

R2101

PLANT CLASSIFICATION, STRUCTURE & FUNCTION

Level 2

Monday 20 June 2022

09:00 – 10:20

Written Examination

Candidate Number:

Candidate Name:

Centre 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 spaces 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. Ensure that all diagrams are labelled accurately with the line touching the named object;
- 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
3

Q1 a) State what is meant by the term 'cultivar'.

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b) Describe how cultivar plant names are written.

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c) Name **THREE** distinct plant examples of a cultivar.

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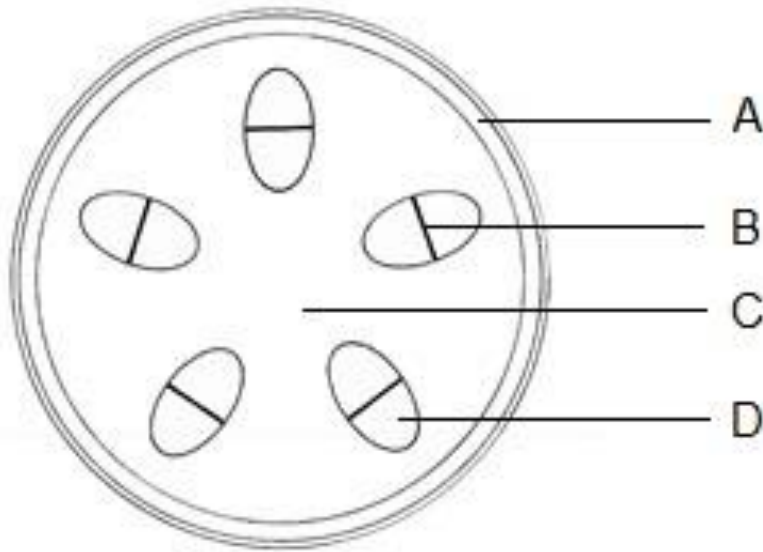
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Q2 a) Name the features labelled A-D on the diagram below:



TS Young dicotyledonous stem

- A.....
- B.....
- C.....
- D.....

b) State **ONE** function for **EACH** of the features labelled A-D on the diagram in a).

- A.....
-
- B.....
-
- C.....
-
- D.....
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c) State **ONE** difference between a woody and an herbaceous stem.

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4

2

Total Mark

Please turn over/.....

MARKS

Q3 a) State what is meant by the following terms:

- i) diffusion
- ii) osmosis

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i).....
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b) Identify **ONE** example of diffusion in a plant.

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c) Identify **ONE** example of osmosis in a plant.

2

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Q4 a) Describe how **EACH** of the following flower parts are adapted for wind and bee pollination by completing the table below:

Flower part	Wind pollination	Bee pollination
pollen		
style		

4

4

b) Name **ONE** wind pollinated plant.

1

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c) Name **ONE** bee pollinated plant.

1

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Total Mark

Please turn over/.....

Q5 a) For **EACH** of the plant adaptations shown below:

- i) name the adaptation
- ii) state its function
- iii) give a **NAMED** plant example

3
3
3



Name of adaptation.....

Function of adaptation.....

Named plant example.....



Name of adaptation.....

Function of adaptation.....

Named plant example.....



Name of adaptation.....

Function of adaptation.....

Named plant example.....

b) Name **ONE** distinct plant where the roots have been modified to form tuberous roots.

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Total Mark

Please see over/.....

MARKS

Q6 a) List **FOUR** requirements for photosynthesis.

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b) Describe **FOUR** ways in which the structure of leaves is designed to maximise photosynthesis.

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Q7 a) State the equation for aerobic respiration in words.

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MARKS
3

b) Name **TWO** environmental factors that affect the rate of aerobic respiration.

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

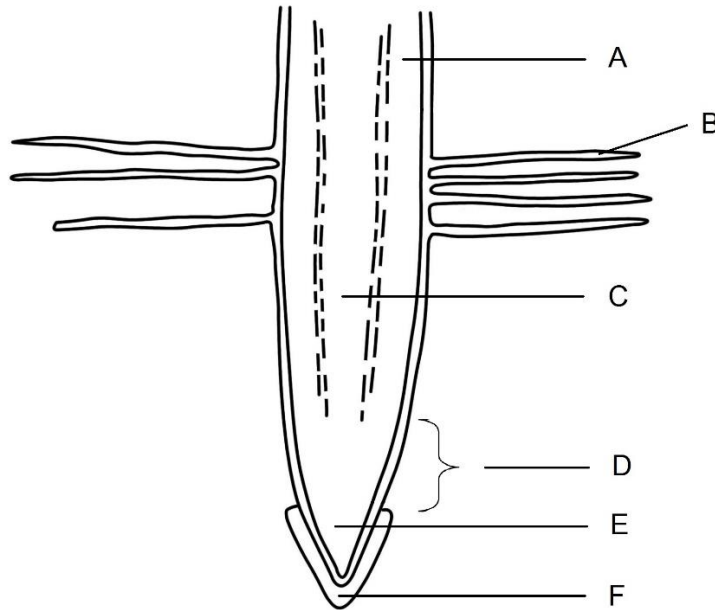
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Total Mark

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Q8 a) Name **EACH** of the features labelled A-F on the diagram below:



LS root tip

- A.....
- B.....
- C.....
- D.....
- E.....
- F.....

b) Identify the features on the diagram shown in a) which carry out the following functions, by completing the table below.

4

Function	Feature
Water uptake	
Transport of minerals	
Cell enlargement	
Starch storage	

Total Mark

Please turn over/.....

Q9 a) Name **TWO** distinct flowering shrubs.

MARKS
2

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b) State the difference between the following terms applied to plant flowers:

- i) corolla and calyx
- ii) filament and style
- iii) ovary and ovule
- iv) tepal and petal

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i).....
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ii).....
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iii).....
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Total Mark

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MARKS

Q10a) State **TWO** functions of fruits.

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b) Name the seed parts which carry out the following functions:

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- i) starch storage
- ii) uptake of water for germination
- iii) forms new root
- iv) point of attachment to fruit
- v) protects against pests

i)

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ii)

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iii)

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iv)

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v)

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c) List **THREE DISTINCT** ways in which the fruit structure has been modified to enable the seeds to be dispersed by wind.

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R2101

PLANT CLASSIFICATION, STRUCTURE & FUNCTION

Level 2

Monday 20 June 2022

Candidates Registered	603		Total Candidates Passed	318	67%
Candidates Entered	475	79%	Passed with Commendation	154	32%
Candidates Absent/Withdrawn	97	16%	Passed	164	35%
Candidates Deferred	31	5%	Failed	157	33%

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 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.
- 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, 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.

	MARKS
Q1 a) State what is meant by the term 'cultivar'.	3
b) Describe how cultivar plant names are written.	4
c) Name THREE distinct plant examples of a cultivar.	3

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**Q1a)** The majority of candidates were able to state that the term 'cultivar' is short for 'cultivated variety'. Cultivars are a sub-group of a species and most cultivars are produced by human intervention through selective breeding. Cultivars are maintained by selective propagation, often vegetatively. Some cultivars can occur through mutations in wild plants which are selected and then maintained by human intervention.

**Q1b)** Maximum marks were gained by candidates who were able to describe how cultivar plant names are written. Suitable answers included:

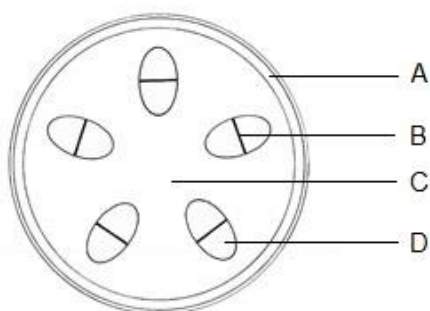
Cultivar names follow the genus and species names (or in some cases the genus only where the species is unknown), they are enclosed by single inverted commas and they commence with a capital letter. Cultivar names are written in the vernacular and since 1959 are no longer written in Latin. Candidates who provided a plant example which was correctly written with the cultivar name indicated were given credit.

**Q1c)** Suitable plant examples of a cultivar were named by the best candidates who achieved full marks. These included:

*Sorbus intermedia* 'Joseph Rock', *Skimmia japonica* 'Fragrans', *Echinacea purpurea* 'Alba'.

Many candidates provided trade designations (selling names) and not cultivar names. These included roses e.g. *Rosa* Iceberg is the cultivar *Rosa* 'Korbin' and *Choisya ternata* Sundance is the cultivar *Choisya ternata* 'Lich'. Seed mixes and series names e.g. *Zinnia elegans* Early Wonder Mixed are also not cultivar names.

**Q2 a)** Name the features labelled A-D on the diagram below:



**TS Young dicotyledonous stem**

- b) State **ONE** function for **EACH** of the features labelled A-D on the diagram in a). **4**
- c) State **ONE** difference between a woody and an herbaceous stem. **2**

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Q2a) Candidates who were able to correctly name the features of a young dicotyledonous stem i.e. A = epidermis, B = vascular cambium/cambium, C = pith, D = phloem were awarded full marks.

Candidates who confused epidermis with endodermis or pericycle or cuticle with cortex could not be awarded any marks.

Q2b) To achieve maximum marks candidates were required to state the function for each of the features named on the diagram of the young dicotyledonous stem. Acceptable answers included:

Epidermis – protects the stem from damage, pest or disease or prevents water loss.

Vascular cambium – is the site of cell division (it is meristematic) and produces the new cells, xylem and phloem giving rise to lateral growth and increase in width. It is responsible for secondary thickening.

Pith – stores starch. It also supports the stem through turgor and can enable transport of substances across the stem.

Phloem – transports sucrose/sugars/products of photosynthesis although various plant hormones and minerals are also transported.

Candidates who stated that the phloem transports water could not be awarded any marks as this is primarily the function of the xylem.

Q2c) The best candidates provided a range of differences between a woody and an herbaceous stem and gained maximum marks. Suitable matched pairs of differences included:

Woody stems undergo secondary thickening and have a vascular cambium whereas herbaceous stems do not. Woody stems have bark with lenticels whereas herbaceous stems have an epidermis with stomata.

Q3 a) State what is meant by the following terms:

- | | | |
|-----|-----------|----------|
| i) | diffusion | 2 |
| ii) | osmosis | 4 |

b) Identify **ONE** example of diffusion in a plant. **2**

c) Identify **ONE** example of osmosis in a plant. **2**



Q3a) Many candidates were able to provide suitable meanings for the specific terms and were awarded full marks. Acceptable answers included:

i) Diffusion

Diffusion is the movement of a substance from a high concentration to a lower concentration (or down a concentration gradient). It can occur with liquids e.g. water, dissolved substances and also gases. Movement is not restricted by any barrier e.g. a cell membrane.

ii) Osmosis

Osmosis is the movement of water from a high water (low solute) concentration to a lower water (high solute) concentration across a semi or selectively permeable membrane.

Q3b) A range of suitable examples of diffusion in a plant were provided by many candidates who achieved maximum marks. These included:

- movement of water vapour through the air spaces of the spongy mesophyll
- loss of water vapour from leaves or through stomata by transpiration
- loss of oxygen or uptake of carbon dioxide via leaves and stomata
- gaseous exchange by leaves or other plant organs
- movement of sugars or minerals within the cell.

Q3c) Candidates provided suitable examples of osmosis in a plant and gained full marks. These included:

- uptake of water by root hair cells which are specialised cells of the epidermis
- movement of water from cell to cell across the cell membranes
- uptake of water by guard cells which control stomatal opening.

Q4 a) Describe how **EACH** of the following flower parts are adapted for wind and bee pollination by completing the table below:

Flower part	Wind pollination	Bee pollination
pollen		
style		

4

4

b) Name **ONE** wind pollinated plant.

1

c) Name **ONE** bee pollinated plant.

1

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**Q4a)** Good descriptions of how specific flower parts are adapted for wind and bee pollination were provided by many candidates who were awarded full marks. Acceptable answers included:

| <b>Flower part</b> | <b>Wind pollination</b>                              | <b>Bee pollination</b>        |
|--------------------|------------------------------------------------------|-------------------------------|
| <b>pollen</b>      | Small, lightweight grains produced in large amounts. | Small number of large grains. |
| <b>style</b>       | Long, flexible and often pendulous.                  | Short and rigid.              |

Candidates who confused pollen with pollination and style with stigma could not be awarded any marks.

**Q4b)** The majority of candidates were able to name suitable wind pollinated plants e.g. *Zea mays*, *Quercus robur*, *Pinus sylvestris*, *Betula pendula* and gained full marks.

**Q4c)** A range of suitable plants were named by candidates that are bee pollinated and were awarded full marks. These included:

*Digitalis purpurea*, *Rosa rugosa*, *Lavandula angustifolia*.

Some candidates believe that *Taraxacum officinale*, *Acer* spp. and *Salix* spp. are wind pollinated. This is a misconception as they produce nectar and are predominately bee pollinated.

**Q5 a)** For **EACH** of the plant adaptations shown below:

- |                                        |          |
|----------------------------------------|----------|
| i) name the adaptation                 | <b>3</b> |
| ii) state its function                 | <b>3</b> |
| iii) give a <b>NAMED</b> plant example | <b>3</b> |



b) Name **ONE** distinct plant where the roots have been modified to form tuberous roots. **1**

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Q5a) To achieve full marks candidates were required to name specific adaptations of plant parts, state their function and give a plant example. Suitable answers included:

Diagram 1

Shows a bulb/bulblet whose function is storage of starch or perennation e.g. *Narcissus pseudonarcissus*, *Allium sativum*, *Tulipa greigii*.

Diagram 2

Shows prickles (not thorn which is a modified shoot) whose function is defence from herbivores or to enable climbing towards the light for improved photosynthesis or competitive advantage e.g. *Rosa rugosa*, *Rubus fruticosus*.

Diagram 3

Shows a leaf tendril whose function is to enable climbing towards light for photosynthesis or to better compete with other plants e.g. *Pisum sativum*, *Lathyrus odoratus*.

Candidates who gave examples of plants with twining stems, twining petioles or plants whose tendrils are not derived from the leaf could not be awarded any marks.

Q5b) Most candidates correctly named *Dahlia* species or cultivars e.g. *Dahlia pinnata* or *Dahlia* 'Bishop of Llandaff' or *Ipomoea batatas* as plants where the roots have been modified to form tuberous roots and were awarded full marks.

Candidates who named *Solanum tuberosum* could not be awarded any marks as this is a stem tuber.

Q6 a) List **FOUR** requirements for photosynthesis.

2

b) Describe **FOUR** ways in which the structure of leaves is designed to maximise photosynthesis.

8

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**Q6a)** Carbon dioxide, water, light or photosynthetically active radiation (PAR), a named nutrient essential for photosynthesis e.g. magnesium and a suitable temperature were correctly given by candidates as requirements for photosynthesis and gained maximum marks.

**Q6b)** The best candidates, who were awarded full marks specified a leaf structure and then described how its structure maximises photosynthesis. These included:

- stomata which enable gas exchange or carbon dioxide uptake
- air spaces inside the leaf in the spongy mesophyll to enable gas exchange or store carbon dioxide
- palisade mesophyll cells or most chloroplasts are on the upper surface of the leaf to maximise light absorption
- the upper epidermis is thin or one cell thick or the cuticle is transparent to enable light to penetrate
- large surface of the leaf or leaf lamina to maximise light interception or diffusion of gases
- petiole, twining petiole or leaf tendril which holds the leaf in the best position for light capture or interception
- a network of vascular tissue or veins with xylem and phloem to deliver water, transport sugars or supply nutrients and minerals necessary for photosynthesis.

Some candidates described leaf design to reduce water loss e.g. stomata on the underside of the leaf, a waxy cuticle, guard cells controlling stomatal opening or adaptations e.g. leaf hairs. Marks were only awarded if they described how these maximise photosynthesis through preventing stomatal closure which would reduce carbon dioxide uptake.

|                                                                                                         | <b>MARKS</b> |
|---------------------------------------------------------------------------------------------------------|--------------|
| <b>Q7 a)</b> State the equation for aerobic respiration in words.                                       | <b>3</b>     |
| b) Name <b>TWO</b> environmental factors that affect the rate of aerobic respiration.                   | <b>2</b>     |
| c) Describe the significance of aerobic respiration in the successful storage of fruits and vegetables. | <b>5</b>     |

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Q7a) Most candidates correctly stated the equation for aerobic respiration in words as:

Glucose/carbohydrate/sugar + oxygen gives rise to carbon dioxide + water + energy/ATP

Marks were also awarded to candidates who used symbols to provide the equation.

Q7b) The majority of candidates named oxygen, carbon dioxide and temperature/heat as the environmental factors that affect the rate of aerobic respiration and achieved maximum marks.

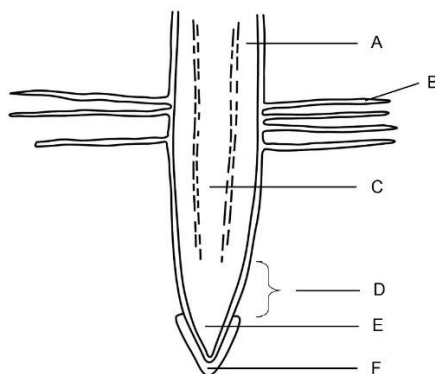
Q7c) Candidates who were awarded full marks made a clear link between the rate of aerobic respiration and storage life of fruits and vegetables, often relating this to the environmental factors named.

The essential statement was that, slowed or reduced respiration increases storage life (or the reverse statement).

Additional statements within the descriptions which achieved marks included:

- high temperature increases the rate of respiration or vice versa
- high temperature therefore reduces storage life or vice versa
- high carbon dioxide or low oxygen reduces the rate of respiration or vice versa
- high carbon dioxide or low oxygen therefore increases storage life or vice versa
- fruit and vegetables are living tissue, so respiration continues after harvest and as a consequence, this leads to senescence or deterioration of produce
- respiration leads to weight loss or loss of carbohydrate which are broken down in this process
- specific methods used to reduce respiration e.g. refrigeration, controlled or modified atmospheres will increase the storage life of fruit and vegetables
- anaerobic respiration which would spoil produce due to ethanol production should be avoided.

Q8 a) Name **EACH** of the features labelled A-F on the diagram below:



LS root tip

b) Identify the features on the diagram shown in a) which carry out the following functions, by completing the table below.

4

Function	Feature
Water uptake	
Transport of minerals	
Cell enlargement	
Starch storage	

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**Q8a)** Candidates who were able to correctly name the features of a longitudinal section of a root tip i.e. A = cortex, B = root hair, C = xylem, D = zone/area of elongation, E = apical meristem, F = root cap gained full marks.

**Q8b)** Maximum marks were awarded to candidates who were able to identify specific features of a root tip which carry out certain functions. These were:

| <b>Function</b>       | <b>Feature</b>           |
|-----------------------|--------------------------|
| Water uptake          | Root hair                |
| Transport of minerals | Xylem                    |
| Cell enlargement      | Zone/area of enlargement |

|                |        |
|----------------|--------|
|                |        |
| Starch storage | Cortex |

Marks were awarded to candidates who had incorrectly named the feature in section a) of the question but had correctly identified the features which carry out specific functions.

Candidates who had confused root anatomy with stem anatomy could not be awarded any marks.

**Q9 a)** Name **TWO** distinct flowering shrubs.

**2**

b) State the difference between the following terms applied to plant flowers:

- i) corolla and calyx
- ii) filament and style
- iii) ovary and ovule
- iv) tepal and petal

**2**  
**2**  
**2**  
**2**

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Q9a) A range of flowering shrubs were named by the best candidates who achieved full marks. Suitable answers included:

Choisya ternata, Cornus alba, Rosa rugosa, Camellia japonica.

Candidates who named climbing plants e.g. *Jasminum officinale*, sub shrubs e.g. *Salvia officinalis* and plants which are classified as a tree or a shrub e.g. *Amelanchier lamarckii* could not be awarded any marks.

Reliable and up to date sources should be referred to e.g. the RHS Plant Finder for correct plant names.

Q9b) Candidates who gained full marks understood the difference between the terms applied to plant flowers and provided short, concise statements. Acceptable answers included:

i) Corolla and calyx

The corolla consists of all the petals whereas the calyx consists of all the sepals.

ii) Filament and style

The filament supports the anther whereas the style supports the stigma.

iii) Ovary and ovule

The ovary becomes the fruit and contains the ovules whereas the ovule becomes the seed and contains the ovum/female gamete.

iv) Tepal and petal

The tepal is typically found in monocotyledons and replaces the petals and sepals which are indistinguishable whereas the petal is found in dicotyledons and is a structure distinct from the sepal.

- Q10a)** State **TWO** functions of fruits. **2**
- b) Name the seed parts which carry out the following functions: **5**
- i) starch storage
 - ii) uptake of water for germination
 - iii) forms new root
 - iv) point of attachment to fruit
 - v) protects against pests
- c) List **THREE DISTINCT** ways in which the fruit structure has been modified to enable the seeds to be dispersed by wind. **3**

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**Q10a)** The majority of candidates were able to state appropriate functions of fruits and were awarded full marks. These included:

- protection of the seed, embryo or ovule from herbivory or pest and disease
- providing nutrients to the embryo or seedling
- aiding seed dispersal
- contributing to seed dormancy or delaying germination.

**Q10b)** Correct names of seed parts which carry out specific functions were provided by many candidates who achieved maximum marks. These were:

- i) **Starch storage** – cotyledons or endosperm
- ii) **Uptake of water for germination** – micropyle
- iii) **Forms new root** – radicle
- iv) **Point of attachment to fruit** – hilum
- v) **Protects against pests** – testa

**Q10c)** A range of ways in which the fruit structure has been modified for seed dispersal by wind were provided by most candidates who gained full marks. Suitable answers included:

- appendages which form a parachute or umbrella structure
- a blade, propellor or wing (samara) structure which enables a helicopter action
- a censer mechanism whereby the pedicel sways in the wind and the seeds are shaken from holes in the top of the 'pepperpot' fruit.

Candidates who gave seed dispersal methods from animals or explosive methods could not be awarded any marks.

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