**R2101****PLANT CLASSIFICATION, STRUCTURE & FUNCTION****Level 2****Monday 11 February 2019****09:30 – 10:50****Written Examination****Candidate Number:****Candidate Name:****Centre Number/Name:****IMPORTANT – Please read carefully before commencing:**

- i) The duration of this paper is **80** minutes;
- ii) **ALL** questions should be attempted;
- iii) **EACH** question carries **10 marks**;
- iv) Write your answers legibly in the lined space provided. It is **NOT** necessary that all lined space is used in answering the questions;
- v) Use **METRIC** measurements only;
- vi) Use black or blue ink only. Pencil can be used for drawing purposes only;
- vii) Where plant names are required, they should include genus, species and where appropriate, cultivar;
- viii) Where a question requires a specific number of answers; only the first answers given that meet the question requirement will be accepted, regardless of the number of answers offered;
- ix) Please note, when the word '**distinct**' is used within a question, it means that the items have different characteristics or features.

ANSWER ALL QUESTIONS

MARKS

Q1 a) State the meaning of **EACH** of the following terms:

- i) herbaceous perennial;
- ii) evergreen tree;
- iii) half-hardy annual.

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i).....

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ii).....

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b) Name **TWO** plant examples for **EACH** of the terms listed in a).

- i) herbaceous perennial;
- ii) evergreen tree;
- iii) half-hardy annual.

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i).....

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iii).....

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c) Name the term used to describe a plant which completes several life cycles in one season.

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Total Mark

Please see over/.....

MARKS

Q2 a) State what is meant by **EACH** of the following terms:

- i) leaf petiole;
- ii) leaf lamina;
- iii) leaf vein;
- iv) leaf midrib.

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i).....
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b) State where **EACH** of the following tissues are found in a dicotyledonous leaf:

2

- i) epidermis;
- ii) phloem.

i).....
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ii).....
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c) State **TWO** characteristics and **TWO** functions of the epidermis in a dicotyledonous leaf.

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Characteristics

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2.....
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Functions

1.....
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2.....
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Total Mark

Please turn over/.....

Q3 a) State the difference between the following types of root:

- i) tap;
- ii) adventitious.

2

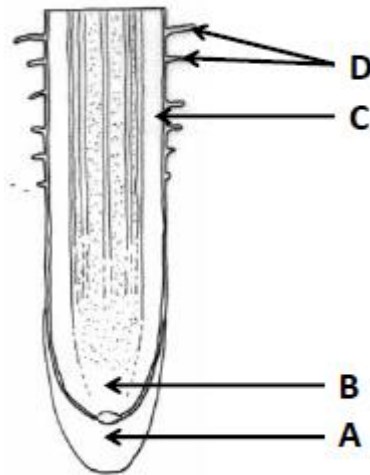
i).....
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ii).....
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b) Name the features labelled **A-D** on the diagram of a root tip below:

4

A root tip



c) State **ONE** function for **EACH** of the features labelled in b).

4

A).....
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B).....
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C).....
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D).....
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Total Mark

Please see over/.....

MARKS

Q4 a) State in words the basic equation for aerobic respiration.

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b) Identify **TWO** differences between aerobic and anaerobic respiration.

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c) Describe the significance of aerobic respiration in the storage of fruits.

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MARKS
1

Q5 a) Name the stage in the plant life cycle when vegetative growth occurs.

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b) Describe **THREE** ways in which stems are adapted for natural vegetative reproduction, by completing the table below:

Name of stem adaptation	Description of adaptation	Plant example
1.		
2.		
3.		

3

3

3

Total Mark

Please see over/.....

MARKS

Q6 a) Draw a fully labelled diagram to show the components of a typical plant cell in the space below:

6

A typical plant cell

b) Describe the process by which plant cells take up mineral nutrients.

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Total Mark

Please turn over/.....

Q7 a) State **TWO** functions of fruits.

MARKS

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b) Describe **THREE** distinct methods by which seeds are dispersed by animals.

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Method 1

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Method 2

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Method 3

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c) **NAME TWO** plants which have fruits that are dispersed by animals.

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Please see over/...

Total Mark

Q8 a) State the meaning of the following terms giving **ONE NAMED** plant example for **EACH**:

MARKS

- i) monoecious;
- ii) dioecious.

2
2

i)

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ii)

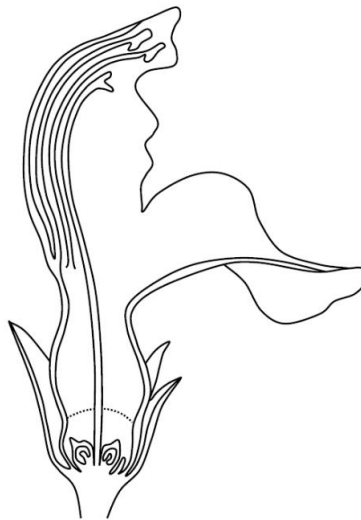
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b) Label **THREE** flower parts that assist bee pollination on the diagram below:

3

A typical bee pollinated flower (*Lamium purpureum*)



c) State how **THREE** characteristics of a flower assist bee pollination.

3

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Total Mark

Please see over/...

MARKS

Q9 a) Name the process by which water is lost from plant leaves.

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b) List **THREE** environmental conditions that increase the rate of water loss from plant leaves.

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c) Describe how **THREE NAMED** leaf adaptations can limit water loss.

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MARKS

Q10 a) State what is meant by **EACH** of the following terms in a plant life cycle:

- i) adult;
- ii) senescent.

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b) Describe **TWO** benefits of senescence of plants or plant organs in horticulture.

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c) Describe **TWO** horticultural situations where senescence of plants or plant organs is a limitation.

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Total Mark

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R2101

PLANT CLASSIFICATION, STRUCTURE & FUNCTION

Level 2

Monday 11 February 2019

Candidates Registered	1270		Total Candidates Passed	854	80%
Candidates Entered	1068	86%	Passed with Commendation	409	38%
Candidates Absent/Withdrawn	171	12%	Passed	445	42%
Candidates Deferred	31	2%	Failed	214	20%

Senior Examiner's Comments:

- 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.
- Candidates must be able to display accurate knowledge of the technical terms and concepts detailed in the syllabus, in the context of horticulture and also 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.
- 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, ensuring that labels are properly attached to the features they describe. Diagrams should preferably be 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. Appropriate feedback must, in any case be provided.

Q1 a) State the meaning of **EACH** of the following terms:

- | | | |
|------|-----------------------|----------|
| i) | herbaceous perennial; | 1 |
| ii) | evergreen tree; | 1 |
| iii) | half-hardy annual. | 1 |

b) Name **TWO** plant examples for **EACH** of the terms listed in a).

- | | | |
|------|-----------------------|----------|
| i) | herbaceous perennial; | 2 |
| ii) | evergreen tree; | 2 |
| iii) | half-hardy annual. | 2 |

c) Name the term used to describe a plant which completes several life cycles in one season. **1**

Q1a) Candidates who were able to clearly state the meaning of the terms were awarded full marks. Acceptable answers included:

- i) **Herbaceous perennial** is a plant which does not undergo secondary thickening and therefore has non-woody growth. It also has a life cycle which is greater than two years or two seasons.
- ii) **Evergreen tree** retains its' leaves over winter and has a single stem or trunk.
- iii) **Half-hardy annual** must be sown under protection from frost and are planted out when the danger of frost has past. Alternatively it is a plant which cannot survive or is killed by frost. Candidates who gave the RHS hardiness rating of H3 i.e. a half-hardy annual can survive temperatures down to -5°C were also awarded marks. To gain full marks candidates were also required to state that a half-hardy annual completes its' life cycle in one year or one season.

Q1b) Maximum marks were awarded to candidates who were able to name two correctly named plant examples for each of the terms. Acceptable answers included:

- i) *Papaver orientale, Alchemilla mollis, Brunnera macrophylla.*
Candidates who named sub-shrubs or biennial plants could not be awarded any marks.
- ii) *Quercus ilex, Eucalyptus gunnii, Pinus sylvestris.*
- iii) *Tagetes patula, Begonia semperflorens, Salvia splendens.*

Where only a genus was given the whole genus must be suitable to answer the question for marks to be awarded.

Q1c) The majority of candidates were able to name ephemeral as the term used to describe a plant which completes several life cycles in one season and gained full marks.

Q2 a) State what is meant by **EACH** of the following terms:

- | | | |
|------|---------------|----------|
| i) | leaf petiole; | 1 |
| ii) | leaf lamina; | 1 |
| iii) | leaf vein; | 1 |
| iv) | leaf midrib. | 1 |

b) State where **EACH** of the following tissues are found in a dicotyledonous leaf: **2**

- i) epidermis;
- ii) phloem.

c) State **TWO** characteristics and **TWO** functions of the epidermis in a dicotyledonous leaf. **4**

Q2a) Candidates who gave accurate and detailed meanings of the terms gained full marks. These included:

- i) **Leaf petiole** is a leaf stalk/stalk that joins the leaf to the stem.
- ii) **Leaf lamina** is the leaf blade or flattened surface of the leaf.
- iii) **Leaf vein** contains xylem and phloem in the leaf vascular bundles.
- iv) **Leaf midrib** is the main or central vein of the leaf.

Q2b) The best candidates were awarded full marks for providing precise statements of the location of the tissues in a dicotyledonous leaf e.g.

- i) **Epidermis** is the outer layer of the leaf and is present on both the upper and lower surfaces. Marks were also gained by candidates who stated that the epidermis is located under the cuticle.
- ii) **Phloem** is located in the vascular bundles.

Q2c) Maximum marks were gained by candidates who were able to state suitable characteristics (the physical features) and functions (what it does) of the epidermis in a dicotyledonous leaf. Acceptable answers included:

Characteristics – flattened cells, tightly packed cells, single layer of cells, the presence of stomata, guard cells or hairs, transparency.

Functions – reduces or controls water loss, enables gas exchange, produces a waxy cuticle, protects from damage, pests and disease.

Q3 a) State the difference between the following types of root:

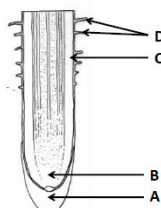
- i) tap;
- ii) adventitious.

2

b) Name the features labelled **A-D** on the diagram of a root tip below:

4

A root tip



c) State **ONE** function for **EACH** of the features labelled in b).

4

Q3a) Many candidates gained full marks for correctly stating the difference between specific types of root. These included:

- i) **Tap** root derives from the radicle/is the primary root
- ii) **Adventitious** roots originate from other plant parts e.g. stem or leaves or from perennating organs e.g. bulbs or tubers which are usually fibrous.

Marks could not be awarded to those candidates who described the functions of roots.

Q3b) Most candidates were able to label the features of the root tip and were awarded full marks. These were:

- A** – Root cap
- B** – Apical meristem
- C** – Cortex
- D** – Root hair

Q3c) Full marks were gained by candidates who were able to state a suitable function for each feature of the root tip. These were:

Root cap – protects the root from damage as it grows through the soil. Mucilage is produced to aid this process.

Apical meristem – site of cell division where longitudinal growth of the root takes place.

Cortex – a packing or starch storage tissue.

Root hair – the main area for water and mineral uptake. (Full marks were given to candidates who linked this to increased surface area).

Candidates who did not label the features on the diagram in part b) of the question but gave correct names with the function in part c) were awarded marks.

MARKS

- Q4 a)** State in words the basic equation for aerobic respiration. **3**
- b) Identify **TWO** differences between aerobic and anaerobic respiration. **2**
- c) Describe the significance of aerobic respiration in the storage of fruits. **5**

Q4a) The majority of candidates were able to state the basic equation for aerobic respiration in words and were awarded maximum marks.

oxygen + glucose/carbohydrate → carbon dioxide + water + energy

Candidates who provided the correct inputs and outputs within a statement were also awarded marks.

Some candidates provided explanations of the process which was not required.

Q4b) To gain full marks candidates were required to identify two differences between aerobic and anaerobic respiration. Acceptable answers included:

- anaerobic respiration takes place in the absence of oxygen
- anaerobic respiration produces ethanol
- anaerobic respiration generates less energy
- glucose is incompletely broken down
- anaerobic respiration takes place in the cytoplasm

Q4c) Candidates who were awarded full marks made the link between respiration and storage life of fruits clearly and logically. They stated that fruit, although detached from the plant is still respiring. The faster the respiration rate the shorter the storage time. Measures that reduce the rate of respiration therefore increase storage time. Additional marks were awarded to candidates who described how environmental factors can be manipulated to reduce respiration and increase storage time e.g. reducing temperature through refrigeration or changing the gaseous atmosphere by increasing carbon dioxide and decreasing oxygen through packaging or in environmentally controlled stores. Marks were also awarded for stating that high respiration rates lead to a loss of marketable weight and a reduction in quality which reduces the time that fruits can be stored.

Q5 a) Name the stage in the plant life cycle when vegetative growth occurs.

1

b) Describe **THREE** ways in which stems are adapted for natural vegetative reproduction, by completing the table below:

Name of stem adaptation	Description of adaptation	Plant example
1.		
2.		
3.		

**3
3
3**

Q5a) The majority of candidates correctly named the stage of the life cycle when vegetative growth occurs as ‘juvenile’ and gained full marks.

Q5b) To gain full mark candidates were required to describe ways in which stems are adapted for natural vegetation. Suitable answers included:

Stolon – horizontal, often arching stem close to the ground which roots and produces daughter plants or plantlets at its tip or its nodes e.g. *Rubus fruticosus*, *Ajuga reptans*, *Ranunculus repens*.

Runner – horizontal stem close to the ground which roots and produces plantlets from nodes along its length e.g. *Fragaria x ananassa*.

Rhizome – an underground or near surface stem, which roots and branches at the nodes e.g. *Elymus repens*, *Iris pseudacorus*, *Iris germanica*.

Corm – swollen, compressed stem which produces new corms above the old one e.g. *Crocsmia ‘Lucifer’*, *Crocus sativus*, *Crocus tommasinianus*.

Candidates who named *Cyclamen* as an example could not be awarded any marks as they produce tubers.

Stem tuber – underground stem with the new shoots and roots arising from nodes (‘eyes’) e.g. *Solanum tuberosum*.

Candidates who gave *Dahlia pinnata* as an example could not be awarded any marks as it is a root tuber.

Candidates who named suckers or bulbils were also awarded marks.

Q6 a) Draw a fully labelled diagram to show the components of a typical plant cell in the space below:

6

A typical plant cell

b) Describe the process by which plant cells take up mineral nutrients.

4

Q6a) Most candidates were able to draw and label six components of a typical plant cell and gained full marks. Suitable components included: cell wall, cell membrane, nucleus, cytoplasm, chloroplast, mitochondrion, vacuole. A few candidates were also awarded marks for labelling the endoplasmic reticulum, plasmodesmata, starch grains and nucleolus.

Marks could not be awarded to candidates who were careless where they attached their labels or confused the cell with plant tissues.

Q6b) The best candidates described the process by which plant cells take up mineral nutrients correctly and were awarded maximum marks. Mineral uptake is achieved by active transport across the cell membrane on protein carriers. It is both selective and energy dependent and minerals are usually moved against a concentration gradient into the cell.

- Q7 a)** State **TWO** functions of fruits. **2**
- b)** Describe **THREE** distinct methods by which seeds are dispersed by animals. **6**
- c)** **NAME TWO** plants which have fruits that are dispersed by animals. **2**

Q7a) Candidates who were able to state two functions of fruits gained full marks. Acceptable answers included:

- protection of the seed from damage
- may aid dispersal of the seed
- may aid dormancy
- may delay germination of the seed
- provision of nutrients for the seed as it develops on the plant
- provision of nutrients for the seed as it germinates (sometimes)

Q7b) The majority of candidates described distinct methods by which seeds are dispersed by animals and were awarded full marks. These were:

Animal frugivory where the fruit is eaten and passed through the gut of the animal and then excreted away from the plant.

Animal attachment/scattering where the fruit attaches to the animals fur and is then carried away elsewhere until it falls off or is brushed off and may germinate.

Animal hoarding by animals e.g. squirrels who bury the fruit in the ground and later forget where they are located so that it is not eaten.

Candidates who described the dispersal of seeds by wind or water could not be awarded any marks.

Q7c) A range of plants which have fruits that are dispersed by animals were named by candidates who gained maximum marks. These included:

Animal frugivory – *Prunus avium*, *Malus domestica*, *Sorbus aucuparia*.

Taxus baccata could not be accepted as it is not a flowering plant and has an aril instead of a true fruit.

Animal attachment/scattering – *Arctium lappa*, *Galium aparine*.

Animal hoarding – *Quercus robur*, *Corylus avellana*.

Q8 a) State the meaning of the following terms giving **ONE NAMED** plant example for **EACH:** **MARKS**

- i) monoecious; **2**
ii) dioecious. **2**

b) Label **THREE** flower parts that assist bee pollination on the diagram below: **3**

A typical bee pollinated flower (*Lamium purpureum*)



c) State how **THREE** characteristics of a flower assist bee pollination. **3**

Q8a) Most candidates who were able to state the meaning of each of the terms and give a named plant example were awarded full marks.

- i) **Monoecious** plants have separate male and female flowers on the same plant e.g. *Corylus avellana*, *Quercus robur*, *Zea mays*, *Betula pendula*.
ii) **Dioecious** plants have male and female flowers on separate plants e.g. *Ilex aquifolium*, *Skimmia japonica*.

Candidates who confused monoecious and dioecious with monocotyledonous and dicotyledonous or deciduous and evergreen plants could not be awarded any marks.

Q8b) Candidates who labelled the flower parts that assist bee pollination e.g. petal, anther, filament, stigma, style gained full marks. Few candidates were able to label the nectary correctly.

Q8c) To gain full marks candidates were required to state how the characteristics of a flower assist bee pollination. Suitable answers included:

- Petals are brightly coloured e.g. blue or yellow which is preferred by most bees. Alternatively petals provide a 'landing platform' which supports the weight of the bees or form a floral tube whose length matches that of the bees tongue
- Nectar guides on the petals direct the bee to the nectary at the base of the petals
- Nectaries contain sugary liquid nectar for bees to feed on and draws the bee deep inside the flower
- Stigmas are positioned to brush against the bee and are sticky to attach the pollen
- Stamens/anthers are positioned to brush against the bee. The anthers also contain sticky pollen

MARKS

- Q9** a) Name the process by which water is lost from plant leaves. **1**
- b) List **THREE** environmental conditions that increase the rate of water loss from plant leaves. **3**
- c) Describe how **THREE NAMED** leaf adaptations can limit water loss. **6**

Q9a) The majority of candidates correctly named the process by which water is lost from plant leaves as transpiration and were awarded full marks.

Q9b) The highest marks were gained by candidates who listed increasing temperature, increasing or high wind speed, low humidity, high light levels as environmental conditions that increase the rate of water loss from plant leaves.

Q9c) A range of leaf adaptations that can limit water loss were described by the best candidate who gained maximum marks. Suitable answers included:

Leaf hairs which reduce wind speed trap moisture and increase humidity close to the leaf surface and also shade it, reducing light and temperature.

Sunken stomata which reduce wind speed and increase humidity close to the stomata.

Needles e.g. conifers reduce the overall leaf area.

Spines which are modified leaves with a reduced area, which in addition shade the leaf reducing light and temperature.

Rolled leaves reduce the leaf area and trap humid air within the leaf close to the stomata.

Thick waxy cuticles enhance waterproofing of the leaf and therefore minimise water loss.

	MARKS
Q10 State what is meant by EACH of the following terms in a plant life cycle:	
i) adult;	1
ii) senescent.	1
Describe TWO benefits of senescence of plants or plant organs in horticulture.	4
Describe TWO horticultural situations where senescence of plants or plant organs is a limitation.	4

Q10a) Maximum marks were gained by many candidates who correctly stated the meaning of the specific terms.

- i) **Adult** is the stage in the plant life cycle when plants are able to reproduce sexually.
- ii) **Senescent** is the stage where reproduction and growth cease.

Q10b) Candidates who made the distinction that senescence could apply to whole plants or plant organs e.g. leaves and described suitable benefits were awarded full marks. These included:

- Seeds are ready to collect to use for propagation or as a food crop
- Autumn leaf colours can be very attractive in the ornamental garden
- Leaf senescence can indicate time to harvest e.g. in onions and potatoes
- Senescent seed heads can provide food for birds in wildlife gardens or winter interest in ornamental borders
- Energy taken back into the plant from senescent leaves is used by bulbs and other organs for growth or propagation the following year
- Senescent plant material can be used to make compost

Q10c) A range of horticultural situations where senescence of plants or plant organs is a limitation were described by the best candidates who gained maximum marks. These included:

- Leaf senescence/senescent annual plants may be unsightly in an ornamental border in winter and need removing/replacing
- Flowering has finished which results in a loss of quality/value for cut flower crops
- Fruit senescence in storage leads to loss of quality/value for edible fruit crops
- Falling leaves can cause a slip hazard in a garden situation or damage lawns
- Shedding seeds/self-seeding can result in a weed problem in an ornamental border which require removing
- Senescent plant material can harbour pests and diseases
