R2101

PLANT CLASSIFICATION, STRUCTURE AND FUNCTION

Level 2

Monday 27 June 2011

9.30 – 10.30

Written Examination

Candidate Number: .....

Candidate Name: .....

Centre Number/Name: .....

IMPORTANT – Please read carefully before commencing:

i) The duration of this paper is **60 minutes**;

ii) **ALL** questions should be attempted;

iii) **EACH** question carries **10 marks**;

iv) Write your answers legibly in the spaces provided;

v) Use metric measurements only;

vi) Where plant names are required, they should include genus, species and where appropriate, cultivar.

Ofqual Unit Code H/601/0307

Please turn over .....

Answer all questions

Marks

1. a) List **ONE** difference in each case between monocotyledonous and dicotyledonous plant organs by completing the table below: **8**

Plant organ	**Monocotyledon**	**Dicotyledon**
Young stem		
Old stem		
Root		
Leaf		

b) Give **ONE NAMED** example of **EACH** of the following:

i) a monocotyledonous plant; **1**
ii) a dicotyledonous plant. **1**

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Total Mark

Please see over .....

2. a) Define the term ‘juvenility’. **2**

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b) State the meaning of the following terms:

i) evergreen; **1**
ii) semi-evergreen; **1**
iii) deciduous. **1**

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c) Name **ONE** semi-evergreen woody perennial. **1**

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d) Complete the table below by naming an appropriate plant in **EACH** case: **4**

	Named Plant
Evergreen Woody Perennial	
Deciduous Woody Perennial	
Evergreen Herbaceous Perennial	
Deciduous Herbaceous Perennial	

Total Mark

Please turn over.....

3. a) Define the term ‘plant tissue’. **1**

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b) Describe the characteristics of the following stem tissues:

i) epidermis; **2**
ii) cortex; **2**
iii) meristem. **2**

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c) State **ONE** function for **EACH** of the tissues listed in b). **3**

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4. a) State the primary function of the leaf. **1**

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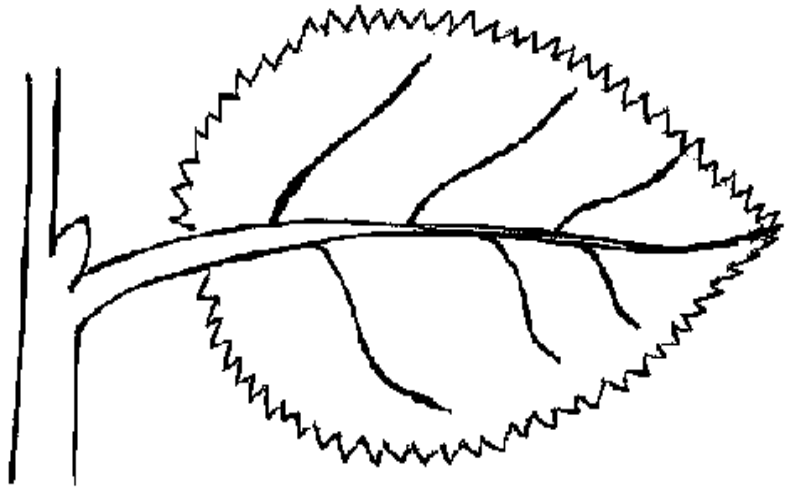
b) Label **SIX** features on the diagram below: **3**



c) Complete the table below using **TWO** examples of leaf adaptations: **6**

Name of adaptation	Function of adaptation	Plant example

Total Mark

Please turn over.....

5. Draw a fully labelled diagram showing the structure of a typical dicotyledonous flower in the space provided below. **10**

Total Mark

Please see over.....

6. a) Describe the functions of the following seed structures by completing the table below: **6**

Seed structure	**Function**
Endosperm	
Testa	
Micropyle	

b) State the difference between epigeal and hypogeal seed germination giving a **NAMED** example for **EACH**. **4**

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Please turn over.....

7. a) Name the site of aerobic respiration in the cell. **1**

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b) State the basic equation for aerobic respiration in words. **3**

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c) State how anaerobic conditions determine the efficiency of respiration. **6**

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8. a) List **THREE** ways in which water moves in the plant. **3**

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b) Describe the pathway of water movement through the plant from the soil to the air. **7**

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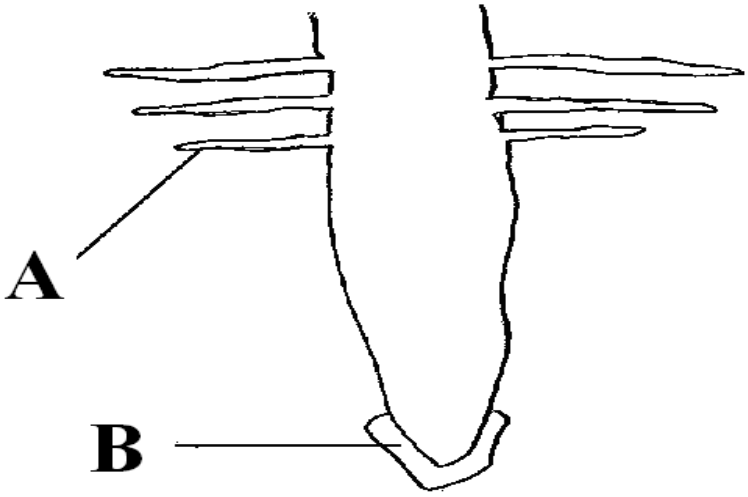
Please turn over.....

9. a) Indicate on the diagram below the areas where the following processes take place:

i) cell division; **1**
ii) cell enlargement; **1**
iii) cell differentiation. **1**

A dicotyledonous root tip



b) Identify the features labelled **A** and **B** in the diagram above and state their function. **4**

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c) State what is meant by the term negative phototropism. **3**

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Total Mark

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10. a) The universal system of plant names is called the 'binomial' system. Explain what is meant by the term 'binomial'. **2**

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b) State **FOUR** advantages of using binomial plant names compared with common plant names in horticulture, using **NAMED** plant examples in your answer. **8**

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Total Mark

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**The Royal Horticultural Society, Wisley, Woking, Surrey GU23 6QB
RHS Registered Charity No: 222879/SC038262**

R2101

PLANT CLASSIFICATION, STRUCTURE AND FUNCTION

Level 2

Monday 27 June 2011

Candidates Registered	628	**Pass with Commendation**	171 (33.66%)
Candidates Entered	508 (80.9%)	**Pass**	192 (37.8%)
Absent/Withdrawn/Deferred	120 (19.1%)	**Fail**	145 (28.54%)
Total Candidates Passed	363 (71.46%)		

Senior Examiner's Comments:

1. Candidates should be able to demonstrate a good range of plant knowledge and be able to give accurately named plant examples where appropriate. Common names and generic names are often too vague and cannot be rewarded in the positive manner that genus, species and where appropriate, variety/cultivar can. This is particularly important when answering questions relating to particular (named) plant(s). Marks can only be awarded for these narratives where the example(s) are correctly and fully identified.

2. Candidates must be able to display accurate knowledge of the technical terms and concepts detailed in the syllabus, in the context of horticulture and be aware that wider interpretation will not be rewarded. The examination should be regarded as a possible introduction to higher level studies, which will only be open to those who are in possession of a clear understanding of the horticultural terms and concepts which are current.

3. The introductory rubric given on the first page of each question paper should be read carefully by candidates. At each examination there are a significant number of candidates who ignore or misread the instructions given and consequently may not perform as well as they could have done.

4. Candidates should pace themselves during each paper. The most successful candidates allow sufficient time to read the question thoroughly before answering it and also take time to read through their answers. They should take care to write as legibly as possible, so that the examiner is in no doubt about what is intended.

5. Candidates need to interpret key words within questions, particularly those such as 'state', 'list' and 'describe'. Questions requiring descriptions or explanations obviously require a more detailed answer than those requiring a list.

6. It is important to ensure that responses to questions are to the point. Candidates should bear in mind that small sketches might be used to convey information more succinctly than words.

7. Successful candidates ensure that their answers are focused and to the point. It is disappointing when they cannot be rewarded for their efforts because the answer is irrelevant to the particular question. Candidates should take note of the mark allocation for specific sections and allocate their time and efforts accordingly.

8. Diagrams can enhance an answer and where appropriate can replace detailed descriptions. They should be large, clear and well annotated, and preferably in pencil. Colour may be used successfully but only where it is relevant to the answer.

9. In each examination it is clear that some candidates are ill prepared to answer papers of the type set. It is essential that candidates have the opportunity to practice questions. Ideally some papers should be answered in a time constrained situation.

10. Candidates should be aware of the reading list of suggested books for the RHS Level 2 Certificate in The Principles of Plant Growth, Propagation and Development which is available from the Qualifications Section and can also be found on the RHS website together with past papers.

Examiners' Comments:

Marks

1. *a) List **ONE** difference in each case between monocotyledonous and dicotyledonous plant organs by completing the table below:* ***8***

Plant organ	***Monocotyledon***	***Dicotyledon***
Young stem		
Old stem		
Root		
Leaf		

*b) Give **ONE NAMED** example of **EACH** of the following:*

i) a monocotyledonous plant; ***1***
ii) a dicotyledonous plant. ***1***

a) Candidates provided a good range of differences between monocotyledonous and dicotyledonous plants. Examples given for stems included; vascular bundles scattered or in a ring, the presence or absence of vascular cambium and secondary thickening/woody growth and the presence or absence of branches. For roots examples included; fibrous versus non-fibrous and/or tap root systems. The differences between leaves were correctly given as those with parallel venation and strap-like shaped leaves compared to many types of venation and leaf shapes including simple and compound leaves.

Marks were awarded for statements which clearly compared the two plant categories under the correct headings. The term lignification was not accepted when used to mean secondary thickening as it takes place in many tissues and cells, not just vascular tissue. Diagrams were accepted where they were clearly labelled.

b) A wide range of plant examples were given e.g. *Iris laevigata* as a monocotyledonous plant and *Quercus robur* as a dicotyledonous plant.

2. *a) Define the term 'juvenility'.* ***2***

b) State the meaning of the following terms:

i) evergreen; ***1***
ii) semi-evergreen; ***1***
iii) deciduous. ***1***

*c) Name **ONE** semi-evergreen woody perennial.* ***1***

*d) Complete the table below by naming an appropriate plant in **EACH** case:* ***4***

	Named Plant
Evergreen Woody Perennial	
Deciduous Woody Perennial	
Evergreen Herbaceous Perennial	
Deciduous Herbaceous Perennial	

a) Full marks were awarded to candidates who correctly linked juvenile growth to non flowering/vegetative growth rather than those who just stated that juvenile growth was 'young' growth or 'the stage between germination and maturity'.

b) Most students provided acceptable answers for this section of the question but it is important to note that evergreen plants retain functioning leaves throughout the year and not just during the growing season. Full marks were awarded to those candidates who correctly stated that semi-evergreen plants generally retain their leaves throughout the year but may lose some or all of them in severe weather conditions (usually in winter).

c) Full marks were given to candidates who provided a suitable semi-evergreen woody perennial e.g. *Ligustrum ovalifolium, Cotoneaster horizontalis, Lonicera fragrantissima or Abelia x grandiflora.* Plants that retain their dead leaves in winter were not acceptable e.g. *Fagus sylvatica* and *Carpinus betulus* as they are not semi-evergreen and only display this behaviour due to pruning to maintain them in a juvenile condition.

d) Most candidates were able to name an evergreen woody perennial e.g. *Pinus sylvestris, Prunus laurocerasus, Buxus sempervirens, Ilex aquifolium* and a deciduous woody perennial e.g. *Betula pendula, Quercus robur, Castanea sativa.* Where only a genus was given e.g. *Quercus* sp., marks were not awarded if the genus contains both deciduous (*Quercus robur*) and evergreen (*Quercus ilex*) species. Many candidates named *Lavandula* sp. and *Fuchsia* sp. as examples ofherbaceous perennials which are incorrect. The distinction between evergreen herbaceous plants which retain their leaves throughout the winter e.g*. Bergenia cordifolia, Helleborus orientalis, Heuchera* cvs., *Stachys byzantina, Lysimachia nummularia, Primula vulgaris* and *Acanthus mollis* and perennials which die down completely and reappear above ground (usually in the spring) e.g. *Papaver orientalis, Agapanthus praecox, Dicentra spectabilis, Phlox paniculata, Hosta* sp.and cvs., *Delphinium* cvs., *Echinacea purpurea* and *Aster x frikartii* was not well understood.

3. *a) Define the term 'plant tissue'.* ***1***

b) Describe the characteristics of the following stem tissues:

i) epidermis; ***2***
ii) cortex; ***2***
iii) meristem. ***2***

*c) State **ONE** function for **EACH** of the tissues listed in b).* ***3***

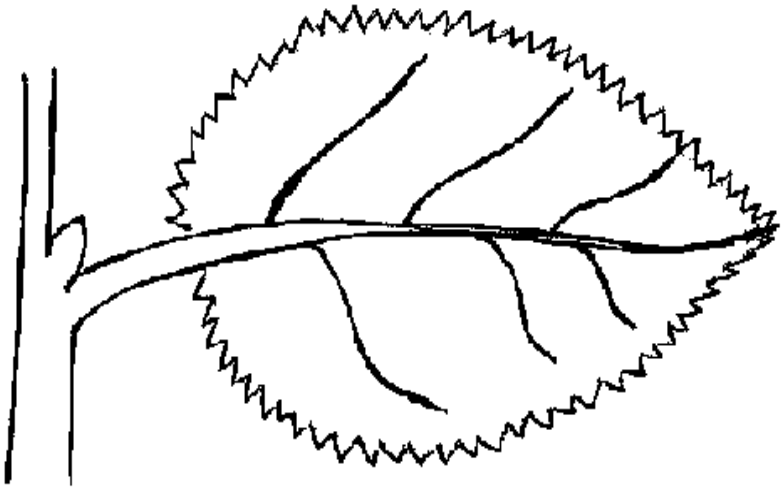
Q3a) Full marks were awarded to those candidates who correctly defined plant issues as a group of cells performing a specific function. Examples of plant tissues were not required.

b&c) The better candidates were able to distinguish between the terms characteristics (part b of the question) and functions (part c of the question) of stem tissues and therefore gave the correct information in the appropriate part of the question. Examples of this are; characteristics of epidermis include its thickness (generally one cell thick), its transparency, its waxy surface and the presence of structures such as stomata or hairs, whereas its function is to protect the stem from water loss and/or damage or from pests and diseases.

Characteristics of the cortex include its composition (parenchyma, collenchyma and sclerenchyma cells), the presence of air spaces between cells and starch grains or chloroplasts within them, whereas its function is to act as a packing tissue, to provide support or to store starch or to photosynthesise in young stems. Meristematic tissue is characterised by being made up of densely packed, undifferentiated, cube-shaped cells which are able to divide and its function is to enable growth of the stem through production of new cells by cell division. Marks were also awarded in part b) of the question for mentioning the position of the tissues in the stem.
It is important that candidates are familiar with the basic anatomy of plant tissues and the cell from which they are composed.

4. *a)* *State the primary function of the leaf.* ***1***

b) *Label **SIX** features on the diagram below:* ***3***



c) *Complete the table below using **TWO** examples of leaf adaptations:* ***6***

Name of adaptation	***Function of adaptation***	***Plant example***

a) Photosynthesis was correctly stated as the primary function of the leaf by nearly all candidates. Additional information was not required.

b) There were many opportunities to label six features on the diagram provided. The most popular ones given were lamina, stem, midrib, lateral vein, petiole and axillary (lateral) bud. The node was often not clearly identified. It is the part of the stem to which the leaf and axillary bud are attached. The better candidates provided more qualified answers such as 'axillary bud' rather than just 'bud'.

c) Candidates who gave the correct name of a leaf adaptation in the first column were able to gain full marks. Adaptations which were acceptable included tendrils, needles, scale leaves in bulbs, succulent leaves etc. It is important to note that spines are leaf adaptations whereas thorns are stem adaptations.

To gain full marks candidates needed to qualify some adaptations to distinguish them from unadapted leaves. For example, 'colourful bract' rather than just 'bract' and 'thick waxy cuticle' instead of 'waxy cuticle'. Candidates who provided precise answers for the function of the adaptation were awarded full marks. For example, 'reducing transpiration' instead of 'reducing water loss', 'protection from herbivores' instead of 'protection' and 'climbing towards the light for photosynthesis' instead of just 'climbing'.

Full marks were awarded to candidates who gave correct botanical names for plants. Candidates should note that cactus is a common name and not a genus.

5. *Draw a fully labelled diagram showing the structure of a typical dicotyledonous flower in the space provided below.* ***10***

Many candidates were able to gain high marks for this question by carefully drawing and labelling a cross section (LS) of a dicotyledonous flower. Maximum marks were awarded to those candidates who provided ten correctly labelled parts of the flower.

Some candidates drew a monocotyledonous flower which, although accurately labelled could not be awarded full marks. The relationship of the receptacle to the other flower parts was not always clear and some candidates occasionally confused carpels or stamens or drew other plant organs instead of a flower.

6. *a) Describe the functions of the following seed structures by completing the table below:* ***6***

Seed structure	***Function***
Endosperm	
Testa	
Micropyle	

*b) State the difference between epigeal and hypogeal seed germination giving a **NAMED** example for **EACH**.* ***4***

a) The best answers described the function of each seed structure and not the appearance although many candidates were uncertain of those functions. Full marks were awarded for complete answers. For example the function of the endosperm is the supply food/starch/substrate for the developing embryo until it is able to photosynthesise. Candidates who gave food storage as an answer gained less marks. Functions of the testa include protection (from pathogens and adverse weather conditions during development/dispersal/prior to germination) and seed dormancy (excludes water and gases/hard seed coat/germination inhibitors). The micropyle functions as a point of entry for the pollen tube to deliver the male gametes, entry of water to trigger germination and the point of emergence of the radicle and plumule.

b) Most candidates were able to describe the difference between epigeal and hypogeal germination. Examples of plants with epigeal germination are *Phaseolus vulgaris, Helianthemum annus, Allium sativum, Tagetes patula, Fraxinus excelsior.* Examples of plants with hypogeal germination are *Vicia faba, Pisum sativum, Lathyrus odoratus, Zea mays, Quercus robur.*

7. *a) Name the site of aerobic respiration in the cell.* ***1***

b) State the basic equation for aerobic respiration in words. ***3***

c) State how anaerobic conditions determine the efficiency of respiration. ***6***

There was a clear distinction between candidates who understood respiration well and those who confused it with water transport and photosynthesis.

a) Most candidates were aware that the site of respiration is the mitochondrion. Some candidates stated 'mitochondria cells' incorrectly as mitochondria are organelles within living cells. A few candidates named various plant tissues. Long statements and descriptions were not required in this section of the question.

b) Candidates who provided the correct equation with all the inputs and outputs in the right order were awarded full marks. Glucose/starch/carbohydrate and oxygen are converted to carbon dioxide and water with the release of energy/ATP. Energy was commonly omitted from the word equation even though this is the key output.

c) Those candidates who stated that anaerobic respiration means 'without oxygen' and that the efficiency of respiration is reduced were awarded marks. Marks were also given where candidates provided some explanation of why this occurs i.e. carbohydrate is incompletely broken down so less energy is released; ethanol is a by product which is toxic and that this will eventually lead to cell/plant death. Additional marks were awarded where candidates included a situation in which anaerobic conditions occur e.g. waterlogged/compacted soils.

8. *a)* *List **THREE** ways in which water moves in the plant.* ***3***

b) *Describe the pathway of water movement through the plant from the soil to the air.* ***7***

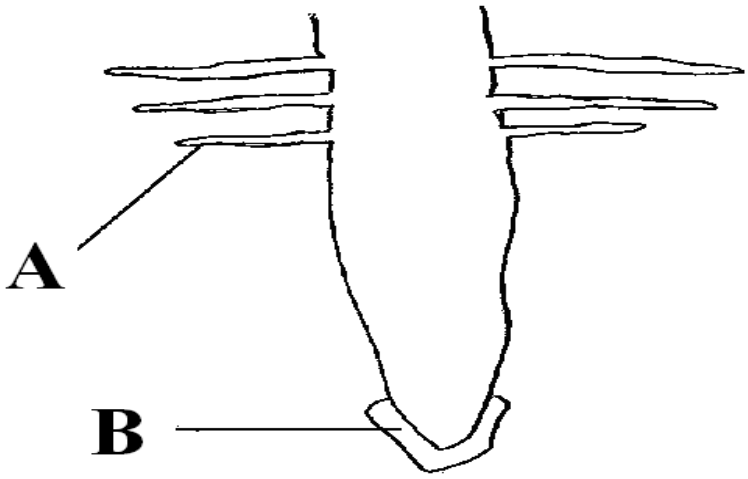
a) Those candidates who read the question accurately gained full marks. Suitable responses included; osmosis, transpiration or transpiration pull, diffusion, root pressure and capillary action or capillary rise.

b) To gain full marks candidates were expected to describe the pathway of water through the plant and not the processes involved. Most candidates described how water enters the root or the root hairs but few described the movement of the water across the cortex or were aware of the endodermis and the casparian strip. The best candidates described how the water rises up the stem in the xylem vessels and enters the leaf, passing through the network of veins and across the mesophyll cells. Many candidates described that water is lost through the stomata but few mentioned that it evaporates first into the intercellular air spaces of the leaf.

9. *a)* *Indicate on the diagram below the areas where the following processes take place:*

i) *cell division;* ***1***
ii) *cell enlargement;* ***1***
iii) *cell differentiation.* ***1***

A dicotyledonous root tip



*b) Identify the features labelled **A** and **B** in the diagram above and state their function.* ***4***

c) State what is meant by the term negative phototropism. ***3***

a) The location of cell division (immediately behind the root cap), enlargement (behind the area of cell division) and differentiation (just before and within the root hair zone where cells become specialised to carry out different tissue functions) were correctly labelled by many candidates.

b) Many candidates correctly identified A (root hairs) and B (root cap). The best candidates gave full details of their functions i.e. root hairs increase the surface area of the root to optimise the uptake of water/dissolved nutrients and the root cap protects the root tip/apical meristem from damage as it grows/pushes through the soil by producing mucilage. Root cap cells are continually replaced and also contain the plant's gravity sensing mechanism.

Unfortunately some candidates confused root hairs with lateral roots and the root cap with the root tip.

c) Full marks were awarded to candidates who stated that negative phototropism is growth (not movement) of a plant organ away from the light.

10. *a) The universal system of plant names is called the 'binomial' system. Explain what is meant by the term 'binomial'.* ***2***

*b) State **FOUR** advantages of using binomial plant names compared with common plant names in horticulture, using **NAMED** plant examples in your answer.* ***8***

a) The majority of candidates were able to explain that the word binomial means two names comprising of the genus and the specific epithet. It is important that candidates are aware that the binomial system relates to how plants are named and not how they are classified. Descriptions of how plants are grouped taxonomically into genera etc. were not required.

b) The majority of candidates were able to provide suitable advantages of using binomial plant names compared to common plant names in horticulture. Acceptable examples included; reference to the name being unique to an individual species; names being universally/internationally recognised; names are stable and governed by rules; they use a common language which is understood worldwide; they give information about the plant (e.g. its habitat, origin, characteristics, compatibility with other plants for breeding or uses); they show relatedness within a genus. The same common name on the other hand can apply to several different plants or one plant may have several different common names or a plant may not have a common name.

Marks were awarded if plant examples were clearly linked to an 'advantage'. Where more than one plant example was used to illustrate one advantage marks were awarded for each example. References to families and cultivars were not required.

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