and light.</p> <p>List the environmental factors that affect the rate of photosynthesis: temperature, light (intensity, quality/PAR and duration), carbon dioxide, water and mineral nutrients.</p> <p>NO DETAILS OF WAVELENGTH ABSORPTION & ACTION SPECTRA ARE REQUIRED.</p> <p>Describe how these factors affect the rate of photosynthesis: to include Law of Limiting Factors and how growers can optimise the conditions for photosynthesis.</p> <p>NO DETAILS OF METHODS ARE REQUIRED.</p>
	<p>4.2 Describe aerobic and anaerobic respiration and the factors that affect them.</p>	<p>State the equations for aerobic and anaerobic respiration in words:</p> <p>Aerobic: sugars, oxygen, water, carbon dioxide, high yield of energy.</p> <p>Anaerobic: sugars, ethanol, carbon dioxide, low yield of energy.</p> <p>List the factors that affect the rate of respiration: oxygen and temperature.</p> <p>Describe how these factors affect the rate of aerobic respiration.</p> <p>Describe the significance of anaerobic and aerobic respiration in horticultural situations: waterlogging, propagation, produce storage, seed storage.</p>
	<p>4.3 Describe the movement of water and minerals through the plant.</p>	<p>Distinguish between diffusion and osmosis to include: gaseous and liquid diffusion, transpiration, and water uptake. Identify examples of diffusion in plants, to include: transpiration and gaseous exchange.</p>

		<p>Identify examples of osmosis in plants, to include: water uptake into cells, turgor, and cell expansion.</p> <p>Describe the pathway of water movement from the soil through the plant into the atmosphere - soil water: pathway across the root (root hairs, osmosis across root cells, flow through root cell walls, endodermis); transport through xylem of stem (transpiration pull): pathway across leaf, (xylem in veins, osmosis across leaf cells, flow through leaf cell walls, evaporation from leaf cell walls into mesophyll spaces); diffusion through stomata of leaf.</p> <p>DIAGRAM OF PATHWAY REQUIRED.</p> <p>State what is meant by the term 'transpiration'. List the factors that affect the rate of transpiration: relative humidity, temperature, wind speed.</p> <p>Describe how the plant may limit water loss, to include: stomatal closure and leaf adaptations (hairs, thick cuticle, needles). ONE named plant example should be known for EACH adaptation.</p> <p>Describe the uptake and distribution of mineral nutrients in the plant: nutrients from soil solution active uptake against concentration gradient into root cells, transport through the plant in xylem, distribution through phloem.</p>
	<p>4.4 Describe the relationship between leaf structure and physiology.</p>	<p>Describe how the internal and external structure of the leaf designed to maximise photosynthesis and minimise transpiration.</p> <p>This should be studied with reference to a typical dicotyledon leaf.</p>

Plant nutrition and the root environment

RHS reference number: R2102

Unit reference number: R/505/2834

Unit equivalent to: A/601/0314

Unit guided learning hours: 23

Unit Level: Level 2

Unit purpose and aim(s): This unit will enable candidates to develop an understanding of the constituents, properties and management of soils and growing media.

Learning outcome The Learner will	Assessment criteria The learner can	Indicative column The learner should be able to
1. Understand the physical and chemical properties of soils.	1.1 Describe the formation of typical mineral soils.	Describe the natural processes of soil formation: weathering of parent rock (physical, chemical and biological), addition of organic matter. Development of main horizons: organic layer, topsoil, subsoil, parent rock.
	1.2 Describe the properties of soil that contribute to the healthy growth of plants.	Compare and contrast the properties of topsoil with subsoil: organic matter content (living and dead organisms, humus), colour, pore space, aeration, water content, nutrient content. Suitability for plant growth.
	1.3 Define soil texture and describe associated characteristics.	Define the term 'soil texture'. Particle sizes of stones, sand, silt, clay (using Soil Survey England and Wales classification). Describe the characteristics of the following soils: sandy loam, silty loam and clay loam: feel (gritty, silky, sticky/hard), nutrients, water retention, temperature.
	1.4 Define soil structure and describe the root environment.	Define the term 'soil structure'. Crumb structure and its influence on plant growth: crumb formation and destruction. Relation between pore space, air and water. Saturation point, field capacity, available water content, permanent wilting point, soil moisture deficit. Importance of an appropriate balance between air and water for the healthy growth of plants.

	<p>1.5 Describe how the root environment can be improved and protected.</p>	<p>Describe cultivations, to include single and double digging, rotary cultivation, forking, raking, consolidation; 'no dig' method; bed systems.</p> <p>Addition of organic and inorganic material (grit/sand, lime).</p> <p>Avoidance and removal of compaction (pans and surface 'after capping'; mulching, green manure, timing of cultivation, 'sub-soiling').</p> <p>Managing soil water content: identify poor drainage (surface symptoms, soil colour, soil smell, indicator plants, surface run off);</p> <p>identify causes of excess water (compaction, run off e.g. patios, high water table);</p> <p>identify appropriate ways of dealing with excess water (soakaway, french drain, raised bed, appropriate planting);</p> <p>identify appropriate irrigation methods (watering can, hose, sprinkler, seep hose; time of day; depth of wetting).</p> <p>NO DETAIL OF DRAINAGE AND IRRIGATION SYSTEMS ARE REQUIRED.</p>
<p>2. Know the importance of organic matter in the root environment.</p>	<p>2.1 Describe the role of organic matter in the soil.</p>	<p>Identify the key categories: dead and living organic matter and humus.</p> <p>Food for soil organisms, nutrient release and recycling .</p> <p>NO DETAILS OF NUTRIENT CYCLES REQUIRED</p> <p>Influence on soil structure (living, dead organisms, humus), water availability, workability, colour.</p>
	<p>2.2 Describe the characteristics and uses of different types of organic matter added to the soil.</p>	<p>Describe the characteristics of the following materials: farmyard manure, garden compost, mushroom compost, composted green waste, leaf mould, chipped bark, composted straw, green manure and crop debris.</p> <p>Describe the appropriate uses for the above materials, to include: mulching, soil improvement, nutrient supply.</p> <p>Describe the benefits and limitations of using the above materials.</p>

		<p>State the purpose of mulching and compare organic mulching materials with inorganic alternatives (eg polythene, woven fibres, gravel, glass).</p> <p>State the environmental implications of mulching and mulching materials, the effect on the soil of green manures.</p>
	2.3 Describe methods of composting and their use/application in horticultural practices.	<p>Describe the importance of the following in the process of composting: choice of material, ratio of green to woody material, aeration, moisture content, lime, pH, temperature, insulation, accelerators, volume, establishment and development.</p> <p>Describe the creation of hot beds.</p> <p>Describe composting using wormeries.</p> <p>Describe the use of composted plant material as a soil improver, mulch, supplier of nutrients.</p> <p>Describe how to make and use comfrey and nettle tea in order to supply nutrients.</p> <p>State the environmental implications of the above mentioned practices.</p>
3. Understand plant nutrition provided by soil and other growing media.	3.1 Describe a range of nutrients required for healthy plant growth.	<p>Major: nitrogen, phosphorus, potassium, calcium, magnesium.</p> <p>Minor: Iron.</p> <p>State ONE role of EACH of these nutrients in the plant.</p> <p>Describe the visual symptoms of deficiency of EACH nutrient listed above.</p> <p>Describe the influence of nitrogen, potassium and phosphorus on plant growth and development e.g. nitrogen for leafy growth.</p>
	3.2 Explain the significance of soil pH to plant growth.	<p>Describe what is meant by the pH terms: acidic, neutral and alkaline/basic.</p> <p>State the pH range found in garden soils (approx 4 – 8).</p> <p>State why 6.5 is the most suitable pH for a wide range of plants in the British Isles.</p>

		<p>State the effects of soil pH on soil structure (soil organisms, crumb formation) and nutrient availability (lime induced chlorosis).</p> <p>Identify materials used to influence the soil pH (lime, sulphur and organic materials). State the benefits and limitations of each (environmental, health and safety issues, timing of application, effectiveness of the material).</p> <p>Explain how plant selection is influenced by soil pH to include suitable named plant examples (minimum of THREE for EACH of acidic, neutral and alkaline/basic).</p>
	3.3 Describe how plant nutrients can be provided and maintained.	<p>Identify the characteristics of organic and inorganic sources of nutrients.</p> <p>Define what is meant by 'fertilisers'.</p> <p>State what is meant by EACH of the following terms applied to fertilisers: soluble and slow release, straight and compound, controlled release using ONE NAMED example for EACH fertiliser.</p> <p>State what is meant by EACH of the following terms: base dressing, top dressing, liquid feed, foliar feed, using ONE NAMED situation to illustrate the use of each.</p> <p>State the benefits and limitations of nutrient sources (environmental, health and safety issues, timing of application, variability of the material).</p>
4. Understand the uses of growing media.	4.1 Explain the considerations required when growing plants in containers.	<p>Restricted root volume, water retention & supply, drainage, stability of compost materials, nutrients, partial sterility, weight/density.</p> <p>State the limitations of using soils in containers.</p>
	4.2 Describe a range of compost types.	<p>To include: peat based, peat free (coir, composted green waste, composted bark), ericaceous, loam based, seed compost, potting compost, multi-purpose compost.</p> <p>Describe ONE NAMED situation to illustrate the use of each compost type.</p> <p>Identify the environmental implications of peat in growing media.</p>

	<p>4.3 Explain the considerations required when growing plants in water culture.</p>	<p>State what is meant by the term hydroponics.</p> <p>Aeration, nutrient supply, nutrient levels and pH control, water supply and quality, pest and disease control, automation.</p> <p>Describe TWO methods of growing plants in water culture, to include: NFT (nutrient film technique), substrate culture (rockwool).</p> <p>State the situations in which water culture can be used, to include: green walls, vegetable production (tomatoes), interior landscaping.</p> <p>Identify the environmental implications of growing plants in water culture.</p>
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Maintaining plant health

RHS reference number: R2103

Unit reference number: Y/505/2835

Unit equivalent to K/601/0342

Unit guided learning hours: 22

Unit level: Level 2

Unit purpose and aim(s): This unit will enable candidates to develop an understanding of pest, disease and weed life cycles including modes of infestation. Cultural, biological, chemical and integrated systems are explored.

Learning Outcomes The learner will	Assessment Criteria The learner can	Indicative Column The learner should be able to
1. Understand the importance of using safe, healthy and environmentally sustainable practices for the maintenance of plant health.	1.1 Explain what is meant by physical, cultural, chemical, or biological control.	<p>Explain what is meant by different methods for pest and disease control to include: physical; cultural; chemical; biological.</p> <p>State TWO benefits and TWO limitations of using EACH method of control.</p> <p>Describe ONE example of EACH method of control and how risks to people and the environment can be minimised.</p>
	1.2 Explain the importance of natural balances in plant protection.	<p>Explain the importance of natural balances in plant protection to include beneficial organisms (ladybirds, lacewings, hoverfly, hoverfly larvae, frogs, hedgehogs, birds).</p> <p>Give TWO examples of how beneficial organisms can be encouraged.</p> <p>Give TWO examples of how garden practices can disturb these balances, including the use of pesticides.</p> <p>Describe TWO methods that can be used to restore and maintain the natural balances to minimise the need for pesticides</p>
	1.3 Describe how the selection of plants can help to avoid plant health problems.	<p>Describe how the selection of plants can help to avoid plant health problems including:</p> <ul style="list-style-type: none"> - choice of resistant cultivars - growing plants appropriate to a situation and soil. Describe ONE example of an appropriate use of a resistant cultivar.

		Describe TWO examples of an appropriate choice of a plant for NAMED situations.
2. Understand the problems posed by weeds in horticulture and how these problems can be minimised.	2.1 Explain why weeds need to be controlled.	Describe what is meant by a weed, to include 'a plant growing out of place'. Describe how weeds cause problems to include: <ul style="list-style-type: none"> - the reduction of plant growth, to include competition for light, nutrients and water. - the reduction of the visual appeal of plantings. - the role of weeds as alternate hosts for plant pathogens, to include white blister rust of brassicaceae and clubroot.
	2.2 Describe the biology of ephemeral, annual and perennial weeds.	State what is meant by EACH of the following types of weed and give the botanical names of TWO examples: <ul style="list-style-type: none"> - ephemeral to include <i>Cardamine hirsuta</i> (hairy bitter cress) and <i>Capsella bursa-pastoris</i> (Shepherds purse). - annual to include <i>Veronica persica</i> (Speedwell) and <i>Poa annua</i> (Meadow grass). - perennial to include <i>Ranunculus repens</i> (Creeping buttercup) and <i>Aegopodium podagraria</i> (Ground elder). Describe how these types of weeds relate to horticultural situations, to include: <ul style="list-style-type: none"> - recently cultivated soil - herbaceous perennial borders - woody perennial plantings - lawns State the botanical names of TWO weeds associated with EACH of these situations.
	2.3 Describe how weeds can be controlled.	State what is meant by contact, translocated and selective herbicides Describe ONE situation where EACH type of herbicide can be used appropriately. State the active ingredient of ONE example of EACH type of herbicide.

<p>3.1 Understand the problems posed by pests and methods by which they can be minimised.</p>	<p>3.1 Explain why pests need to be controlled.</p>	<p>State what is meant by the term 'plant pest'. Describe the damage done by:</p> <ul style="list-style-type: none"> - rabbits - cabbage white (large white) butterfly larvae - black bean aphid - peach potato aphid - two spotted spider mite - glasshouse whitefly - vine weevil - slugs - potato cyst eelworm
	<p>3.2 Describe the life-cycle of garden pests.</p>	<p>Describe in outline the life-cycles of:</p> <ul style="list-style-type: none"> - cabbage white (large white) butterfly - black bean aphid - glasshouse whitefly - vine weevil - slugs - potato cyst eelworm
	<p>3.3 Describe the biology of pests.</p>	<p>Describe methods of feeding from the list in 3.1. to include:</p> <ul style="list-style-type: none"> - piercing/sap sucking - biting - rasping <p>Describe the method of breathing used by insect pests. Other biology needed to understand control.</p>
	<p>3.4 Explain how pests can be controlled.</p>	<p>Describe TWO different methods of minimising (including prevention) the effects of EACH of the plant pests named in 3.1; methods should be selected from more than one of the control options available (chemical, physical, cultural, biological).</p> <p>Describe how knowledge of the life-cycle and biology of pests named in 3.2 contribute to the success of their control.</p>
<p>4. Understand the problems caused by diseases and methods by which they can be minimised.</p>	<p>4.1 Explain why plant diseases need to be controlled.</p>	<p>State what is meant by the term 'plant disease'. Describe the damage caused by plant diseases to include:</p> <ul style="list-style-type: none"> - grey mould - strawberry powdery mildew - damping off - honey fungus - rose black spot - potato blight

		<ul style="list-style-type: none"> - club root - hollyhock rust - apple and pear canker - fireblight - bacteria canker on <i>Prunus</i> - potato leaf curl virus (and vector peach potato aphid) - tobacco mosaic virus
	4.2 Describe the life-cycle of garden diseases.	<p>Describe in outline the life-cycles of:</p> <ul style="list-style-type: none"> - damping off - clubroot - potato blight - honey fungus - bacterial canker - potato leaf curl virus
	4.3 Describe the biology of diseases.	Describe methods of spread of EACH of the diseases named in 4.1
	4.4 Describe how diseases can be controlled.	<p>Describe TWO different methods of minimising the effects (including prevention) of EACH of the diseases stated in 4.1. Methods to be selected from more than one of the control options (physical, cultural, or chemical) available.</p> <p>Describe TWO methods of avoiding the spread of plant viruses.</p> <p>Explain how knowledge of the life-cycle and biology of diseases stated in 4.2 contribute to the success of their control.</p>
5. Understand the problems caused by plant disorders and methods by which they can be minimised.	5.1 Explain why plant disorders need to be controlled.	<p>State what is meant by the term 'plant disorder'.</p> <p>Describe how plants and their growth are affected by:</p> <ul style="list-style-type: none"> - frost - shade - drought - water-logging - high/low temperature damage - soil pH including the symptoms of lime induced chlorosis - fasciation - rose balling
	5.2 Describe methods of preventing and ameliorating plant disorders.	State ONE method of avoiding EACH of the disorders described in 5.1.

Understanding plant propagation

RHS reference number: R2104

Unit reference number: D/505/2965

Unit equivalent to M/601/0343

Unit guided learning hours: 23

Unit level: Level 2

Unit purpose and aim(s): This unit will enable candidates to develop an understanding of the principles and main practices of plant propagation in horticulture.

Learning outcome The Learner will	Assessment criteria The learner can	Indicative column The learner should be able to
<p>1. Understand the role of seeds in plant propagation.</p>	<p>1.1 Describe the structure of seeds and their significance in propagation.</p>	<p>State what is meant by the term 'seed'. State that a seed is the product of sexual reproduction.</p> <p>Identify the benefits to the plant of sexual reproduction (variation allows adaptation to the environment).</p> <p>Describe the internal and external structure of a dicotyledonous seed (<i>Phaseolus vulgaris</i>): testa, cotyledon, embryo, radicle, plumule, hypocotyl, epicotyl, hilum, and micropyle.</p> <p>State horticultural benefits of propagating plants from seed, to include:</p> <ul style="list-style-type: none"> - produces variation from which new cultivars can be developed - only method for some species - may get large numbers from each plant - easily stored - can avoid virus transmission <p>State limitations of propagating plants from seed, to include:</p> <ul style="list-style-type: none"> - some plants may not produce viable seed - difficult germination - lack of uniformity - time to maturity - some seeds do not store easily <p>State examples of plants that are usually propagated from seed, to include: <i>Daucus carota</i>, <i>Phaseolus vulgaris</i>, <i>Solanum lycopersicon</i>, <i>Lobelia erinus</i>, <i>Nigella damascena</i>, <i>Lolium perenne</i>.</p>

		State the main horticultural uses of seed, to include: vegetable and bedding production, annuals, lawns.
	1.2 Describe the process of and requirements for successful seed germination.	<p>State what is meant by 'seed viability': seeds contain a living embryo and will germinate when conditions are right.</p> <p>List the requirements for seed germination: moisture, temperature, oxygen, light/dark.</p> <p>State the meaning of seed 'dormancy': viable seed fails to germinate even when all germination requirements are met.</p> <p>Describe the changes that take place in a germinating seed, including taking in water, rising respiration rate, breakdown of food store, rapid cell division, the splitting of the seed coat and emergence of the radicle.</p> <p>Distinguish between epigeal and hypogeal germination to include: <i>Phaseolus vulgaris</i> and <i>Vicia faba</i>.</p>
	1.3 Describe appropriate methods of harvesting and storing different types of seed.	<p>Describe the preparation and storage of <i>Phaseolus vulgaris</i> and <i>Nigella damascena</i> seed under EACH of the following headings: harvesting; separation; cleaning; drying; storage conditions and packaging (e.g. paper bag, plastic box, silica gels).</p> <p>State what is meant by the terms: orthodox (dry) and recalcitrant (moist/fleshy) seed. Name examples of seeds requiring cool dry storage, to include: <i>Daucus carota</i>, <i>Phaseolus vulgaris</i>, <i>Lobelia erinus</i>, <i>Nigella damascena</i>, <i>Lolium perenne</i>.</p> <p>Name examples of seeds requiring short-term cool moist storage, to include: <i>Quercus robur</i> and <i>Aesculus hippocastanum</i>.</p> <p>State the effect that storage factors (length of time, temperature, seed moisture content) have on the ability of seed to germinate.</p> <p>Describe the preparation of fleshy fruits (<i>Solanum lycopersicum</i>) for seed storage, under EACH of the following headings: harvesting; maceration; separation; cleaning and drying.</p>

<p>2. Understand methods of propagation from seeds and spores.</p>	<p>2.1 Describe the process of growing seeds in containers.</p>	<p>For EACH of the following plants, identify suitable containers and growing media; describe the method of sowing; pricking out; potting off; aftercare: <i>Begonia semperflorens Cultorum Group</i> (fine seed), <i>Lactuca sativa</i> (medium seed), <i>Cucurbita pepo</i> (large seed).</p> <p>Describe methods of avoiding pest and disease problems, to include: clean water, hygienic conditions (containers, sterile growing media and growing environment), sowing density.</p>
	<p>2.2 Describe the process of growing seeds in open ground.</p>	<p>Describe the ground preparation of an outdoor site for seed sowing to include: weed control, nutrition, levelling, consolidation, tilth.</p> <p>Describe appropriate methods of sowing seed in open ground using a NAMED example in EACH case: broadcast (grass seed mixture), sowing in drills (carrot), station sowing: in groups of 3 or 4 seeds (parsnip), or in a drill or trench (peas), individually (runner beans).</p> <p>For EACH of the above examples named, indicate the appropriate time of sowing and describe the aftercare, to include: watering, thinning, on-going weed control.</p>
	<p>2.3 Describe the propagation of ferns by spores.</p>	<p>To include collection of spores, media used, method of sowing and aftercare.</p> <p>(NO DETAILS OF LIFE CYCLE REQUIRED)</p>
<p>3. Understand the role of vegetative reproduction in plant propagation.</p>	<p>3.1 Describe the significance of vegetative propagation of plants.</p>	<p>State what is meant by the term 'vegetative propagation'. State that vegetative propagation involves asexual reproduction and results in a clone (genetically identical material).</p> <p>Identify the benefit to the plant of asexual reproduction (fertilisation is unnecessary).</p> <p>Identify natural/artificial methods of vegetative propagation, to include: bulbs, corms, rhizomes, stolons/runners, suckers, stem and root tubers, divisions, layers, cuttings.</p> <p>State horticultural benefits of propagating plants by vegetative means, to include: retains characteristics of parent plant, time to maturity, avoids seed dormancy problems, only possible method for some plants.</p>

		State limitations of propagating plants by vegetative means, to include: limited availability of material, lack of variation, transmission of diseases (virus), requirement of different skills compared to seed sowing, requirement for different propagation environments.
4. Understand methods of vegetative propagation.	4.1 Describe how juvenility and plant health affect the success of vegetative propagation.	<p>State what is meant by the term ‘juvenility’.</p> <p>State what is meant by the term plant health, to include: free from pest and disease, nutritional balance, correct light levels.</p> <p>Describe the effect of juvenility and plant health on successful propagation (ability to form roots/stems).</p>
	4.2 Describe methods of vegetative propagation.	<p>State the characteristics of materials used in growing media for vegetative propagation, to include: peat alternative, perlite, sand/grit.</p> <p>Describe how and when to collect and prepare: softwood, semi-ripe and hardwood cuttings. Examples from: <i>Pelargonium Fuchsia Cornus, Buddleja, Chamaecyparis</i>.</p> <p>State the meaning of the terms ‘sticking’ and ‘wounding’; ‘heel cutting’.</p> <p>Describe how and when to propagate by division, examples from: <i>Rhus typhina, Alchemilla mollis, Hosta</i></p> <p>Describe how and when to propagate by layering, to include: air layering, simple layering, serpentine layering; examples from: <i>Ficus elastica, Cotinus Clematis</i>.</p> <p>Describe how and when to propagate by leaf cuttings, to include: leaf petiole, leaf lamina, examples from: <i>Saintpaulia Peperomia; Begonia Rex Cultorum Group; Streptocarpus</i></p> <p>Describe how and when to propagate by leaf bud cuttings, to include: <i>Camellia Clematis</i>.</p> <p>Describe how and when to propagate by root cuttings, to include: <i>Papaver orientale Primula denticulate</i>.</p>

	<p>4.3 Describe the propagation facilities and aftercare for vegetative propagation.</p>	<p>State the environmental conditions required for EACH method of propagation described in 4.2.</p> <p>State a propagation facility for rooting EACH of the types of cutting described in 4.2 (examples to include a heated propagator, mist bench, cold frame, the open ground).</p> <p>Describe how to manage the environment, to include: temperature, moisture/drainage, airflow, relative humidity to encourage the rooting process.</p> <p>State how to avoid damage from ONE NAMED pest and ONE NAMED disease during the rooting process.</p> <p>Describe the aftercare of vegetatively propagated plants (from 4.2), including the removal of diseased, dead material, feeding, hardening off (where appropriate), potting off (where appropriate).</p>
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Understanding garden features, plant selection and planning

RHS reference number: R2111

Unit reference number: F/601/0251

Unit guided learning hours: 29

Unit Level: Level 2

Unit purpose and aim(s): This unit will enable candidates to develop an understanding of basic surveying and design principles and to apply them to basic garden design and planning requirements. Additionally, the unit will enable candidates to develop an understanding of plant selection for soft landscaping.

Learning outcome The Learner will	Assessment criteria The learner can	Indicative column The learner should be able to
Please note that when it states 'could include.....' in the indicative column a candidate can use any examples that are relevant and comply with the assessment criteria of the learning outcome.		
1. Know how to carry out and record a garden survey.	1.1 Describe how to identify potential hazards and risks on a site, including overhead and underground hazards (e.g. electric cables); unsafe buildings, features and trees; topography and existing features (e.g. watercourses and ponds).	Define hazard and risk as used in risk assessments. site topography; unsafe hard landscaping features and garden buildings; trees; areas of water in the garden; overhead and underground services.
	1.2 Describe the potential restrictions which may limit work on the site, including financial constraints; difficulties with access for plant, equipment and materials; topography (degree and extent of slopes); boundary constraints and restrictions on the time the works can be carried out.	Completion of work in stages to suit client's cash-flow, access points for plant and equipment, delivery of materials, the need to negotiate work at boundaries with neighbours, seasonal restrictions to the timing of work (day length, weather) and legal restrictions (local byelaws). Ways to overcome restricted access.
	1.3 State what existing garden features need to be identified, including buildings, hard landscape features, and the trees and plants that are to be retained.	The survey should identify any significant features to be retained such as garden buildings, hard landscaping features, trees and plants with design or sentimental importance and other features that need removal.

	1.4 State why it is necessary to identify the existence of overhead and underground services.	State that the presence of underground services (drainage, water, sewage, gas, oil, electricity, cable TV) may limit where excavations can safely be made, and overhead cables may restrict site access for equipment and large plants. Implications of damaging services in addition to health and safety: cost, inconvenience, damage to soil.
	1.5 Describe how to carry out basic linear surveying techniques, including the use of tapes, offsets and triangulation.	How to carry out a linear survey using measuring tapes; including running measurements along a defined base line, offsets at 90 degrees and triangulation to specific points.
2. Know how to carry out a site appraisal and record essential data.	2.1 State what needs to be recorded when carrying out a site appraisal, including soil type, contour, aspect, micro climate, exposure and drainage.	The collection of physical information about the site; soil depth and texture, pH and drainage, the contour (extent of slopes), aspect and exposure and microclimate (frost pockets, heavy shade, rain shadows, sun traps, wind tunnels); visual clues to areas with microclimates; visual assessment of external features (fine views, eyesores, the style of the house).
3. Understand basic garden planning principles and the elements that contribute to a good design.	3.1 Describe the relevance of garden planning principles to the production of a garden design that 'works' – one that follows accepted 'rules' or 'conventions', and which is pleasing to the eye.	To include examples of how a successful garden design (one which is pleasing to the eye) demonstrates accepted principles of garden planning (unity/cohesion, balance, form, scale/proportion, movement/direction, rhythm, repetition, simplicity).
	3.2 State the meaning of the following terms: symmetry, asymmetry, colour, focal points.	To include examples of each term in a garden context and how colour can be used in garden design to provide unity, adjust mood and play visual tricks. Uses of focal points to include: to draw the eye, to encourage exploration, to distract, to create false perspective, to provide theme interest.
4. Understand the characteristics of accepted garden design styles.	4.1 Describe the difference between formality and informality in garden design.	To include examples of features associated with each style of design, (fountains, knot gardens and wildlife ponds, wildflower meadows).

	4.2 Describe the main characteristics of a knot garden, a landscape garden and a cottage garden.	To include the typical hard and soft landscaping features of a knot garden (clipped hedges, shapes, infill, pattern); a landscape garden (English landscape garden, borrowed views, serpentine lakes, Palladian bridges, ha has, temples, follies, grottos, hermitages, Chinese bridges and pagodas); and a cottage garden (annuals and 'easy' perennials, vegetables, gravel paths, brick edging, picket fences).
5. Understanding the effective and appropriate use of hard landscaping materials.	5.1 Describe a range of horizontal elements: paths, steps, patios and decking. Compare the benefits and limitations of a range of materials for each of the above including concrete, paving and wood.	Comparison to include suitability of each material in practical and in design terms: in-situ concrete, paving (flags, block pavers, brick), wood (railway sleepers, log sections, bark) gravel, man-made decking materials.
	5.2 Describe a range of vertical elements: walls, fences, screens, pergolas, furniture, statuary. For each of the above, compare TWO examples of natural and man-made materials used in their manufacture.	Natural materials to include where appropriate: rock (marble, limestone, flint, slate), wood (timber, wicker), bamboo, reeds. Man-made to include: brick, concrete, plastic, glass fibre and metal. Comparison to include suitability of each material in practical and in design terms.
6. Understand the effective use of soft landscaping elements.	5.3 Describe rock gardens and water features. State TWO examples of manufactured and TWO of natural materials for EACH element.	Rock garden examples to include different types of garden feature for the display of alpines, rock garden, scree garden, troughs; and the materials to include suitable types of stone, hypertufa, artificial rocks, Pulhamite; artificial stone troughs. Water features to include: open water (raised and wildlife ponds, rills) and self-contained features (fountains, pebble ponds) and materials to include puddled clay, butyl liner, drilled natural stones, metal, glass and plastic, wood and brick for raised ponds.
	6.1 Name appropriate grass species for the following types of lawn: hard wearing utility, high quality ornamental, shade tolerant.	Examples could include: a utility lawn must include <i>Lolium perenne</i> , and others from <i>Festuca rubra rubra</i> , <i>Poa pratensis</i> , <i>Agrostis capillaris</i> , an ornamental lawn must include <i>Agrostis capillaris</i> + <i>Festuca rubra subsp. commutata</i> , shade tolerant lawn must include <i>Festuca rubra rubra</i> , and others from <i>Poa nemoralis</i> , <i>Poa trivialis</i> , <i>Lolium perenne</i> .

	<p>6.2 Name FIVE evergreen and FIVE deciduous trees (large shrubs), suitable for planting in a domestic garden. State details of their decorative merits, height and spread and site requirements; describe a situation where each could be used effectively.</p>	<p>Tree no more than 10 metres</p> <p>To include: Evergreen trees: <i>Luma apiculata</i> <i>Arbutus unedo</i></p> <p>Deciduous trees: <i>Malus</i> 'Golden Hornet'</p>
	<p>6.3 Name FIVE evergreen and FIVE deciduous plant species, suitable for hedging or screening (including formal or informal use). State details of their decorative merits, height and spread and site requirements; describe a situation where each could be used effectively.</p>	<p>Examples could include: Evergreen: <i>Taxus baccata</i> Deciduous : <i>Fagus sylvatica</i></p> <p>Give details of the usual size to which plants are grown as a hedge or screen, decorative qualities (formal, informal, leaf, flowering and fruiting); planting requirements and an example of use.</p>
	<p>6.4 Name TEN deciduous and TEN evergreen shrubs suitable for planting in a variety of garden situations. State details of their decorative merits, height and spread and site requirements; describe a situation where each could be used effectively.</p>	<p>Examples could include: Deciduous: <i>Buddleja davidii</i>, <i>Hamamelis mollis</i> Evergreen: <i>Mahonia aquifolium</i>, <i>Rosmarinus officinalis</i></p>
	<p>6.5 Name TEN herbaceous perennials suitable for planting in a variety of garden situations. State details of their decorative merits, height and spread and site requirements; describe a situation where each could be used effectively.</p>	<p>Examples could include: <i>Acanthus spinosus</i>, <i>Verbena bonariensis</i></p>

	<p>6.6 Name TEN Alpine or Rock garden plants suitable for planting in a variety of garden situations. State details of their decorative merits, height and spread and site requirements; describe a situation where each could be used effectively.</p>	<p>Examples could include: <i>Dianthus alpinus</i>, <i>Iberis sempervirens</i></p>
	<p>6.7 Name FIVE plants grown as biennials, which are suitable for planting in a variety of garden situations. State details of their decorative merits, height and spread and site requirements; describe a situation where each could be used effectively.</p>	<p>Examples could include: <i>Digitalis purpurea</i>, <i>Erysimum cheiri</i></p>
	<p>6.8 Name TEN hardy plants grown as annuals, suitable for planting in a variety of garden situations. State details of their decorative merits, height and spread and site requirements; describe a situation where each could be used effectively.</p>	<p>Examples could include: <i>Lathyrus odoratus</i> <i>Calendula officinalis</i></p>
	<p>6.9 Name TEN half-hardy plants suitable for seasonal bedding. State details of their decorative merits, height and spread and site requirements and describe a situation where each could be used effectively.</p>	<p>Examples could include: <i>Nicotiana glauca</i>, <i>Salvia splendens</i></p>
	<p>6.10 Name TEN patio or basket plants suitable for planting in a variety of garden situations. State details of their decorative merits, height and spread and site requirements; describe a situation where each could be used effectively.</p>	<p>Examples could include: <i>Lobelia erinus</i>, <i>Helichrysum petiolare</i></p>

	6.11 Name FIVE bulbs, corms or tuberous plants used for winter or spring interest, and FIVE for summer or autumn interest, in a variety of garden situations. State details of their decorative merits, height and spread and site requirements; describe a situation where each could be used effectively.	Examples could include: <i>Galanthus nivalis</i> , <i>Lilium regale</i>
7. Understand how to incorporate key elements into a cohesive design.	7.1 Describe how elements of hard landscaping should be selected and used to ensure that a design is cohesive.	With reference to 7.1, 7.2 and 7.3 A description of what makes a 'cohesive' design, with examples covering hard and soft landscaping elements and furniture.
	7.2 Describe how elements of soft landscaping should be selected and used to ensure that a design is cohesive.	Coherence - all parts of the design forming a unified whole, linked by consistent styles or materials in hard landscaping and furniture, and themes in planting, to the house itself as part of the garden landscape and the local landscape.
	7.3 Describe how other materials and items (e.g. garden furniture) should be selected and used to ensure that a design is cohesive.	
8. Understand the importance of safe, healthy, environmentally sensitive and sustainable development of garden sites.	8.1 Describe TWO hazards associated with EACH of the following: access, slope, location of features, water, electricity, materials, plants.	Slopes to include inclines on grass, ramps, steps. Exemplar: Hazards of materials to include splinters, sharp edges (possible limitation of re-used, reclaimed and recycled materials), slippery surfaces. Hazards of construction not required.
	8.2 State how the risks related to the hazards identified in 8.1 can be minimised by careful planning during the planning and design stage.	Exemplar: for materials; the risk of slipping on wood decking minimised by specifying non-slip varnishing materials; risk of splinters by specifying planed/sanded timber.

	8.3 Describe how the environmental sustainability of landscaping materials may affect choices made during the planning and design stage.	Environmental sustainability to include: choice of materials from sustainable sources and using local sources to reduce transport; 'reduce, re-use, reclaim, recycle'.
	8.4 State how sustainable practices in the maintenance of a garden can be integrated successfully during the planning and design stage.	Examples to include the harvesting of rain and grey water, composting areas, use of drought-tolerant plants, minimal use of lawns, mulching, no-dig systems, bio-diverse planting, ponds, insect hotels and wildlife habitats.
	8.5 State how sustainable practices can be undertaken during the construction stage.	State how the ideas of 'reduce, re-use, reclaim, recycle' can be applied during the construction of a garden, to include: transport and waste disposal issues, on-site working practices (not leaving water running for example)

Understanding the choice, establishment and maintenance of garden plants and lawns

RHS reference number: R2112

Unit reference number: T/601/0263

Unit guided learning hours: 22

Unit Level: Level 2

Unit purpose and aim(s): This unit will enable candidates to develop an understanding of plant selection, establishment and maintenance of a range of ornamental plants.

Learning outcome The Learner will	Assessment criteria The learner can	Indicative column The learner should be able to
Please note that when it states 'could include.....' in the indicative column a candidate can use any examples that are relevant and comply with the assessment criteria of the learning outcome.		
1. Understand the choice of plants for seasonal display and their establishment and maintenance.	1.1 Describe, in the context of seasonal displays, what is meant by the terms: bedding, hardy, half-hardy, tropical, edging, groundwork (infill) and dot plant; give TWO plant examples of EACH.	State what is meant by seasonal displays including when the plants can be planted out. The terms Hardy and Half-hardy should be defined in relation to temperature tolerance (either in degrees Celsius or Zones) as well as plant husbandry.
	1.2 Explain the importance of F1 hybrid plants and the term 'hybrid vigour'. State FOUR specific plant examples.	Significance of hybrid vigour and uniformity of growth rate, height and colours.
	1.3 Name TEN plants suitable for growing in a Hardy annual border.	Examples of Hardy Annuals could include: <i>Calendula officinalis</i> <i>Nigella damascena</i> <i>Tropaeolum majus</i>
	1.4 Name TEN plants suitable for summer bedding displays.	Examples could include: <i>Lobelia erinus</i> <i>Petunia x hybrida</i> <i>Salvia splendens</i> <i>Tagetes patula</i>
	1.5 Name FIVE plants suitable for spring bedding displays, including TWO bulbs (or corms or tubers).	Examples could include: <i>Erysimum 'Bowles's Mauve'</i> <i>Myosotis sylvatica</i> <i>Viola x wittrockiana</i> <i>Bulbs Hyacinthus orientalis and Named Tulipa Cultivars, e.g. Tulipa 'Queen of Night'</i>
	1.6 Name TEN plants suitable for summer display	Examples could include: <i>Fuchsia 'Thalia'</i>

	in containers or hanging baskets.	<i>Lobelia erinus</i> <i>Pelargonium zonale</i> <i>Salvia splendens</i>
	1.7 Name FIVE plants suitable for winter display in containers or hanging baskets.	Examples could include: <i>Ajuga reptans</i> <i>Buxus sempervirens</i> <i>Crocus chrysanthus</i> <i>Hedera helix</i> <i>Viola x wittrockiana</i>
	1.8 Describe the soil or growing media preparation, sowing (H.A border) or planting out of plants for seasonal display for the situations listed in 1.3 – 1.7.	Seasonal displays to include Spring bedding, Summer bedding & Hardy Annual borders. To include: the preparation of annual borders and seasonal bedding displays (removal of previous bedding, soil cultivation, marking out, sowing methods for HA to include Station sowing, Drills and Broadcasting, thinning and planting); growing media, liners and additives for hanging baskets and containers; choice of container; filling and planting of hanging baskets and containers (depth, spacing). Watering.
	1.9 Describe the routine maintenance of seasonal bedding, including control of weeds and common pests and diseases (aphids, slugs and snails, vine weevil, grey mould, powdery mildew) for the situations listed in 1.3 – 1.7	Appropriate seasonal maintenance tasks to include irrigation (hand watering, sprinklers and drip systems), deadheading, feeding. Methods of weed control to include Physical (Hand weeding methods) control of pests and diseases listed for appropriate situations. Control of ONE appropriate weed, pest and disease for each situation.
2. Understand the choice of herbaceous perennial plants and 'bulbs' for display, and how to grow them.	2.1 Name TEN herbaceous perennial plants suitable for growing in an herbaceous border.	Examples could include: <i>Aster novi-belgii</i> <i>Hemerocallis fulva</i> <i>Papaver orientale</i> <i>Sedum spectabile</i> <i>Verbena bonariensis</i>

	2.2 Name FIVE herbaceous perennials suitable for growing in shade and FIVE suitable for use as ground cover.	Examples could include: Shade <i>Astrantia maxima</i> <i>Brunnera macrophylla</i> Ground cover <i>Alchemilla mollis</i> , <i>Geranium macrorrhizum</i>
	2.3 Name TEN bulbs or corms or tubers, of which FOUR should be suitable for growing in the border, FOUR for containers and FOUR for naturalizing.	Examples could include: FOUR suitable for growing in the border including <i>Iris germanica</i> , <i>Crocasmia 'Lucifer'</i> , <i>Dahlia 'Bishop of Llandaff'</i> FOUR for containers for example <i>Narcissus 'Tête à tête'</i> , <i>Crocus vernus</i> , <i>Galanthus nivalis</i> FOUR for naturalizing for example <i>Galanthus nivalis</i> , <i>Narcissus 'Tête à tête'</i> , <i>Crocus vernus</i> NOTE: bulbs can be suitable for more than one category, e.g. <i>Galanthus nivalis</i> can be used in containers, in the border or naturalised in grass.
	2.4 Describe the soil preparation, planting, routine maintenance and control of weeds, pests and diseases (aphids, slugs and snails, vine weevil, grey mould, powdery mildew, stem or bulb eelworm) required for growing herbaceous perennials and bulbs, corms or tubers.	Soil preparation to include cultivation, addition of organic matter and/or fertiliser. Planting to include specification (bare root, container grown, planting techniques for herbaceous perennials and bulbs, corms and tubers. Routine maintenance tasks to include support, watering, deadheading, feeding, and renovation by division. Methods of weed control to include Physical (Hand weeding methods), Chemical (Use of Herbicides) and Cultural (Mulches). Control of pests and diseases for appropriate situations.
3. Understand the choice of woody plants for display and their establishment and maintenance.	3.1 Name TEN trees suitable for growing in a domestic garden.	Tree no more than 10 metres. Examples could include: <i>Malus x zumi 'Golden Hornet'</i> , <i>Prunus x subhirtella 'Autumnalis'</i> <i>Acer griseum</i> <i>Amelanchier x grandiflora 'Ballerina'</i> <i>Cercis canadensis 'Forest Pansy'</i>

	<p>3.2 Name TEN shrubs suitable for growing in a domestic garden.</p>	<p>Examples could include: <i>Potentilla fruticosa</i>, <i>Buddleja davidii</i> <i>Cornus alba</i> <i>Daphne bholua</i> <i>Hamamelis x intermedia</i> <i>Forsythia x intermedia</i></p>
	<p>3.3 Name FIVE trees grown for winter interest and FIVE grown for autumn display.</p>	<p>NOTE: Do not include plants which have year round interest, e.g. Evergreens. Give examples which have specific interest at the named season.</p> <p>Examples could include: Trees for Winter interest <i>Acer griseum</i> <i>Prunus serrula</i></p> <p>Trees for Autumn interest <i>Acer griseum</i> <i>Amelanchier x grandiflora</i> ‘Ballerina’ <i>Cercis canadensis</i> ‘Forest Pansy’</p>
	<p>3.4 Name FIVE shrubs grown for winter interest and FIVE grown for autumn display.</p>	<p>NOTE: Do not include plants which have year round interest, e.g. Evergreens. Give examples which have specific interest at the named season.</p> <p>Examples could include: Shrubs for Winter interest <i>Cornus alba</i> <i>Daphne bholua</i> <i>Hamamelis x intermedia</i></p> <p>Shrubs for Autumn interest <i>Euonymus alatus</i> <i>Callicarpa bodinieri</i> <i>Clerodendrum trichotomum</i> <i>Rhus typhina</i></p>
	<p>3.5 Name FIVE lime-hating trees OR shrubs.</p>	<p>Examples could include: <i>Camellia japonica</i>, <i>Arbutus unedo</i></p>
	<p>3.6 Name FIVE bush roses suitable for growing in a rose bed, including cluster-flowered (floribunda) and large-flowered (hybrid tea) examples.</p>	<p>For example: <i>Rosa</i> ‘Iceberg’, cluster-flowered (floribunda) <i>Rosa</i> ‘Sweet Dreams’, large-flowered (hybrid tea)</p>

	3.7 Name FIVE climbers and FIVE wall shrubs suitable for a variety of garden situations including shaded and north-facing.	Define climbers AND wall shrubs Examples could include: <i>Hydrangea anomala</i> subsp. <i>petiolaris</i> <i>Lonicera japonica</i>
	3.8 Describe the soil preparation and planting for trees and woody shrubs.	To include timing, site preparation (cultivation, addition of ameliorants, mycorrhiza and/or fertiliser), specification (bare root, root-ball, container-grown); planting techniques (tools, depth and spacing, staking, protection); formative pruning, mulching and watering.
	3.9 Describe the routine maintenance for trees and woody shrubs, to include pruning and the control of weeds and common pests and diseases (aphids, powdery mildew, black spot of roses, canker, coral spot, honey fungus).	To include control of annual and perennial weeds; pruning to include timing and methods for named Spring flowering shrub (e.g. <i>Forsythia x intermedia</i> 'Lynwood'), Summer flowering shrub (e.g. <i>Buddleja davidii</i>) and a Winter stem specimen (e.g. <i>Cornus alba</i>); checking protection and ties, stakes; control of aphids, powdery mildew and blackspot on roses; coral spot on shrubs; canker and honey fungus on trees.
4. Understand the choice of alpine and rock garden plants and how to grow them.	4.1 Name FIVE alpine or rock garden plants for spring display and FIVE for summer display.	Do not include heaths, heathers and conifers. State what is meant by: - true alpines - rock garden plants. Select rock garden plants or true alpines for spring and summer display examples could include: <i>Spring: Pulsatilla vulgaris, Sedum acre</i> <i>Summer: Leontopodium alpinum, Helianthemum nummularium</i>
	4.2 Describe soil characteristics, soil preparation and routine maintenance for the display of alpine or rock garden plants in open soil.	To include soil requirements (free draining, good aeration, ability to hold moisture, appropriate pH, low nutrient content, free of weeds, pests and diseases) and preparation for planting in rock gardens, scree beds and gravel borders. Routine maintenance to include trimming, mulching with grit, winter protection, weeding, control of ONE relevant pest and ONE disease for these situations.

	4.3 Describe choice of container, the characteristics and preparation of the growing medium, and the routine maintenance required for an alpine or rock garden display in containers.	To include growing media requirements (free draining, good aeration, ability to hold moisture, appropriate pH, low nutrient content, free of weeds, pests and diseases); factors affecting choice of container/sink, trough; planting methods and routine maintenance to include trimming, mulching with grit, weeding, winter protection; control of ONE relevant pest and ONE disease for these situations.
5. Understand the planting and maintenance of a garden pool.	5.1 Name TWO AQUATIC plants from each of the following groups: floating, deep-water, marginal and bog plants.	Examples could include: Floating: <i>Stratiotes aloides</i> Deepwater: <i>Nymphaea</i> 'Chromatella' Marginal: <i>Caltha palustris</i> Bog garden plant: <i>Gunnera manicata</i>
	5.2 Describe the planting and establishment of aquatic plants in a garden pool.	To include selection for suitable vigour, containers, growing medium, nutrition, planting techniques. Differentiate between deep water aquatics, floating, marginal plants (in containers) and also bog plants (bog garden in soil). Construction of pond not required (see R2111).
	5.3 Describe the annual maintenance of a garden pool including possible controls for algae including blanket weed.	Seasonal maintenance tasks to include: Water/vegetation balance, role of oxygenator plants; maintenance of water levels in summer; control of vigorous growth and invasive pondweeds, division of plants; netting against leaves, management of ice formation. Controls for algae to include pond balance, use of barley straw or other additives and manual methods of removal.
6. Understand the establishment and maintenance of lawns.	6.1 State appropriate grass mixtures for the establishment of a high quality ornamental lawn and for a hard-wearing utility lawn.	State a mix of grass species for an ornamental lawn Examples could include: <i>Agrostis capillaris</i> + <i>Festuca rubra</i> subsp. <i>commutata</i> and a utility lawn which must include <i>Lolium perenne</i> , plus others such as <i>Festuca rubra rubra</i> , <i>Poa pratensis</i> , <i>Agrostis capillaris</i>

	6.2 State the benefits and limitations of establishing lawns from seed.	To be compared with establishing lawns by turf (see 6.4) to include ideal months to carry out task, time required for establishment, immediate impact, evenness of initial growth, sustainability, species in mix. Costs (either in purchase or labour these must be qualified, i.e. x£s per kilo or labour hours x square metres).
	6.3 Describe the procedure for establishing a lawn from seed.	To include: timing, site preparation (hand cultivation, weed eradication methods, consolidation, levelling, base dressing stating both the ingredients and rate), seed sowing (techniques, mixtures, rates as grams per square metre), protection, irrigation, first cut.
	6.4 State the benefits and limitations of establishing a lawn from turf.	To be compared with establishing lawns by seed (see 6.1) to include ideal months to carry out task, time required for establishment, immediate impact, evenness of initial growth, sustainability, customising of species in mix. Costs (either in purchase or labour these must be qualified, i.e. x£s per kilo or labour hours x square metres).
	6.5 Describe the procedure for establishing a lawn from turf.	To include: timing, site preparation (hand cultivation, weed eradication methods, consolidation, levelling, base dressing stating both the ingredients and rate), laying techniques, top dressing naming material, irrigation. Do not include drainage systems.
	6.6 Describe the annual maintenance programme for quality ornamental and for hard-wearing utility lawns.	To include: for a high quality ornamental lawn and for a hard-wearing utility lawn: height of cut, frequency of cut, remove clippings or not; feeding, scarifying, aeration, top dressing, edging, weed control, control of named pests and diseases. Tasks should relate to a 12-month maintenance programme. Identify differences between the maintenance procedures for utility and fine turf.
	6.7 Describe the range of equipment used for mowing, feeding, scarifying and aerating to maintain lawns.	To include: a high quality ornamental lawn and for a hard-wearing utility lawn; types of mower, lawn feed distributor, scarifier (springtine rake and powered mechanical) and aerator (solid and hollow tines).

	<p>6.8 Describe the symptoms of a range of common lawn pests and diseases, including red thread, <i>Fusarium</i> patch, fairy rings, leatherjackets and moles; state an appropriate control measure for EACH.</p>	<p>Symptoms limited to effects on the grass seen by inspecting the surface.</p>
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Understanding the production of outdoor vegetables and fruit

RHS reference number: R2113

Unit reference number: A/601/0264

Unit guided learning hours: 23

Unit Level: Level 2

Unit purpose and aim(s): This unit will enable candidates to develop an understanding of the basic cultural operations and production methods necessary to obtain outdoor vegetable and fruit crops.

Learning outcome The Learner will	Assessment criteria The learner can	Indicative column The learner should be able to
Please note that when it states 'could include.....' in the indicative column a candidate can use any examples that are relevant and comply with the assessment criteria of the learning outcome.		
1. Know the importance of site selection for outdoor food production in a garden or allotment.	1.1 State the factors to be considered when selecting a site including: soil depth, texture and structure, drainage, pH, aspect, slope, susceptibility to frost and wind, area of land available and availability of water.	Indicate how each factor listed will affect the suitability of a site for growing fruit and vegetables outdoors.
	1.2 Describe the reasons for providing shelter for an outdoor food production area including, the effects of wind reduction, frost potential and influences upon pollination.	Indicate how the effects of providing shelter influence the growth of fruit and vegetable crops.
	1.3 State the benefits and limitations of living and non-living windbreaks.	To include: the characteristics of effective living windbreaks: can filter winds effectively but take up space, encourage beneficial organisms but can also harbour pests and diseases, require time to establish and need to be maintained; non-living windbreaks: take less space but require more frequent replacement.
	1.4 Name FOUR plant species suitable for a living windbreak.	Examples could include: any deciduous or evergreen species suitable for informal or formal use. <i>Fagus sylvatica</i> <i>Carpinus betulus</i> <i>Pinus nigra</i> <i>x Cuprocyparis leylandii</i> <i>Crataegus monogyna</i>

	1.5 Name FOUR types of non-living permeable windbreak.	To include: plastic mesh, webbing, fencing, trellis or hurdles.
2. Understand the cultural operations used to produce outdoor food crops in a garden or allotment.	2.1 Describe a range of soil cultivation techniques suitable for the vegetable garden including: digging, rotary cultivation, consolidation and tilth production.	To include: single and double digging; tilth production for sowing seed (fine, medium and large) and planting (transplants, sets). Double digging here refers to removing one spit of soil, working the second spit and incorporating organic matter; not to the removal of two complete spades' depth of soil.
	2.2 Describe how the timing of soil cultivations will be influenced by soil texture, structure, weather and climate.	To include: the influence of the soil texture and structure on its readiness for cultivation; the effect of weather and the variance in the 'cultivation window' depending on local climate and soil texture.
	2.3 Describe what is meant by the bed system for growing vegetables. Compare this with open ground production.	To include: compaction / traffic /walking over the ground to cultivate it; depth of soil; speed of warming;
	2.4 Describe what is meant by a raised bed, giving a specification for a typical raised bed and paths.	To include the following methods: soil thrown up from paths in between beds in mounds; and a framework of timber or other material filled with soil. Beds not more than 1.5m width, 3m length, paths (approx.) 0.5m wide.
	2.5 Explain the 'no-dig' system of managing raised beds.	A description to include: initial weed removal, use of surface mulches to smother weed growth and addition of large quantities of organic matter to the surface only. Give reasons for the use of the 'no-dig' system.
	2.6 State the methods used to advance and extend the productive season of outdoor food crops including: the use of polythene, mulches, fleece, 'enviromesh', low tunnels, cloches and cold frames.	State the methods used to warm soil to allow early sowing; to protect crops against spring frosts and bring on tender vegetables for planting out; and to allow late crops to continue under protection.
	2.7 Describe propagation methods used in the production of vegetable crops, including: direct sowing and raising plants in	To include: direct sowing in drills and thinning; transplanting from seedbeds; group sowing in blocks, and sowing into modules for tender vegetables.

	seed beds, blocks and modules.	
3. Understand the principles of vegetable crop production.	3.1 Describe the individual production of vegetable crops including runner beans, winter cabbage, Brussels sprouts, carrots, courgettes, onions, leeks, beetroot, potatoes and salad crops to include lettuce and radish.	To include: the production of each crop from time of sowing/planting out to harvest, covering all the relevant activities listed in 3.2. Named cultivar/s of each vegetable listed.
	3.2 Describe how quality and yield may be determined by the following: base and top dressings, thinning, weed control, crop support, irrigation and pest and disease control.	To include: examples of vegetable crops to illustrate effects on growth and yield. .
	3.3 Describe how EACH of the vegetables in 3.1 may be harvested and stored successfully.	To include: methods of harvesting (single harvest, continual harvesting) and storage (preparation, conditions, length of time) for individual crops.
	3.4 State ONE common pest and ONE common disease of the vegetables named in 3.1, describing symptoms and control measures.	To include physical, cultural and chemical control measures where appropriate.
	3.5 State the benefits and limitations of crop rotation.	Benefits to include: avoidance of pest and disease build-up in beds, effective use of nutrients in soil. Limitations to include: only effective against soil borne P&D, not effective against non-specific P&D; the amount of space required and commitment; restriction of choice.
	3.6 Describe a four-bed system of crop rotation.	To include an appropriate succession of plant groups over four years.
	3.7 Explain how successional cropping can be achieved for a NAMED crop by using sowing and planting dates, choice of cultivars and environmental protection.	To include a description of each: staggered sowing; planting dates; choice of cultivars; use of protection (fleece, polythene) and soil warming to extend season.

	3.8 Explain how intercropping can be used to maximise production.	Use ONE example to show how rapid-growing crops can be sown between rows of slower vegetables to maximise production from a given area.
	3.9 Describe the effect of plant spacing on a NAMED crop.	To include close spacing to produce 'baby' vegetables and uniformity. Normal spacing to maximize crop potential.
	3.10 Describe what is meant by 'cut and come again' vegetables.	Distinguish between single harvesting and 'cut and come again' cropping with reference to lettuce and spinach.
4. Understand the production of top and soft fruit for a garden or allotment.	4.1 Distinguish between top and soft fruit.	State what is meant by the terms 'top fruit' and 'soft fruit'.
	4.2 List the types of top fruit (including apples, pears, plums and cherries) and factors for their selection, to include dessert and culinary cultivars; harvesting season; and storage capability.	To include: purpose of fruit (dessert, culinary); flavour; late or early season cropping; potential for storage. Named cultivar/s of each top fruit listed.
	4.3 List the major types of soft fruit (strawberries, raspberries, blackcurrants, gooseberries, blueberries and grapes) and factors to be considered when choosing suitable cultivars, to include the fruit type; choice of early, mid and late season cultivars; flavour; and freezing capability.	To include: fruit type (cane, bush, vine); purpose of fruit (dessert, culinary); flavour; late or early season cropping; potential for freezing or other storage methods. Named cultivar/s of each soft fruit listed.
	4.4 Describe the production of top fruit (apples and plums) and state the factors to be considered when choosing plants, including fruit type; plant quality; rootstock choice; size of tree; training style; pollination compatibility and cultural requirements.	Plant quality to include method of supply (bare root, container); pollination requirements to include an outline of apple pollination groups and triploids; production to include establishment (ground preparation, planting and support, mulching, formative pruning for tree shape and yield, irrigation) ; and maintenance (pruning, thinning fruit, top dressing, control of one main pest and one disease).

	4.5 Describe the production of soft fruit including raspberries, blackcurrants and strawberries.	Production to include: establishment (ground preparation, planting and support where necessary, mulching, pruning and irrigation); and maintenance (pruning, top dressing, weed, pest and disease control, replacement and tying in where appropriate).
	4.6 State the advantages of purchasing certified stock.	Advantages to include: certified stock is virus-free; guaranteed true to name and type.
	4.7 Describe how quality and yield can be determined by the following: planting; base and top dressings; mulching; weed control; irrigation; training systems; appropriate pruning; and pest and disease control.	Including examples of how each factor can affect quality and yield in named fruit. Training systems to include cordons, fans, espaliers and step-overs.
	4.8 Describe the importance of formative and maintenance pruning for tree shape and yield.	To include: formative pruning for an apple tree from whip to productive open-centred bush; and maintenance pruning of a spur bearing apple tree.
	4.9 Explain the importance of cross pollination and fertilisation in top fruit, including flowering periods, compatibility, diploid and triploid cultivars.	State what is meant by the terms compatibility and incompatibility, diploid and triploid. Explanations to include: pollination groups in apples (based on flowering periods); examples of diploid and triploid apple cultivars; self-fertile cultivars.
	4.10 State four methods of ensuring effective pollination in fruit production.	To include: cultivar selection; planting extra pollinators such as crab apple; shelter belts and hedges to encourage pollinators and provide windbreaks.
	4.11 Describe the harvesting and storage of the fruit crops named in 4.4 and 4.5.	To include: period of harvest; ripeness /under-ripeness at picking; method of storage, period of storage; storage conditions (packing, atmosphere, temperature).
	4.12 State ONE common pest and ONE common disease of the fruits named in 4.4 and 4.5, describing symptoms and control measures.	For each pest and each disease, give ONE characteristic symptom and ONE appropriate method of control from: physical (barriers, sticky traps/glue bands, pheromone traps); cultural controls (certified stock, resistant cultivars); biological controls (indigenous predators of pests, pheromone traps to reduce pest breeding); and chemical controls.

Understanding protected environments and their use in plant cultivation

RHS reference number: R2114

Unit reference number: L/601/0267

Unit guided learning hours: 23

Unit Level: Level 2

Unit purpose and aim(s): This unit will enable candidates to develop an understanding of the control of the environment in greenhouses, frames, polythene tunnels and cloches; the horticultural uses of protected environments; the production of a range of plants in greenhouses and tunnels; and the care of plants in the house and conservatory.

Learning outcome The Learner will	Assessment criteria The learner can	Indicative column The learner should be able to
Please note that when it states 'could include.....' in the indicative column a candidate can use any examples that are relevant and comply with the assessment criteria of the learning outcome.		
1. Know a range of types of protected structure, and their use in growing plants.	1.1 Describe a range of protected structures, to include greenhouses, cold frames, polythene tunnels, cloches and conservatories.	To include labelled diagrams of each type of protected structure to show the main structural features.
	1.2 Describe horticultural uses for each of the structures listed in 1.1, including plant propagation, crop production and decorative display.	To include: Plant propagation including taking cuttings and sowing seeds; 'growing on' tender seedlings; hardening off; growing fruit, salad vegetable and herb crops; main season cropping, and displaying tender perennials and houseplants, as well as specialist plant collections.
2. Know the environment provided by a range of protected structures.	2.1 Describe the environmental differences between the protected environment and outdoors including temperature; humidity; light; concentration of atmospheric gases; air movement; and irrigation requirements.	To include: outdoor variability and seasonality, contrasted with indoors – control and supplementation. Protected environment details: for air and soil temperature - the range of growing conditions from frost-free winter protection to the requirements for shade in summer; for relative humidity the importance of air movement, damping down; for light – supplementing and replacement lighting, day length and quantity of light; for concentration of atmospheric gases – possibility of carbon dioxide becoming a limiting factor for photosynthesis; carbon dioxide enrichment reasons and methods; air movement – ventilation by natural air movement, forced draught or fan ventilation; for humidity control

		and to minimise disease transmission; irrigation requirements – methods of overhead watering and sub-irrigation for crops grown in containers and in the border soil.
	2.2 State the benefits and limitations of using protected structures for growing plants, (for example tomato, <i>Lycopersicon esculentum</i>) compared with growing the same plants outdoors.	Examples to include: tomato (<i>Lycopersicon esculentum</i> , also called <i>Solanum lycopersicum</i>). Benefits arising from the control and supplementation listed in 2.1; higher yields and quality; longer season of fruiting and ripening; can grow a greater range of cultivars. Limitations – relative costs; effort required; different pest and disease problems indoors.
	2.3 Describe the effect of the environmental factors listed in 2.1 on plants in a protected environment.	To include examples using named plants and horticultural situations.
3. Know the structural and cladding materials used for a range of protected structures.	3.1 List and describe the characteristics of a range of materials used for framework construction including, steel, aluminium, wood, and plastics. State the benefits and limitations of EACH.	Characteristics to include: weight, strength, reduction of light transmission, aesthetics, and relative cost compared to other structural materials.
	3.2 Describe the properties of different cladding materials, which can be used for structures, including glass; polyethylene film; polycarbonate; acrylic sheets, shade netting; and horticultural fleece. State the benefits and limitations of EACH.	Characteristics to include: lifespan, light transmission, surface abrasion, strength, weight, safety, relative costs compared to other cladding materials.
4. Understand the control of the environment in protected structures.	4.1 Describe the factors that affect light levels in protected structures, including shape of structure; site factors; orientation; type and condition of cladding materials.	To include: shape of structure – Venlo, widespan, Mansard, curvilinear; Angle of incidence. aesthetics; site factors – exposed/sheltered, latitude; orientation – E-W, N-S; type (see 3.2) and condition of cladding materials – new, scratched, dirty, screened/painted with shading compound.

	4.2 Describe how the temperature can be maintained in structures including heating by gas, oil or electricity; heat distribution using circulating water and air; cooling by forced or natural ventilation; evaporation; and shading.	To include information on methods of heating and cooling protected structures; relative costs compared to other heating systems; and practical considerations such as reliability/supply to site.
	4.3 Describe methods of changing the relative humidity (RH) in a protected environment, including the effects of 'damping down', ventilation and temperature changes.	State what is meant by 'damping down'. Describe patterns of ventilation in a structure which will help adjust relative humidity. The use of forced draught or fan ventilation and natural ventilation systems. Describe how changes in temperature affect relative humidity which in turn affect water and nutrient uptake.
	4.4 Describe manual and automated methods of irrigation including the use of watering cans, hose pipes, capillary systems and 'drip' systems.	To include the benefits and limitations of different watering methods (for example the potential for disease from overhead watering of some crops). Containerised crops and crops grown in border soil.
	4.5 Describe how light levels can be manipulated by the use of supplementary lighting and shading, including blinds and shading paints.	To include the use of: shading, blinds and paints to avoid overheating in protected structures; supplementary lighting to extend the growing season; and, in outline only , use of artificial light/dark periods to prepare poinsettia crops.
	4.6 Describe the importance of cultural and biological controls to limit the damage caused by plant pests and diseases.	State what is meant by cultural and biological controls; Describe the use of cultural controls to limit two pests or diseases. Give two examples of how biological controls are used for specific pests (Latin names for biological controls are not required: type of control - nematode, mite, wasp, ladybird – is sufficient with the correctly identified pest.) State the advantages that cultural and biological control have over chemical control methods.

<p>5. Know the types of container and growing media used for production and display in protected environments.</p>	<p>5.1 Compare the properties and characteristics of materials used in the manufacture of plant containers including</p> <p>terracotta, plastic, polystyrene, peat, paper, natural and reconstituted stone, and recycled materials.</p>	<p>To include: properties – weight, strength, colour, porosity, heat retention, longevity, disposability; characteristics – heavy/light, breakable, temperature affected by colour, various watering requirements. Relative costs compared to other containers.</p> <p>Exemplar: Polystyrene is used for the manufacture of modular bedding containers. It is very light, non-porous, brittle but quite strong, generally supplied in white which does not heat up the rootzone of bedding plants excessively. Watering from below is effective as the base is pierced for root growth. Polystyrene bedding containers are not designed for re-use but can be broken up and used to increase drainage in large containers; they are not recyclable.</p>
	<p>5.2 Describe the factors that should be considered when choosing containers for the display of plants in greenhouses and interior displays, including management considerations and visual appeal.</p>	<p>To include: management considerations – moving, watering (including whether containers are water tight) cleaning; visual appeal – aesthetics, domestic colour schemes and styles. Weather resistance.</p>
<p>6. Understand the horticultural uses of the protected environment.</p>	<p>6.1 Describe the use of protected environments for the over-wintering, production and display of plants.</p>	<p>To include one example for each situation.</p>
	<p>6.2 Describe the production of a range of plants which can be grown in a protected environment in a garden situation under the following headings: propagation and establishment; maintenance; control of pests, diseases and disorders. Examples should include one decorative pot plant (<i>Cyclamen persicum</i>), one salad crop (<i>Lycopersicon esculentum</i>), one cut flower (<i>Chrysanthemum x</i></p>	<p><i>Lycopersicon esculentum</i> is also called <i>Solanum lycopersicum</i>.</p>

	<i>morifolium</i>), one bedding plant (<i>Impatiens walleriana</i>) and one bulb for forcing (<i>Narcissus 'Tête à tête'</i>).	
7. Understand the care of plants in an interior situation.	7.1 Describe the environmental factors that must be taken into account when displaying plants inside domestic buildings.	To include the challenges faced by plants in a domestic environment: temperature; humidity; light; air movement; and irrigation requirements. Pollution and dust problems Health and safety Public pedestrian traffic.
	7.2 Describe the choice of suitable containers and growing media for house plants.	To include: management considerations and visual appeal of containers; drainage, nutrients and water retention in composts and hygiene.
	7.3 Describe the management of one fern (<i>Adiantum raddianum</i>), one foliage (<i>Ficus benjamina</i>) and three seasonal flowering plants (<i>Euphorbia pulcherrima</i> , <i>Kalanchoe blossfeldiana</i> , and <i>Saintpaulia ionantha</i>) under the following headings: potting; feeding; watering; deadheading; re-potting; pest and disease identification and control.	To include; Propagation, establishment, growing on, support, environmental control, pest and disease identification and control.